AIC 2014
INTERIM MEETING

TERCER
ENCUENTRO MEXICANO
DEL COLOR

Color, culture and identity:
past, present and future
Color, cultura e identidad:
pasado, presente y futuro

October 21-24, 2014
Oaxaca, México

PROCEEDINGS

Editors

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This publication includes the lectures, papers and posters presented in AIC 2014 Interim Meeting "Color, culture and identity: past, present and future". The conference, wich also marked the 3rd. Mexican Color Encounter, was held in Oaxaca, México, on October 21st to 24th, 2014 and was organized by the Mexican Association of Color Researchers (AMEXINC).

ISBN EN TRÁMITE

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AIC PRESIDENT FOREWORD

Mexico is a colorful country with a long tradition in the use of color in everyday life. Buildings, clothes, urban landscapes, etc. show a great variety of vivid colors that the Mexicans use as a way of experimenting emotions and sensations. Perhaps in Oaxaca we have a marvelous example of it.

The "Asociación Mexicana de Investigadores del Color" is a regular member of the International Color Association AIC. In the last AIC Congress in Newcastle, Carlos Aguirre Vélez could show to the General Assembly of the AIC the advantages of celebrating an Interim Meeting of the AIC in Oaxaca, Mexico: the warmth of its people, the beauty of its landscapes and cityscapes, his old culture of thousands of years and the facilities for tourism: accommodation, food, sights, etc. The AIC warmly welcomed the idea of going to Oaxaca to hold a Meeting there.

I know the great effort that the organizing committee of AIC 2014 has done to organize this event. I want to express my public recognition and thanks to all of the members of the OC and SC, mentioning them in the names of Georgina Ortiz and Carlos Aguirre Velez. We spent very nice days talking about color, obtaining useful information for our studies, showing our last research and also, and no less important, enjoying with the visits to the city and monuments, the very good Mexican food and the hospitality of the Mexican people.

This conference has been a great event in the history of the color community: 7 workshops, 8 invited talks, 111 oral communications, 57 posters, and 28 oral sessions. These are the figures, but further than this we have to take into account the quality of the presentations and talks and the high level of the studies presented along the conference. In my opinion the aims of the AIC 2014 "Color and culture" have been fulfilled.

Also, we have had the opportunity to know better the culture and beauty of this part of the great nation that is Mexico. Along these days we felt a color sensorial experience: in the streets of Oaxaca, in the landscapes of the surroundings and in the warmth of its people.

Today the AIC and the color community are very happy seeing that color studies are consolidated in a regular member: Mexico. Thank you very much for your great effort in organizing this conference and for the work done in order to increase the presence of color studies in science, art, design, architecture, psychology, physiology and technology. And to the editors of these proceedings in the person of Professor Georgina Ortiz.

Javier Romero
President AIC

PRÓLOGO PRESIDENTE DE LA AIC

México es un país lleno de colores con una larga tradición en el uso del color en la vida cotidiana. Edificios, ropa, utensilios, paisajes rurales y urbanos, etc. muestran una gran variedad de colores vivos, que los mexicanos usan como una forma de experimentar emociones y sensaciones. En Oaxaca, tenemos un maravilloso ejemplo de ello.

La "Asociación Mexicana de Investigadores del Color" es un miembro regular de la Asociación Internacional del Color AIC. En el último Congreso de la AIC, en Newcastle, Carlos Aguirre Vélez mostró a la Asamblea General de la AIC las ventajas de celebrar una reunión intermedia de la AIC en Oaxaca, México: la calidez de sus gentes, la belleza de sus paisajes, su antigua cultura de miles de años y las facilidades para el turismo: alojamiento, comida, lugares de interés, etc. La AIC acogió calurosamente la idea de ir a Oaxaca celebrar una reunión allí.

Sé del gran esfuerzo que el comité organizador de la AIC 2014 ha hecho para organizar este evento. Quiero expresar mi reconocimiento público a todos los miembros del Comité Organizador y del Comité Científico, y en nombre de ellos citar a los doctores Georgina Ortiz y Carlos Aguirre Vélez. Hemos pasado muy buenos momentos hablando del color, obteniendo información muy útil para nuestros estudios, mostrando nuestra última investigación y también, y no menos importante, disfrutando con las visitas a la ciudad y sus monumentos, la muy buena comida mexicana y la hospitalidad del pueblo mexicano.

Esta conferencia ha sido un gran acontecimiento en la historia de la comunidad de color: 7 talleres, 8 conferencias invitadas, 111 comunicaciones orales, 57 posters y 28 sesiones orales. Estas son las cifras, pero más allá de esto tenemos que tener en cuenta la calidad de las presentaciones y charlas y el alto nivel de los trabajos presentados a lo largo de la conferencia. En mi opinión se han cumplido los objetivos de la AIC 2014 "Color y cultura".

Además, hemos tenido la oportunidad de conocer mejor la cultura y la belleza de esta parte de la gran nación que es México. A lo largo los días del congreso sentimos una experiencia sensorial del color: en las calles de Oaxaca, en los paisajes de los alrededores y en la calidez de su gente.

Hoy la AIC y la comunidad de color están de enhorabuena al ver que los estudios sobre el color se consolidan en un miembro regular: México. Muchas gracias de nuevo por el gran esfuerzo en la organización de esta conferencia y por la labor realizada con el fin de incrementar la presencia de estudios de color en la ciencia, el arte, el diseño, la arquitectura, la psicología, la fisiología y la tecnología. Y como no a los editores de estos resúmenes en la persona de la Profesora Georgina Ortiz.

Javier Romero
Presidente AIC

EDITOR FOREWORD

Sometime during the sixties, we learned about the International Colour Association, AIC, and at that moment, we realized that we were not alone on the arduous path of the study of color.

Since then, our motivation to create a Mexican organization whose main characteristic would be to have members interested in any of the aspects of color. Unfortunately, at that moment, Mexicans were not interested in color because they lived it. For this reason, our organization was born on May 11th, 2005 through the interest and effort of seven founders; most of them, academicians, among them were designers, artists, physicists, and psychologists. And we all agreed that the research will be the focus of our association.

Of course, our association should have the name of Mexico, so we called it Asociación Mexicana de Investigadores del Color, better known as AMEXINC, which represents a diverse group of Mexican color researchers and scholars.

And it was thanks to this last point that we have had the opportunity to attend national and international conferences and give lectures in different schools and universities, and this have helped us to publicize the association.

In 2006, we attended the 8th Conference of the Argentinian Group of Color, where we have the opportunity to know the, at that time, President of the AIC, Dr. José Luis Caivano, who invited and encouraged us to be part of the AIC and then to organize the Interim Meeting in 2014.

We accepted the challenge even though we are a small association. Considering that we are a multicultural country we choose as the principal subject the culture, in the past, the present day and the future. We choose Oaxaca because of its traditions in the use of color and the importance of their population in the elaboration of natural traditional dyes.

The AIC also agreed to realize, at the same time, the Third Mexican Color Meeting so we can involve our nationals and take the advantage that our colleagues from other countries can know us.

Our highest appreciation to all the speakers for coming to our country and for the presentation of their high valuable work; thanks to the AIC because their confidence allowed us to made an International Congress that was a great accomplishment for our association, and hopefully not the last one, because if we have learned something from this experience, it was that color can unite not only individuals but continents and, above all, it can unite minds and goodwill for the development of human knowledge.

Georgina Ortiz Hernández
Chair of scientific committee

PRÓLOGO DE LA EDITORA

En algún año de la década de las sesentas, tuvimos conocimiento de la Asociación Internacional de Color y en ese momento nos dimos cuenta que no estabamos solos en el arduo camino del estudio del color. Desde entonces nuestra motivación fue crear una organización Mexicana, cuya característica principal fuera el que a las personas integrantes de la misma les interesara y/o trabajaran el color en cualquiera de sus aspectos, desafortunadamente en ese entonces a los mexicanos no les interesaba el color, porque lo vivían, razón por la cual esta organización nació hasta el 11 de mayo de 2005, gracias al esfuerzo e interés de siete fundadores, en su mayoría académicos, entre los cuales estaban diseñadores, artistas, físicos y psicólogos.

Por lo cual estuvimos de acuerdo que la investigación sería el centro de nuestra naciente asociación.

Por supuesto, tendría el nombre de México, y fue así que se nombró a esta insipiente agrupación, Asociación Mexicana de Investigadores del Color, conocida como AMEXINC, la cual representa a un grupo de diversos estudiosos del color en la República Mexicana.

Y gracias a este último punto es que asistimos a congresos nacionales e internacionales, impartiendo conferencias en diferentes escuelas, universidades y de esta forma dando a conocer a la AMEXINC.

En el año de 2006, asistimos al 8° congreso del Grupo Argentino del Color, en el cual conocimos al Presidente de la Asociación Internacional del Color. Dr. José Luis Caivano, quien nos impulsó e invito a formar parte de la AIC, y posteriormente a organizar el Interm meeting 2014.

Aceptamos el reto, no obstante que somos una asociación aún pequeña. Considerando que somos un país multicultural el tema principal de este evento sería la cultura, en el pasado, presente y futuro; elegimos Oaxaca por su tradición en el uso del color y la importancia que tienen sus habitantes en la elaboración de tintes naturales tradicionales.

También se aceptó que se realizara al mismo tiempo el Tercer Encuentro de Investigadores del Color, porque así seguíamos involucrando a nuestros connacionales, y se aprovecharía el que los colegas de otros países nos conocieran.

Nuestro más alto reconocimiento a los ponentes por haber asistido a nuestra tierra y presentar trabajo de gran valía; gracias a la AIC por haber depositado su confianza en nosotros ya que por ustedes se nos permitió realizar un congreso internacional, que fue un gran logro para nuestra asociación, y esperamos que no sea el último, porque si algo aprendimos fue que el color une no sólo personas, sino continentes y sobre todo une intelectos y buena voluntad en el desarrollo del conocimiento humano.

Georgina Ortiz Hernández
Coordinadora del Comité Científico

CONFERENCE PROGRAM

HORA	TUESDAY **21** MARTES	WEDNESDAY **22** MIÉRCOLES	THURSDAY **23** JUEVES	FRIDAY **24** VIERNES	**25**
8:00 a 9:00	**REGISTRATION / REGISTRO (conference, workshops, gala, tour)**				
9:00 a 10:00	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	*Opening Ceremony* Ceremonia de Inauguración	*Keynote* **3** Magistral Dr. Lindsay MacDonald	*Keynote* **5** Magistral Dr. Albert Vanel	**TOUR TO MITLA / EXCURSIÓN A MITLA**
10:00 a 11:15	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	*Keynote* **1** Magistral Dr. José Luis Caivano	Sede 1 - Impacto del color en las personas (11) Sede 2 Iluminación y color (12)	Sede 1 Diseño y cultura (22) Sede 2 Iluminación II (23)	**TOUR TO MITLA / EXCURSIÓN A MITLA**
11:15 a 11:30	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	*Coffee break, posters exhibit* *Café con ponentes y visita posters*	*Coffee break, posters exhibit* *Café con ponentes y visita posters*	*Coffee break, posters exhibit* *Café con ponentes y visita posters*	**TOUR TO MITLA / EXCURSIÓN A MITLA**
11:30 a 12:45	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	Sede 1 Significados Tradicionales (1) Sede 2 - Elementos colorimétricos aplicados (2)	Sede 1 Usos de los significados (13) Sede 2 Textiles (14)	Sede 1 Moda y Luz (24) Sede 2 Significados Tradicionales II (25)	**TOUR TO MITLA / EXCURSIÓN A MITLA**
12:45 a 14:00	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	Sede 1 Color y Tradición (3) Sede 2 Color en las ciudades (4)	Sede 1 - Impacto del color en las personas II (15) Sede 2 Lenguaje del color (16)	*Keynote* **6** Magistral Dr. Georges Roque	**TOUR TO MITLA / EXCURSIÓN A MITLA**
14:00 a 15:30	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	**MEAL / COMIDA**	**MEAL / COMIDA**	**MEAL / COMIDA**	
15:30 a 16:45	**AIC EC MEETING** / **WORKSHOPS / TALLERES**	Sede 1 Pigmentos (5) Sede 2 - Color y Teoría en la Arquitectura (6)	Sede 1 - Arte y ámbito contemporáneo (17) Sede 2 - Diseño de espacios urbanos (18)	Sede 1 Color en las ciudades II (26)	
16:45 a 18:00	**WORKSHOPS / TALLERES**	Sede 1 - Significados del color y del lenguaje (7) Sede 2 Percepción y color (8)	Sede 1 - Procesos básicos II (19) Sede 2 - Elementos colorimétricos aplicados II (20)	*Keynote* **7** Magistral Dr. Georgina Ortiz	
18:15 a 19:15	**WORKSHOPS / TALLERES**	**Coffee break / Café con ponentes** Sede 1- Educación y color (9) Sede 2 Procesos básicos del color (10)	**Coffee break / Café con ponentes** Sede 1 - Aplicación del color en la Arquitectura (21)	*Closing Ceremony* Ceremonia de Clausura	
19:30 a 20:30	**ASAMBLEA EXTRAORDINARIA DE AMEXINC**	*Keynote* **2** Magistral Dr. Renata Pompas	*Keynote* **4** Magistral Dr. Roy Berns		
21:00	**ASAMBLEA EXTRAORDINARIA DE AMEXINC**	***Reception and Calenda*** **Recepción y Calenda**		***Gala Dinner*** **(21:00) Cena de Gala**	

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KEYNOTE SPEAKERS

Color and cesia as signs:
Indexical use of color and cesia in culture and nature

José Luis Caivano
National Council for Research and University of Buenos Aires Color Research Program, FADU-UBA

Abstract

In this communication, the issue of indexical uses of color and cesia will be addressed, both in cultural contexts and in the natural environment, facing the question about the realms in which these kinds of semiosis can be present in nature.

Keywords: visual semiotics, chromatic signs, cesias, icons, indexes, symbols, culture, nature

Some Basic Notions Of Semiotics And Signs

Let's review the triadic conception of the sign according to Charles Sanders Peirce (1860-1908 [1931-1935: 1.541, 2.228, 2.230, 2.274, 2.303, 4.536]). A sign is something that stands for some other thing (its object) in order to bring information or knowledge to a third agent (the interpretant). The substituting sign is called *representamen*, the *object* is the substituted thing, what is represented by the representamen, and the *interpretant* is the idea or knowledge that the representamen transmits about the object.

Charles Morris (1938) has described three dimensions of *semiosis* (the process of signification): the *syntactic* dimension, which refers to the relations of signs to one another, the *semantic* dimension, which refers to the relations of signs to the objects that they may denote, and the *pragmatic* dimension, which deals with the relations of signs to their interpreters or users.

In the semantic dimension, the relation of signs to the objects could happen in different ways, and this gives origin to three kind of signs, which in the peircean tradition are known as icons, indexes and symbols. The *icon* is characterized by holding relations of similarity to its object. The *index* points to its object by a relation of physical contiguity, through a necessary physical connection. The *symbol* represents its object by relations of conventionality, i.e. learned codes.

Within the indexical signs, Juan A. Magariños de Morentin (2007: section I.10) makes a distinction among three different kinds of indexes, according to the temporal relationship by which signs and objects are linked: *signals* are indexical signs that appear before their objects, *clues* are signs that remain after the objects that caused them, while *symptoms* are indexical signs that occur simultaneously with their objects.

Color: A Visual Sensation, A Visual Sign

In an article published in the journal *Color Research and Application* (Caivano 1998), the issue of the indexical function of color was approached with the following arguments:

It is a well known fact (or at least it is a widely accepted notion) that color does not belong as a property to physical matter, nor to luminous radiation. Color is an *image* (we could also say a *sign*) produced in the mind of an organism that is furnished with a sensorial system, such as vision, that reacts to certain portion of this radiation. This image or sign is the reproduction that the visual system makes of the radiation coming from light sources or from objects that reflect or transmit the radiation falling upon them.

This kind of reproduction or representation is the most primary function accomplished by color, i.e., the one by which color (as a sensation, image or sign) is constituted as a substitute of physical radiation in order to provide the brain with useful information about the external world.

In this particular context, color works mainly as an indexical sign, because it is evident that between the sensorial image (the sign color) and the physical phenomenon (radiation) there is no similitude or homology whatsoever, nor a codified relationship, but only a physical connection, a neurophysiological response, built during millions of years along the evolutionary process of visual systems (see Kuehni 1991).

In the human visual system, this connection is the one responsible for reacting to radiation around 680 nanometers of wavelength by generating a reddish color sensation, which stands out in an environment where usually green and blue predominate.

Cesia

Cesia is also a visual sensation. From different spatial distributions of the luminous radiation around objects (radiation that, in addition to being absorbed, could be reflected or transmitted, either regularly or diffusely by objects or surfaces), and from the visual context in which they occur, human beings get sensations of transparency, translucency, matte opacity, mirrorlike appearance, gloss, etc. (Caivano 1991, 1994).

These sensations of cesia also bring useful information to the brain. For instance a mirror image (produced by regular reflection, in one predominant direction) and a blurred image (produced by diffuse reflection, in multiple directions) tell us something about the characteristics of the surface in which these reflections and images are produced: the first one is smooth and polished, the second one is rough or textured (Figure 1).

Figure 1. A mirror image, produced by regular reflection (bottom left), and a blurred image, produced by diffuse reflection (middle right).

In a volume of water seen through a transparent media, a cloudy, translucent or turbid image is due to diffuse light transmission, or scattering, while a transparent or clear image is due to a regular transmission of light. As interpreters of these images, we may know something about the properties of the liquid that produce them, i.e. these images have certain meanings for us (Figure 2).

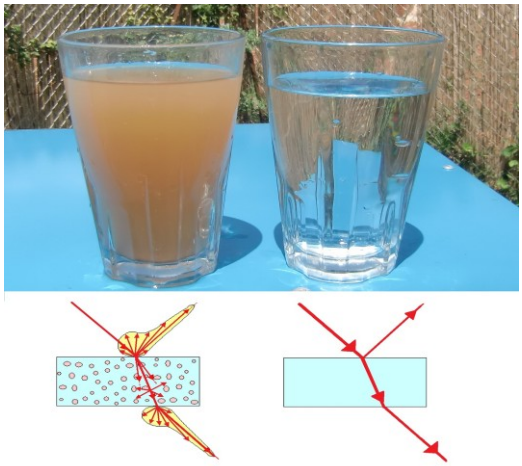


Figure 2. The visual appearance or cesia of liquids informs about their properties, working in an indexical way: turbid, translucent media (left), and clear transparent media (right).

With regard to the semantic function, likewise color, cesia is also a visual representation, a visual sign or image capable of indicating certain physical characteristics of materials, among other aspects. The most obvious and immediate thing is (by the fact that sensations of cesia are induced by physical properties) that cesia works as a sign for these physical properties. Thus, a sheet of matte paper tell us about an object that, due to its physical conformation, is capable of reflecting light in all directions, while if we see a satin or glossy paper we know that there is something different in the finishing of its surface that makes light to be reflected in a more directional way (Figure 3).

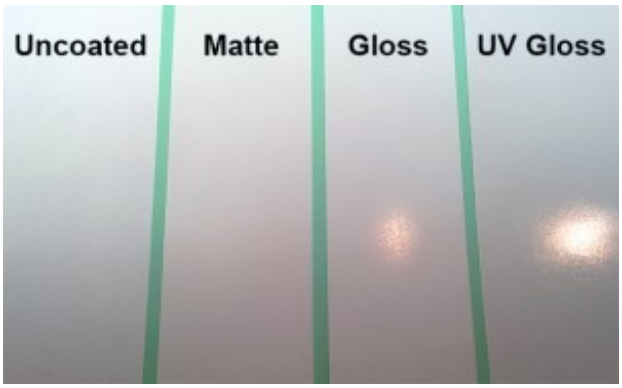


Figure 3. A series of paper surfaces with different visual appearances or cesias, showing increasing gloss from left (highly matte) to right (highly glossy). (image from The MGX Copy Blog)

Let's see another example. We can detect scratches on a polished surface because the scratches are seen with a matte appearance, in comparison to the glossy appearance of the polished surface around them. The matte appearance is produced by the perception of diffuse reflection, and thus, in this regard, this particular cesia acts as an indexical sign, where the meaning comes form a relationship of physical contiguity between the sign (cesia) and what it denotes, the information it provides about the physical world.

Icons, Indexes, Symbols

In addition to the *indexical* function, color and cesia may have, of course, *symbolic* and *iconic* values. They can represent feelings and moods, produce associations with concepts; in other words, they can have different meanings, also by means of established, acquired or learned codes (when they behave as symbols), and by means of relations of similarity or resemblance with the represented objects (when they work as icons). However, we will concentrate here on the *indexical* uses of color and cesia.

Indexes In Human Culture

As an index, in general, color serves for identification purposes, to allow visibility, to facilitate distinguishing between objects and recognizing objects on a background. For instance, these are the main responsibilities of color in football matches and army uniforms.

More specifically, as a symptom (an index in which the sign and its object occur simultaneously), color is a sign that evinces emotions. Usually, fear is expressed by a pale face, while anger is expressed by a reddish face. The chromatic sign and the emotion occur at the same time. Color may be also a symptom of illness or health. For example, the disease of oral thrush affecting the tongue produces a different color than is shown by a healthy tongue.

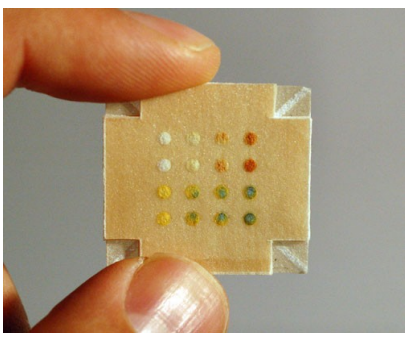
Color works also as an index in genuine synesthesia. If there is a certain neurophysiological mechanism that connects the sensory channels in the case of people having genuine synesthetic experiences, then, we should study this phenomenon inside the sphere of indexicality. This is different from the pseudo-synesthetic associations, which fall in the sphere of iconicity (Caivano, Buera and Schebor 2012: 96). Genuine synesthesia arises as a physical, automatic, and compulsive response to a given stimulus, i.e., an effect produced by a cause. Thus, it consists of indexical relationships.

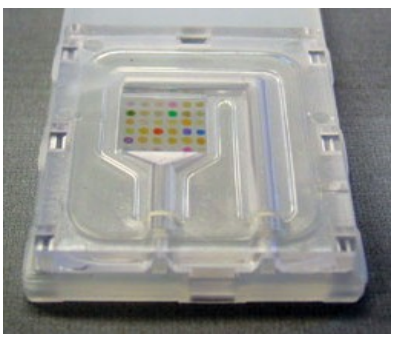
In a chromatic *metonymy* (a rhetorical figure resorting to indexical relationships), the meanings attributed to the color of an object are transferred to another object, according to a relation of contiguity. Both elements have a certain indexical proximity, which can have and existential or causal origin: a relationship between cause and effect, container and content, a part and the whole, etc. (see Sebeok 1991: 132). The banana juice packaging of Figure 4 exploits a metonymic relationship between container and content. The use of chips of color samples in order to *indicate* the color that we want for an object implies taking a part for the whole, and bears thus an indexical relationship.

Figure 4. Metonymic relationship between container and content: a banana juice packaging (designed by Naoto Fukasawa).

Examples of indexical uses of color can be found also in clinical analysis, which are usually based on colorimetric techniques. Figure 5 shows a device prepared to detect glucose and protein in urine using colorimetric assays (at left), and a colorimetric sensor that uses chemically responsive dyes to detect volatile organic compounds in exhaled breath (at right).

Figure 5. Indexical uses of color in clinical analysis.





Another example of an indexical use of color is related to nutrition, where color is taken as an indicator of the variety of food. There is a sort of "rule" which advices that eating food of five colors is a healthy practice.

- *Yellow* and *orange* foods provide beta-carotene and vitamin C.
- *Green* food has potassium, folate, vitamin C, vitamin K and lutein.
- *Violet* and *purple-blue* foods have anthocyanin and antioxidants.
- *Red* food provides lycopene, anthocyanin and carotenoids.
- *White* food has potassium, magnesium, allicin and fiber.

It must be emphasized, however, that colors are not nutritive by themselves, they work as indicators (i.e., indexical signs) of different nutrients present in food.

Always keeping within the sphere of semantic relationships (relations of signs to objects), we can observe how colors work as indexes of temporal change. This is evident, for example, in the case of leaves in autumn (Figure 6), but is also present in many other physico-chemical processes in which a color change indicates a time span.

Figure 6. Color as an index of temporal change in leaves.

A particular example of an informative function of color can be observed in the Seven colors mountain, in Jujuy, Argentina, where the colors of the different strata are clearly working as indexical signs (Figure 7). A geologist is able to extract plenty of information through the colors of the sedimentary or rocky layers. Here we are in front of an indexical image, because the colors are caused by the same materials and pigments that are being represented by them. The informative function predominates here too:

1. Gray, dark green and violet indicate marine sedimentary rocks, from the Precambrian era (600 million years ago).
2. Purple, dark pink, whitish colors stand for quartzite and sandstones, from the upper Cambrian period (540 million years ago).
3. Light gray to yellow are outcrops of argillaceous sandstones and lutite, from the Ordovician period (505 million years ago).
4. Red nuances correspond to gravels (conglomerates) and sandstones, from the Cretaceous era (144 to 65 million years ago).
5. Reddish to light pink shades are recent sandstones and clay stones, from the Tertiary period (65 to 21 million years ago).

Figure 7. The seven colors mountain, in Jujuy, Argentina.

It is well known that in aerial perspective, color works as an index of distance. In a landscape, objects far away from the observer look bluish and less saturated than near objects. This was a familiar fact for the Renaissance painters, who started using this device to give more realism to their representations. Cesia may also be and index of distance; objects seen in turbid or translucent media provide clues for evaluating distance (Figure 8).

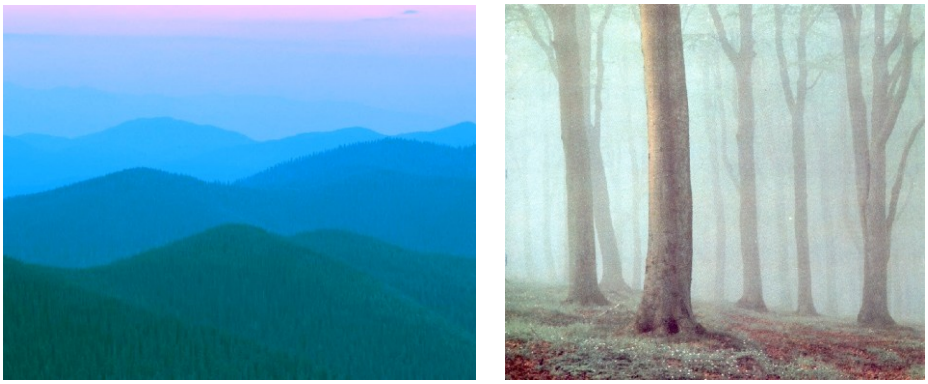


Figure 8. Color and cesia as indexes of distance: aerial perspective (left), a misty forest (right).

Cesia may be also an index of different states of frozen water: solid compact ice looks transparent, ice with bubbles appears translucent, while soft snow shows a matte appearance (Figure 9). In the Artic, cesias are very informative indices. This is what is usually meant when saying that Eskimos have near twenty words for white. Actually, it is not just for white, but for different whitish appearances involving cesia.

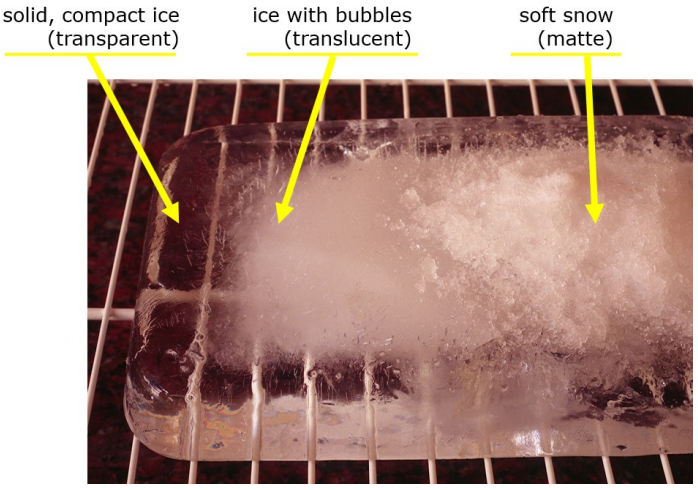


Figure 9. Different appearances or cesias in frozen water.

Cesia works as an index in liquid foods. For example, milk diluted with water looks translucent, while pure milk is white and more opaque.

Color and cesia together work as indexes in food. A crunchy, juicy red delicious apple has a glossy cesia and a saturated red color, but a mealy and dry apple usually appears with a matte cesia and a non saturated red color (Figure 10).

Figure 10. Color and cesia as indexes of food quality.

The following example was already mentioned in a previous publication (Caivano 1998: 397):

> The color purple illustrates a case of an index transformed into symbol. In the past, when purple was very difficult and expensive to obtain, it was the color of royalty. In the Roman Empire, only senators, victorious generals, and the emperor himself were allowed to wear purple. Today, this indexical connection has disappeared, but purple still conveys meanings of magnificence, pomp, dignity, nobility, and elevated position. In Spanish, the cardinals' rank in the Roman Catholic Church is still referred to as *purpurado*. The general rule that can be verified is that the repertoire of symbols in a culture grows at the expense of other types of signs, for instance iconic and indexical signs (Peirce 1860-1908 [1931-1935: 2.302], Short 1988). In other words, a sign that in a certain context begins to be taken as an *icon* (because of a relationship of similarity between it and what it represents), or as an *index* (because of a physical connection between it and its object), with time and with its reiterative use becomes a *symbol*, because habit causes the relationship to be preserved in an arbitrary way, independently of the original connection.

Based on the triadic peircean model of semiotics, developed as a semiotic nonagon, Guerri and Huff (2006: 196-197) present a logical and exhaustive classification of indexical functions of color within the semantic categories. The main three headings of the classification of color indexes, from which subsequent triads are derived, take into account: 1) color within the parameters of physics, chemistry and physiology, 2) color as a symptomatic property, and 3) color in relation to its material performance. In this sense, all the examples analyzed so far in the present paper can have a logical place in this developed triadic model.

Indexes In Non-Human Realms

For the previous examples, we have resorted to indexical semiosis of color and cesia in the form of signs originated either in culture or nature, but always interpreted by human beings, i.e., cultural semiotics, or anthroposemiotics. Now, let's go beyond this, and pose the following questions:

● Can semiotic phenomena involving color and cesia (and in particular of the indexical type) be present in other realms of the biological world, such as in other animal species and even in plants?

● Could these processes be extended even beyond, to other realms of nature, the ones that are usually classified as the abiotic or inert world?

We are referring here to signs originated in nature and interpreted by organisms or systems outside the human realm. Let's analyze first some examples from the animal kingdom.

There is a symbiotic relationship between bees and flowers: bees seek pollen for food, while flowers benefit from unintentional pollination made by bees. Certainly, symbiosis is also a semiotic process. It is defined as a close and often long-term interaction between different biological species. Thus, symbiosis involves communication and exchange of information in the form of an indexical relationship. Flowers send visual signals to bees, in the form of reflecting ultraviolet radiation, that humans are unable to see. Figure 11 shows how a flower appears to human vision as compared to bee vision. ¿How flowers send visual signals to bees? In this example, human vision perceives one color, while bee vision detects two colors, which allow to differentiate more clearly the parts of the flower, and attract as a target.

Figure 11. A flower as seen by a human being (left) and a bee (right). (Bjorn Roslett Science Photo Library)

Colors are signals for mating in birds and other animals. Jack Hailman (1997: 280-300) develops this issue in some extent. The importance of color as an indicator for successful mating is emphasized in the following paragraph:

> The two major requirements for a potential mate are that it be of the same species and the opposite sex ... Mating with another species wastes time and gametes because such mating often produce no offspring ...
> The necessity for correct attraction of potential mates has often been used to explain dramatic differences in display coloration between male and female, and among males of different species. (Hailman 1997: 280)

Animals may also exhibit deceiving behaviors by using color indexes. Figure 12 shows a venomous coral snake, at left, and a harmless red milk snake that mimics the bright colors of the venomous coral snake, at right. "Deception in animals is the transmission of misinformation by one animal to another, of the same or different species, in a way that propagates beliefs that are not true. Deception in animals does not automatically imply a conscious act, but can occur at different levels of cognitive ability" (Wikipedia 2015).

Figure 12. Deceiving behavior by means of color. A venomous coral snake (left), and a harmless red milk snake (right).

Finally, let's reflect about color semiosis and indexical activity in what is called the abiotic or inert world. First, I would like to call into question the notion that the abiotic world is completely inert. A planet that orbits a star, is really an inert or inanimate object? (We should remember that the meaning of "animate" is related to motion). A star (or our sun) is also inanimate? There are certain internal or external forces moving these objects. If these forces (e.g. gravity) are internal to the star or planet, can it be called an inanimate object? If our Earth is inanimate, how to explain the tectonic movements, volcanic activity, wind, tides, etc.?

As a matter of fact, biological activity, life, was possible because the Earth (with the solar system) provided the necessary elements. It was the Earth that gave origin to life. Thus, since life is a semiotic process, semiosis must be also present in the elements that preceded and allowed life. Additionally, we can emphasize that the traditional divisions or frontiers between living and nonliving systems, between animals / plants and minerals, are fading from year to year, as Georges Deflandre already pointed out in 1956 in his book entitled *Life, creating rocks* (Deflandre 1956 [1977: 5]).

The same book by Deflandre explains how sedimentary rocks have been built, in fact, by billions of microscopic organisms (animals, plants, protists), glued together. That is to say, what we usually consider minerals have been originated by former living organisms, and the transformation that allowed this process still continues. Having said this, we can notice that even "inert" materials can interact and produce physical and chemical exchanges among them.

One of the many examples of interaction between elements considered outside the biological world is a process that involves minerals and luminous radiation: the phenomenon of mineral fluorescence. This is a kind of interchange by which some minerals receiving radiation in a certain range of wavelengths (for instance, ultraviolet radiation) are able to temporarily absorb a small amount of this radiation and, an instant later, release it in a different wavelength (for instance, within the range that is visible to humans).

In this case, UV radiation (short wavelength) has the ability to excite electrons within the atomic structure of the mineral. "These excited electrons temporarily jump up to a higher orbital within the mineral's atomic structure. When those electrons fall back down to their original orbital a small amount of energy is released" in the form of longer wavelength radiation (King c.2013).

This process of action and reaction is already an elementary kind of semiosis, certainly of indexical nature, involving an exchange between nonliving entities, such as light and minerals.

Conclusion

Semiotics, and particularly visual and color semiotics, is not only concerned with signs that depend on culture; it includes sign processes both in culture and in nature. Indexical semiosis, i.e., semiotic processes involving the kind of signs characterized as indexes, can be taken at the basis of the building of visual semiotics, independently of verbal semiotics. Juan Magariños de Morentin (2007: section II.28) refers to the fallacy that implies the reference to the model of speech when trying to build a model for visual semiotics. He says that this fallacy has stopped and distorted the development of a semiotics of visual images, particularly because it has slowed the emergence and development of an indexical semiotics.

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Mexico And Its Colors Between Stereotype And Globalization

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Abstract

In view of the two events that will link Mexico with Italy – my attendance to the AIC 2014 "Color and Culture" Interim Meeting in Oaxaca and the adhesion of Mexico to the Expo 2015 in Milan –, I assigned the following theme to the students of the "Digital Textile Design" course at AFOL Moda - Milano, of which I am Course Director: "Mexico and its colors as interpreted by textile designers in Italy, between stereotype and globalization".
This theme promotes the comparison and the development of relationships through cultural elaboration and allows a reflection on globalization, construed as coexistence of local peculiarities and global characteristics.
The purpose was to expand on the theme of the blend of *local* cultures, as they spread in the *global* world. The basic question was: "How is Mexico seen from the screens of a computer?"
A first selection of images on the Internet clearly showed that the distinguishing feature is color: it is warm, vivid, varied, and reminiscent of the feathers of birds and the petals of tropical flowers. The work was thus first based on the definition of the range of colors, which were lively, exuberant, succulent, and cheerful.
Subsequently, the images were used to build a "concept-brief" or **"**mood board", i.e. an evocative image made up of many other images, embodying the aesthetical approach of the ensuing project.
As far as the method was concerned, the work included 7 steps: Italian design and Mexican visual culture. The spread of information on the Internet. The concept-brief or mood board. The color as a sign of identity. The construction of the color palette. The working method. The conclusions.

Key words: Teaching method, fashion, trends, design, identity, culture.

Introduction

Milan, my hometown, will be hosting the renowned world's fair known as "Expo 2015" in one year, with 141 countries having already signed on to participate.
Milan will directly experience what globalization means, understood as coexistence of local particularities and adoption of global characteristics, a multi-pole global dimension where codes are local but widespread globally.
We will experience a melting pot of people, ethnic groups, cultures, environmental experiences, national histories, religious beliefs, lifestyles, aesthetic choices and trends.
The students of the "Digital Textile Design" course at AFOL Moda – of which I am Course Director – are studying to become printed fabric and surface designers, so they are used to monitoring and experiencing the contemporary aesthetic and visual expressions of the globalized world.
In view of the AIC Meeting in Oaxaca, they were given the theme "Mexico and its colors as interpreted by textile designers in Italy, between stereotype and globalization", which promoted the comparison and the development of relationships through cultural design.

As a matter of fact, we believe our initiative, which was based on the exchange between the Mexican culture and the Italian culture through the interpretation of young talents, provides a great instrument to understand and respect our complex and diverse world.

Italian design and Mexican visual culture

The project consisted in the design of inkjet printed fabrics with a Mexican *feel*, recognizable in some iconic stereotypes, reinterpreted through Italian design.
Consequently, two peculiar dimensions needed defining.
Italian design, whose current production is intended for designers worldwide, yet selecting projects based on style consistency so as to never betray the image of the Italian company requesting the product, stands out for the harmony of parts, the proportion of shapes and components, the balance of colors with unsaturated hues and soft tones, and the search for a clear and friendly pleasantness.
The 14 students involved in the project came from different cultures, as some of them were

foreigners who got to Milan to learn the know-how of Italian design. Consequently, the final collection did not result from Italian design, but from a design made in Italy with an Italian spirit.

As far as the Mexican *feel* was concerned, lessons of Mexican history, history of Mexican art and Mexican textiles were deliberately avoided, as the theme assigned was developed exclusively by analyzing the most popular stereotypes with which a country and its visual culture are conveyed and perceived in the globalized world, through the Internet.

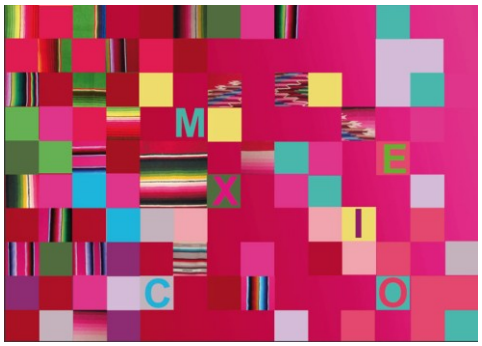
The spread of information on the Internet

The focus was to expand on the theme of the blend of *local* cultures, as they spread in the *global* world. The key question was: “How is Mexico seen from the screens of a computer?”.
Post-modernity got us used to shifts in the meaning of global village expressive language and to ever-changing and inter-combining traditions. Movies, objects, establishments, shops, music, fashion, leisure time, and cult events go beyond national boundaries and bring people from all around the world together based on their contents.
The hallmarks of modernity are eclecticism, simultaneity of forms and ever-changing metamorphosis.
National traditions mingle and are changed by external contributions, which in turn are absorbed and changed by a local interpretation.
Today’s global world is 2.0. As a matter of fact, while the 20th century was marked by the scientific, technological, labor and industrial revolution, we are currently going through an IT revolution with

the spread of information and knowledge, which mostly relies on the Internet and social networks.

The concept-brief or moodboard

The image of Mexico was searched for on the Internet, on Wikipedia and research websites, webpages and image websites, by surfing and selecting the elements that were deemed most representative: from Frida Kahlo (whose celebrity was revived by the 2002 movie by Julie Taymor, featuring Salma Hayek, and about whom a major exhibition is being held in Rome) to Luis Barragán, from the Maya culture to the "Día de los Muertos", from tortillas to tacos, from textiles to handicrafts, from vegetation to nature, from Our Lady of Guadalupe to talismans.



Each student collected a variety of images of landscapes, indigenous clothes, handicrafts, objects, religious celebrations, and architectures, seeking the definition of the local identity between past models and current influences.
Subsequently, each student selected the images s/he deemed most relevant and they collectively defined the overall color range: lively, exuberant, succulent, and cheerful.
Rudolf Steiner, the Austrian intellectual who founded the anthroposophy, said: "'One must be able to think as much in colors and shapes as in concepts and thoughts", while 15th-century Italian polymath Leonardo Da Vinci wrote on the autonomy of visual thinking: "The painter will do countless things that words cannot say".
Consequently, images resulted in a concept-brief or moodboard, i.e. an evocative image made up of many other images, visually embodying the aesthetical approach of the ensuing project.

Color as a sign of identity

Colors and iconic images have always been associated with belonging to a group or a community, symbolizing the internal and external cohesion of its members and highlighting their presence in the territory. Color can thus also be considered as an image and a symbol of the geographical and political belonging of inhabitants, as well as an sign and instrument of identity.
An initial selection of the images found on the in Internet clearly showed that the distinctive feature of color – which is warm, vivid and varied – was the fact that it was reminiscent of the feathers of birds and the petals of tropical flowers.

The construction of the color palette

Based on the individual moodboard, each student sought the common thread of his/her aesthetic and stylistic choice and selected the most important and relevant colors, without quantity limits.
In the subsequent collective work stage, each student presented the colors deemed to have the strongest *Mexican feel*. A discussion resulted in the choice of 28 hues, divided in 4 groups of 6 colors, including shades with different lightness, darkness and intensity levels.
Made-up names played a very important role in client and press communication, while the use of adjectives and associations enhanced the product message and allowed memorizing the collection concept.
Finally, color notations, based on NCS Navigator, Munsell and Pantone TPX color systems, enabled students to practice a more accurate color communication system.

Working method

1) *In the first stage* of the work, students were invited to choose one of the suggested themes and to show its concept by means of a selection of significant images.
Concept visualization was carried out by selecting the most significant images from photos on the Internet and by reprocessing them artistically, to make the message more effective. This material was used to create a moodboard (i.e. a visual presentation of the feel, which did not focus on project development, but on its sensations) in horizontal A3 format (mm. 420 x 297).
The overall landscape impression of each themed moodboard was assessed in terms of:

- Overall balance and proportion
- Aesthetic and perceptive quality
- Types of elements (shape and dimension)
- Characteristic and characterizing elements
- Distribution of elements in a configuration (random, organized, chaotic, uniform, etc)
- Color combination and quality

2) *In the second stage,* students extrapolated 24 colors, representing the specific theme chosen, in terms of shade, intensity, lightness/darkness and aesthetic quality.
The scheme had to include at least one color for each of the 11 'Basic colors' suggested by Berlin and Key[i] - white, black, green, yellow, blue, brown, violet, pink, orange, grey – yet considering them as a reference 'family', while adjusting the balance between warm shades and cool shades, so as to create a harmonic numerical distribution. The same criterion was required for the brightness ratio between dark and light shades, with intermediate brightness shades.
Subsequently colors were divided into 4 macro-areas, i.e. pastel, neutral (construed based on an enlarged and non-scientific use of trends, including grey, beige and 'dirty' colors) or average or – if the palette required it – vivid (for small touches), and dark shades.

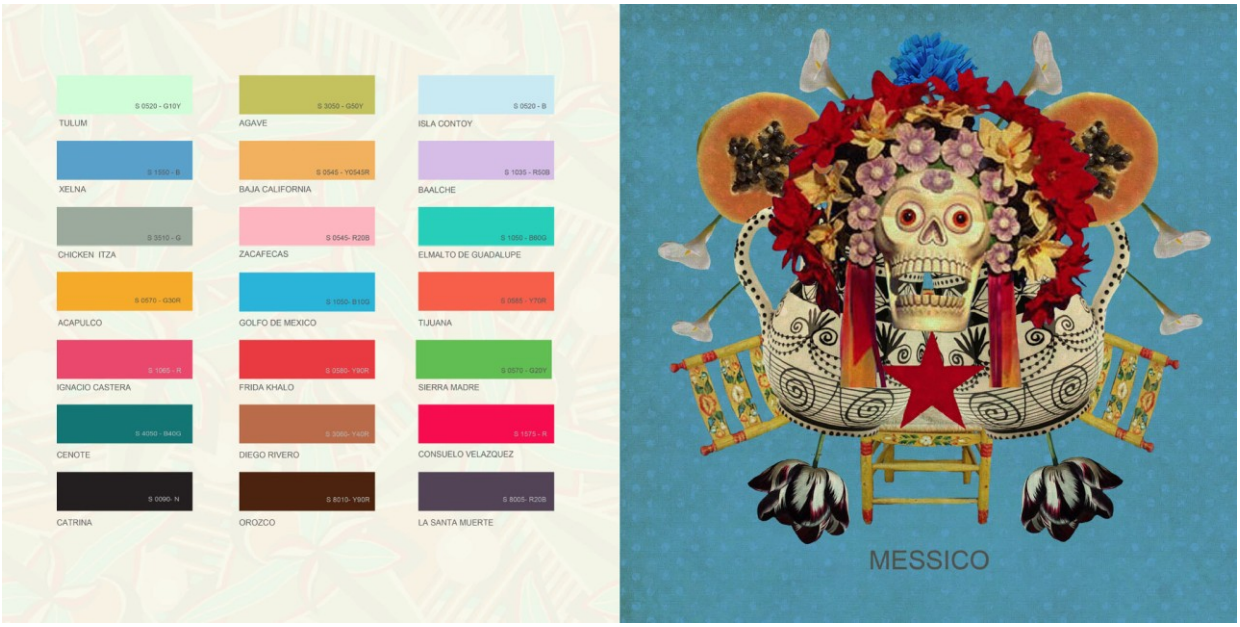
- Pastel

• Neutral / or Average
• Average / or Vivid
• Dark

This division reflected the traditional, now obsolete, characterization of colors: daytime/nighttime, men's/women's, children's/adults', underwear/clothing, knitwear/outerwear, classic/sports. However, its conceptual framework allowed covering all types of use[ii].
Each of these macro areas required the inclusion of 6 colors arranged vertically from lightest (top) to darkest (bottom), in harmony with the biologic knowledge of the world that perceives force of gravity as a downward attraction of what is heavier and an upward ascent of what is lighter.
Moreover, every vertical macro area had to possess a balanced distribution between warm colors and cool colors. When a warm color and a cool color had the same brightness, the warm color – advancing and outward-oriented – was on top[iii], while the cool color – retreating and inward-oriented – was on the bottom.
The 4 macro-areas were distributed in a graphic scheme.[iv]

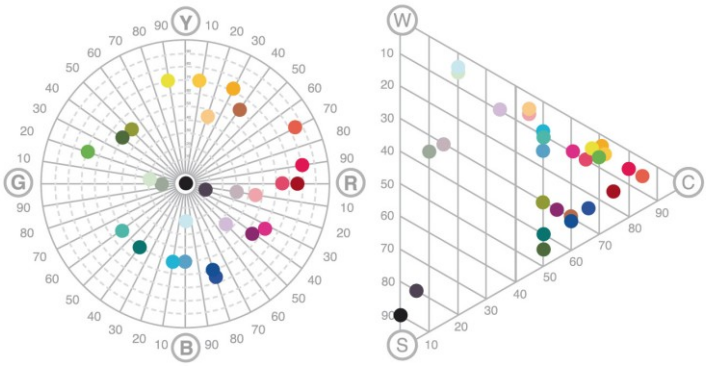
3) *In the third stage,* every student built the palette of his/her own project first by distributing colors according to the above-mentioned scheme and rules and then by slightly changing the order to improve aesthetic effectiveness (for instance, to prevent the same horizontal line crossing the four vertical macro areas from including two or more colors of the same family, yet with different hues).
As a matter of fact, even if the method is implemented properly, palettes are required to have an aesthetic appeal in line with general market trends and visibly rigid schemes have to be avoided as they will not be welcomed. The color palette, intended for a market where preferences change quickly, should always suggest a new and surprising element.

4) *In the fourth stage* every student assigned some make-up names to each shade.



5) *In the fifth stage* the NCS Navigator assigned a value to each shade.

This experience was intended to teach how to build evocative, well-constructed and ever-changing *Color Cards* and *Color Books* that may be appealing to the market.



Conclusions

Based on a shared color chart, each student developed 3 inkjet printing designs, which were different in terms of forms yet consistent in colors. 9 of these designs were selected and the company Eurojersey printed them on the "Sensitive" fabric. A report will be presented at the Meeting about an event that was created in cooperation with other courses by AFOL Moda – Milano.

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i Brent Berlin, Paul Kay, Basic Color Terms: Their Universality and Evolution.

ii Renata Pompas, Textile Design. Ricerca – Elaborazione – Progetto. Hoepli, Milano, 1994.

iii Renata Pompas, Combinaciones de color para proyectos, Escuela de Diseño de la Universidad Católica de Chile, Santiago, 2011.

iv According to a method I personally designed it, as course director and teacher of 'Project' and 'Color' subjects.

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La Couleur Dans Les Cultures Du Monde

Par M. Albert-Vanel

Résumé

Cet ouvrage, récemment paru, procède d'une enquête, qui a duré vingt ans, et a suscité une multitude de voyages autour du monde. Il fut également l'objet de cours d'histoire de l'art sur les civilisations à l'ENSAD de Paris.
L'objectif était de vérifier si la séquence colorée des chercheurs américains Berlin et Kay : ″Basic color terms″ de 1969, était ou non fondée. Car elle prétend décrire le niveau culturel d'une société au travers de cette séquence de couleurs.
Mais l'équipe de Serge Tornay (Laboratoire d'Ethnologie - Nanterre Université Paris X), tendait à démontrer le contraire, dans : ″Voir et nommer les couleurs″ de 1978.
La discussion était donc ouverte, et on pouvait se demander si les différents peuples à travers le monde possèdent, ou non, la même culture que nous envers la couleur ?
Maintenant il nous paraît probable que la séquence Berlin et Kay ne décrit pas réellement l'évolution linguistique des populations rencontrées. Par contre elle pourrait bien décrire l'évolution de leurs réalisations picturales, architecturales, design des objets, peintures corporelles, etc.
Dans beaucoup de civilisations, la couleur est, en effet, considérée comme étant la chair des dieux. C'est dire toute son importance.
Et cet aspect unitaire constitue un lien profond entre les cultures, qui se structure selon une évolution allant du simple noir et blanc aux multiples nuances, avec des couleurs de plus en plus nombreuses.
C'est donc ce point de vue que nous proposons d'exposer dans cette conférence.

Mots clef : couleur culture séquence de couleurs ethnologie langage

A la suite de la publication de **Berlin et Kay: « Basic color terms »**, en ethnologie de 1969, il s'est instauré un débat, consistant à savoir si les différents peuples à travers le monde possèdent ou non la même culture que nous, envers la couleur ?
Selon Berlin et Kay, on trouve dans toutes les langues du monde, une séquence fondamentale appelée « **Basic color terms** ». Dans cette séquence, les couleurs seraient citées toujours dans le même ordre. Cette séquence serait même révélatrice de l'avancée des sociétés en question. Il s'agit de :

BLANC
NOIR
ROUGE
VERT
JAUNE
et
ou
JAUNE
VERT
BLEU
BRUN
VIOLET
ROSE
ORANGE
GRIS

La thèse de Berlin et Kay paraît séduisante. Cependant, on peut admettre les doutes et les réserves émis par **Serge Tornay**, en ce qui concerne son application au langage des peuples de la Terre.
En effet, Serge Tornay et son équipe (Laboratoire d'Ethnologie - Nanterre Université Paris X), tendent à démontrer le contraire, dans : ″**Voir et nommer les couleurs**″ de 1978.

Ainsi ils observent que certains peuples, comme les Inuits, ont développé une vingtaine de termes de couleur pour signifier le blanc, alors que leur société est demeurée à un stade assez primitif, et que nos sociétés occidentales, n'en possèdent pas autant.
De même, des éleveurs de bétail, tels les Santal de l'Inde, ou les Mursi d'Ethiopie, ont un vocabulaire décrivant essentiellement les nuances des robes du bétail. Il en résulte que, pour eux, l'herbe est également brune, tout comme le bétail…
Et il semblerait que si Tornay a raison, concernant le langage, il n'en va pas de même des réalisations humaines, telles qu'architectures, design des objets, masques, sculptures polychromes, peintures corporelles, etc. Et il se pourrait bien que la séquence Berlin et Kay décrive l'évolution temporelle de ces réalisations.
Dans beaucoup de civilisations, la couleur est, en effet, considérée comme étant la **chair des dieux**. C'est dire toute son importance. En effet, un objet n'est sacré que tant qu'il est en couleur. La forme est considérée comme n'étant que le support à la couleur.
Et cet aspect unitaire constitue un lien profond entre les cultures, qui se structure selon une évolution allant du simple noir et blanc aux multiples nuances, avec des couleurs de plus en plus nombreuses.
Ainsi la céramique chinoise est un bon exemple de cette évolution, avec des couleurs de plus en plus variées, au fur et à mesure de ses progrès technologiques. Il semblerait donc que la séquence Berlin et Kay se justifie bien du point de vue historique. C'est donc ce que nous proposons d'exposer dans cette conférence.

Le noir et blanc
Il semble, bien effectivement, que tout commence avec le noir et blanc. Il représente le cycle fondamental du jour et de la nuit, de la lumière et des ténèbres, de la vie et de la mort.
Dans l'animisme, ce sera le chaman noir et le chaman blanc, celui qui visite le sous terre, et celui qui visite les cieux.
Et on trouvera également en Afrique et dans les civilisations de la terre, cette importance du noir et blanc, pour signifier les choses essentielles, telles que la vie et la mort, ou encore dans les peintures corporelles propres à impressionner l'ennemi.
C'est l'opposition la plus forte, symbolisée par l'image du Yin-Yang chinois, alternance immuable, le temps qui passe, et qu'on ne peut arrêter.
Ainsi cette opposition du noir et du blanc va avoir quelque chose d'oppressant, de contraignant, d'implacable, et d'imposé. Il sera ressenti comme un refus de la couleur, un refus des plaisirs de la vie. Il traverse les civilisations, et sera illustré, de manière contemporaine, par les tours de verre et d'acier des villes nouvelles, surtout dans les quartiers d'affaires, que l'on dira justement déshumanisés.

La triade sacrée
Puis vient le rouge, et avec lui la vie. C'est à la fois le feu et le sang, la tragédie de la vie humaine. Très tôt les ossements seront peints en rouge, en signe de renaissance. Et ce sont les trois couleurs que l'on trouvera dans les peintures des grottes de la préhistoire.
Ce rouge est issu des oxydes de la terre, qui permettent par chauffage, d'obtenir différentes nuances de rouge.
Le noir et blanc, abondamment utilisé dans l'écriture égyptienne, sera complétée par le rouge, afin de souligner ce qui est important.
Le Japon utilisera un rouge minium sur ses temples, en tant que couleur insurpassable.
Le rouge fut longtemps la seule teinture véritable, jusqu'à en faire la robe de mariée au Moyen Âge.
Il ne faut donc pas s'étonner de retrouver ces trois couleurs en alchimie, puisqu'elles étaient censées marquer les différentes phases de l'œuvre, et son accomplissement : Œuvre au noir,

Œuvre au blanc, et Œuvre au rouge. Et c'est dans le rouge de la Pierre Philosophale, que l'on devait pouvoir guérir et même renaître…
Ce sera également le point de repère, la chose essentielle et à distinguer de son environnement : le tapis rouge, la décoration, le rideau de théâtre, le bouton essentiel…

Les quatre tonalités
Les autres couleurs vont apparaître plus tardivement. Déjà le jaune tiré de la terre apparaît, comme un dérivé du rouge. Ainsi le rocou, plus ou moins dilué, donnera naissance à une teinture proche du jaune.
Mais les autres couleurs, telles que le bleu et le vert étaient toujours absentes, dans les cultures dites ″sauvages″, ou dans les ″arts premiers″. Et ce ne sont guère que les plumes des oiseaux, qui ont pu fournir ces diverses couleurs, avec l'apparition de divers contes, tel que celui du serpent arc-en-ciel, en Amazonie, ainsi qu'en Malaisie, en Polynésie.
Ces couleurs restèrent donc célestes et mythiques, pendant bien longtemps. Et il faudra attendre l'Egypte ancienne, pour voir apparaître un bleu véritable, remplaçant le coûteux lapis-lazuli.
Désormais on le trouvera dans les mosaïques telles celles de Samarkand, et de bien d'autres contrées.
Cette couleur bleue, ainsi que le vert, apparaîtront en Occident, seulement vers la fin du Moyen Âge. On les retrouvera dans les vitraux des cathédrales. Mais pour cela, il fallut une importante évolution de la chimie des pigments, que ne possédaient pas les civilisations primitives.
Ainsi ces quatre tonalités fondamentales vont-elles caractériser les oppositions cardinales : celles des quatre éléments, des quatre saisons, des quatre orientations de l'espace, des quatre caractères psychologiques.
Le rouge va naturellement s'opposer au vert de la végétation. Et cette opposition sera représentative de celle de l'homme ou du vivant, à la couleur de la nature.
Mais il s'instaure également un autre couple antagoniste : celui du jaune et du bleu.
Il signifiera l'opposition du terrestre au céleste, de la terre et de l'eau.

Les six primaires
Avec l'héraldique du Moyen Âge, on passe à six couleurs fondamentales : le gueules, le sinople, l'azur, l'argent et l'or. Ce seront les couleurs qui donnent les figures les plus lisibles, à tel titre qu'elles sont réemployées dans notre actuelle signalétique routière.
Cela signifie qu'aux quatre tonalités précédentes, s'ajoutent le noir et le blanc.
Couleurs de la Création du monde, selon la Genèse.
Curieusement ce seront également les six couleurs authentiques du bouddhisme. On les trouvera donc dans la roue du karma, pour signifier les cycles de vie, et les cycles d'évolution et de culture. Ce seront également les couleurs des stupas et des chortens, le Ming T'ang chinois, ou ″Maison du calendrier″, temple de lumière.
Dans les cathédrales gothiques, l'adjonction du noir et blanc va figurer le zénith et le nadir. C'est dire que l'espace plan se transforme alors en espace tridimensionnel.
Ce sera la base de tous les systèmes de couleurs, une volonté de globalité.
Il ne faudra donc pas s'étonner de les voir caractérisées par G. Jung comme des archétypes. Et on les retrouvera également comme primaires psychologiques, d'après Hering.

L'or
Reste cependant une couleur importante, ignorée de la séquence Berlin et Kay. C'est la couleur or, que l'on ne peut confondre simplement avec le jaune.
On la trouve plus spécialement dans l'héraldique du Moyen-Âge, associée à d'autres couleurs.

Si elle est peu présente en Occident, elle est cependant omniprésente dans l'Asie du sud, que ce soit en Thaïlande ou en Birmanie.
Là, il s'agit véritablement de la ″chair des dieux″ !
Mais c'est également l'or des icônes de la sainte Russie. Une lumière céleste, celle du Paradis. Sa signification sera à la fois celle de la richesse et de l'aboutissement, de l'insurpassable, de la perfection. Mais en même temps ce sera la couleur du vide, sa recherche étant considérée comme vaine et illusoire.

L'arc-en-ciel
Les couleurs secondaires procèdent par mélanges entre les couleurs primaires. Il s'agit de l'orange, du pourpre, du turquoise et du citrine. Ces couleurs, par rapport aux éléments, seront caractérisées comme étant des forces et des énergies en action, ainsi que le chaud et le froid, le sec et l'humide.
Elles permettent donc le passage, la progression, entre les primaires, et vont aboutir aux concepts de l'arc-en-ciel et du cercle chromatique.
Avec les mosaïques de Byzance, l'arc-en-ciel n'est plus seulement une nuée céleste fugitive, mais devient une réalité matérielle.
On trouvera aussi cette image de l'arc-en-ciel dans les représentations du Bouddha, et des saints personnages. Une sorte de clôture insurpassable.
Et ce seront les yantras de temples hindouistes de l'Inde du sud, les cônes de pigments sur les marchés, la profusion des couleurs…
Il va signifier la fête et la joie du carnaval. Et au Mexique, ce sera la mort joyeuse des cimetières du Yucatan.

Le charme dangereux des nuances
Avec les mélanges entre couleurs, c'est comme une arborescence qui s'ouvre progressivement, jusqu'à atteindre un très grand nombre de tonalités.
Ces nuances sont très caractéristiques des couleurs de la nature : les sols, les terres, les roches, les poteries que l'on peut en tirer, les écorces d'arbre, les joncs, les formes artisanales, comme celles des paniers… Ce seront également les couleurs raffinées de kimonos japonais.
La Kabbale juive reflète particulièrement bien cette montée dans les différentes strates de l'univers.
Mais en même temps le bouddhisme met en garde contre le charme trompeur des nuances. Il y verra une nostalgie des couleurs de ce monde, et un frein à l'évolution, pour lequel il vaut mieux préférer les couleurs vives, que les couleurs ternes issues des mélanges.
Les couleurs pures seront considérées comme sacrées et proches du divin, elles sont ″pures et vierges″, alors que les couleurs ternes et les nuances, sont des couleurs ″bâtardes″. On les dira même issues de la copulation. Elles reflètent la triviale réalité du monde terrestre.
Ainsi le brun et le marron seront couleurs d'entropie, de pauvreté, de modestie, de saleté…

Les combinaisons de couleurs
Ce serait toutefois une erreur que de ne considérer que la symbolique liée aux couleurs isolées. La couleur est comme un langage, et ce qui compte le plus ce ne sont pas les lettres de l'alphabet, ou même les mots, mais bien davantage l'association de ces mots, pour former des phrases.
Ainsi la séquence des couleurs est-elle à considérer comme formant une combinatoire.
Cela est tout à fait évident dans les costumes de certaines ethnies de Birmanie et de Thaïlande, où ce qui compte, n'est pas tellement le sens de telle ou de telle couleur, mais le sens donné par son association avec une ou plusieurs autres couleurs.

La mondialisation

Ainsi la séquence Berlin et Kay parait bien décrire une évolution historique. Mais il n'est pas sûr qu'elle décrive l'évolution des sociétés humaines, au temps de la mondialisation.
Celle-ci a radicalement changé la donne.
Bien sûr, on a vu que l'évolution des techniques a permis l'acquisition de nouveaux pigments. Les perles colorées du Gabon sont un bon exemple de la diffusion d'un produit occidental en Afrique, et dans le reste du monde.
Mais en même temps bien des civilisations encore ″en voie de développement″, s'emparent des techniques occidentales, comme les peintures industrielles, pour mettre leur environnement en couleurs. Cela est particulièrement visible en Afrique de l'est, avec la mise en couleurs de leur maison par les femmes Ndébélé de la région de Johannesburg, ou encore les polychromies audacieuses de Arabie heureuse...
Il en résulte que cette séquence des couleurs paraît essentiellement décrire une symbolique, et une psychologie de la couleur. Et, à ce titre, elle permet de caractériser les réalisations humaines.
Ainsi le glissement s'est fait en faveur de cette symbolique qu'apportent les couleurs.
On peut même avancer que le challenge de ces prochaines années sera celui de la bonne communication entre les peuples, et de leur compréhension réciproque.
C'est là où la couleur peut jouer un rôle fondamental, en tant que langage commun, dépassant les problèmes purement formels, et les incompréhensions dues aux mots des différents langages.

Conclusion

Ainsi l'ouverture sur les couleurs du monde nous apprend beaucoup et permet de dépasser nos propres clivages. Il est temps, en effet, de quitter le point de vue égocentrique de l'Occident et d'examiner l'apport du monde entier avec ses convergences.
Pour terminer, j'évoquerai le livre de Gerald Hawkins : *Mindsteps to the Cosmos*. Dans cet ouvrage, l'astronome britannique fait état du fait que, dans l'histoire du monde, le temps des furent longs à venir, l'accélération actuelle devient vertigineuse ! Cela dessine une courbe prédictive, selon laquelle on arriverait, au milieu du 21ème siècle, à un moment où le progrès technologique serait infini dans un temps quasiment nul. On peut alors se demander ce qu'il en résultera ?
Car Arthur Koestler dans *Les Somnambules* pose la question : Est-ce que le progrès moral de l'humanité ira à la même vitesse ?
On peut en douter. Il pourrait donc s'agir d'un suicide collectif, si toute cette puissance technologique tombe entre de mauvaises mains…
Aussi, en cette époque de mondialisation, où l'on se préoccupe du sort de la planète, préoccupons-nous également du sort de ses habitants. Il est grand temps de penser que tous les hommes constituent une grande famille, embarquée sur le même bateau ! Et la première des démarches est bien celle de l'ouverture d'esprit et de la compréhension.
Il devient essentiel de mettre fin aux intégrismes de tous bords, de dialoguer, de comprendre, de pénétrer les différentes cultures, et d'en faire un héritage commun. Car il ne s'agit plus d'une menace, mais d'un enrichissement.

Naturaleza, Formación y Organización de los Símbolos Cromáticos

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Este texto no tiene como objetivo el análisis de un símbolo cromático en particular. En este sentido, cabe precisar que no me interesan directamente los significados simbólicos de cada color, sino más bien la manera en que se forman estos símbolos, su forma de significar, así como su organización en sistemas.

Para empezar, discutiré la naturaleza del simbolismo de los colores en relación con el concepto de símbolo como signo convencional. Me gustaría poner en cuestión algunas ideas bien establecidas y a las que muchas personas todavía dan fe. Una es que los símbolos de color tendrían un valor universal. Otra es que los símbolos cromáticos son arbitrarios. Y finalmente, una tercera idea es que los símbolos de color se podrían entender de manera aislada, como una relación directa entre tal color y tal significado simbólico. Luego analizaré su formación, ya que muchos comparten las mismas características que permiten darles una cierta estabilidad, misma que es necesaria para que funcionen como códigos compartidos dentro de una comunidad dada.

Finalmente, en la medida en que, en la mayoría de los casos, un símbolo cromático no surge de manera aislada sino que es parte de un sistema, analizaré algunos de estos sistemas y propondré una manera de clasificarlos. En otras palabras, me gustaría proponer una aproximación de tipo estructuralista al simbolismo de los colores. Básicamente, este tipo de aproximación significa que lo que cuenta es el sistema, más que los elementos que lo componen. Ello quiere decir que el valor de los elementos, los colores en este caso, proviene del sistema y no de los colores mismos. Estoy consciente de que mi propuesta puede suscitar resistencias. Sin embargo, quisiera proponerla en la medida en que esta aproximación tiene ventajas, creo yo, para explicar ciertos mecanismos y proponer una manera de entender los colores menos usual que la que predomina en la reflexión sobre el tema.

1. Naturaleza de los símbolos cromáticos

1.1. Símbolo y significado

Entre todas las formas de expresar el significado de los colores, el simbolismo es de lejos una de las más frecuentes, en todas las culturas, tanto "primitivas" como "modernas". También es uno de los aspectos más espectaculares de los fenómenos relacionados con el color, y uno de los más fascinantes. Una primera pregunta que surge es de saber si el color tiene otros significados que simbólicos? Esta pregunta, a su vez, depende de la definición que da uno a la palabra "símbolo". Si aceptamos la idea de Peirce, según la cual los símbolos son signos convencionales o que dependen de una costumbre (adquirida o innata) (Peirce 1932: 2.297), podemos disociar estos *símbolos convencionales* de los *significados expresivos* que confiere una persona dada a los colores y que son idiosincrásicos. Es el caso de algunos pintores, sobre todo modernos. Un pintor como Matisse insistió mucho en esta idea: "cuando pongo un verde, ello no quiere decir 'hierba'; cuando pongo un azul, ello no quiere decir 'cielo'" (Matisse 1972: 95, nota 43). Con esta idea, Matisse se rebela en contra de los

significados convencionales dados a los colores y reivindica un significado que llama "expresivo", relacionado con la sensación que este color le produce a él, una sensación que no es fija, ya que varía en función de sus estados de ánimo.

1.2. ¿Simbolismo universal o relativo?

Si tomamos como punto de partida la idea de símbolo como signo convencional, cabe preguntarse si cada uno de los colores principales estaría asociado a un significado simbólico mediante una asociación unívoca, estable, y que sería universal. Basta con abrir el *Diccionario de los símbolos* de Chevalier y Gheerbrandt en el artículo "color" para leer: "El primer carácter del simbolismo de los colores es su universalidad, no solamente geográfica, sino también a todos los niveles del ser y del conocimiento, cosmológico, sicológico, místico, etcétera" (Chevalier y Gheerbrandt 1982: 294).

¿Cómo entender esta idea que el simbolismo de los colores sería universal? Una respuesta es que su carácter universal se debe a que todos los símbolos cromáticos tendrían el mismo origen. Es la opinión, no muy convincente, del barón Frédéric de Portal en el primer capítulo de su libro *El simbolismo de los colores,* donde escribe que "Los colores tuvieron el mismo significado en todos los pueblos de la alta antigüedad; tal conformidad indica la existencia de un origen común que entronca con la cuna de la humanidad y que encuentra su más alta energía en la religión de Persia" (Portal 1996: 1). Se trata de un libro publicado en 1837 y escrito en un espíritu esotérico, así que se tiene que tomar con muchas precauciones. No es cierto que los colores tuvieron desde el principio un mismo significado simbólico, ni tampoco que tendrían el mismo origen. Existen otras explicaciones del carácter supuestamente universal de los símbolos cromáticos. De acuerdo con la psicóloga Eva Heller, las asociaciones entre colores y sentimientos son experiencias universales que tienen los mismos efectos en todos los humanos[1] (Heller 2009: 17).

La teoría opuesta a la teoría universalista es la teoría relativista, de acuerdo con la cual los símbolos de color son relativos a cada cultura, y por lo tanto, no pueden pretender tener un valor universal. Los lingüistas han insistido mucho en el hecho de que, en tanto signos, los colores se tienen que entender dentro de un sistema dado y no de un manera universal que trascendiera el sistema al que pertenecen. Como lo expresó Benveniste: "Dos sistemas pueden tener un mismo signo en común sin que resulte de ello sinonimia ni redundancia, es decir que la identidad sustancial de un signo no cuenta, sino solamente su diferencia funcional" (Benveniste 1974: 53). Y da precisamente el ejemplo de los colores:

> El rojo del sistema binario de los semáforos no tiene nada en común con el rojo de la bandera tricolor, ni tampoco el blanco de esta bandera con el blanco del duelo en China. El valor de un signo se define solamente dentro del sistema que lo integra. No hay signo trans-sistémico (Benveniste 1974: 53).

1.3. Símbolos cromáticos y arbitrariedad

Esta cita lleva a distinguir los colores de los sistemas a los que pertenecen. Volveré a este asunto. Si aceptamos entonces que los colores son relativos a un sistema cultural dado,

[1] En otra ocasión, he analizado y puesto en cuestión esta idea de un significado universal de los símbolos cromáticos. Véase mi conferencia « Los significados del color en las obras de arte », de próxima aparición en las memorias del decimo Congreso de la Asociación internacional de semiótica visual, Buenos Aires, septiembre del 2012.

¿significaría esto que son arbitrarios? Esta cuestión es muy debatida. ¿Son los símbolos arbitrarios o no? Todo depende por supuesto de lo que se entiende por "signo", por "símbolo", y por "arbitrario". Saussure consideraba el signo como arbitrario y distinguía *signo* y *símbolo* desde este punto de vista, ya que para él el símbolo no es completamente arbitrario: "Lo característico del símbolo es no ser nunca completamente arbitrario; no está vacío, hay un rudimento de lazo natural entre el significante y el significado" (Saussure 1982: 105).

Vamos a seguir esta hipótesis para examinar hasta donde nos puede ayudar. Sin embargo, es necesario matizar primero la idea saussuriana de arbitrariedad del signo que ha sido puesta en cuestión por otros lingüistas, y por Benveniste en particular. De manera interesante, este último toma como ejemplo el caso tan a menudo dado como el paradigma de la arbitrariedad de los símbolos cromáticos: el duelo, cuyo símbolo es negro en Occidente y blanco en Oriente. Sin embargo, nos explica que este símbolo aparece solamente arbitrario desde el punto de vista completamente distante de quien observa desde fuera la relación estrecha que existe entre una realidad objetiva y un comportamiento humano. Pero, para quienes viven esta realidad, no la viven como arbitraria sino como necesaria, y con un significado que consideran como normal porque están acostumbrados a el (Benveniste 1966: 51).

Retomando a Benveniste, Levi-Strauss insistirá también en las mismas ideas, es decir que el carácter arbitrario del signo es algo provisional, ya que una vez que se integra a un sistema dado, pierde su carácter arbitrario. Lévi-Strauss escoge también un ejemplo relacionado con los colores: los semáforos. Es de manera arbitraria que los reglamentos de tránsito decidieron atribuir un valor semántico al rojo y al verde. Pero, una vez instaurado este sistema, nos parece normal y consideramos como evidente que el rojo fue escogido para significar la interdicción de pasar debido a su significado de peligro, de violencia y de sangre. De la misma manera, nos gusta pensar que el verde, significando esperanza y tranquilidad, fue electo para significar que la vía está libre y que podemos pasar. Sin embargo, Lévi-Strauss se pregunta ¿que habría pasado si se hubieran invertido los dos colores? Sugiere así que hubiéramos asociado al rojo la idea de calor humano y comunicabilidad, y al verde un símbolo glacial y venenoso (Lévi-Strauss 1958: 108).

Así la idea de que los símbolos de color son "arbitrarios" (en el sentido de signos convencionales) se tiene que matizar. Para evitar estos problemas relativos a la arbitrariedad, se habla más bien hoy en día de *motivación*. Como lo hizo notar Benveniste, en un signo, la relación entre significante y significado no es arbitraria, sino necesaria (Benveniste 1966: 51), ya que no se pueden disociar dentro de la unidad que constituye el signo. En cambio, considera que, entre el signo como conjunto (significante y significado) y el referente (es decir aquello a lo que remite), la relación puede ser motivada o inmotivada. En el caso del signo lingüístico, esta relación es inmotivada, ya que no existe ninguna motivación entre la palabra /res/ y el animal al que remite esta palabra, como lo había hecho notar Saussure, ya que este mismo animal se llama de otra forma en otros idiomas.

1.4. Símbolos cromáticos y motivación

Tomando en cuenta esta precisión y siguiendo a Saussure, se ha sugerido que se tiene que distinguir el *símbolo* que es motivado del *signo* que es inmotivado (Todorov 1972: 275, entre otros). Desde esta perspectiva, me propongo mostrar que, en efecto, los símbolos cromáticos son muy a menudo motivados. Sin embargo, veremos también que no todos los símbolos cromáticos son motivados. Seguiré con el ejemplo ya dado de la "arbitrariedad" de

los símbolos de color: el duelo en Occidente y en Oriente. Si es tan famoso, es porque la diferencia de costumbre entre Oriente y Occidente es tan contundente como la diferencia entre blanco y negro, es decir el contraste más fuerte. Sin embargo, esta diferencia tajante no significa necesariamente que haya arbitrariedad en este simbolismo. Curiosamente, un autor como Todorov, quien considera el símbolo como motivado, piensa sin embargo que en este caso preciso "la motivación [es] casi inexistente para el color negro" (Todorov 1972: 282), lo que se debe de poner en cuestión.

En efecto, cómo lo hizo notar Otto Pächt (1994: 88), la muerte se puede simbolizar por la noche, o la ausencia de luz, pero también por la palidez de los fantasmas y de los espíritus. Así, podríamos decir que este símbolo no es arbitrario, sino motivado de manera diferente y aun opuesta en los dos casos. Ello nos lleva a proponer de distinguir cuidadosamente *relativismo* y *arbitrariedad*. El símbolo del duelo es relativo a la división entre dos grandes áreas culturales, las de Oriente y Occidente, pero esta relatividad no se debe a la arbitrariedad, sino a una motivación distinta.

Otra explicación ha sido dada por el historiador del arte Meyer Schapiro. Considera en efecto que el blanco y el negro, más allá de su oposición, tienen mucho en común. Ambos son acromáticos y representan los dos polos extremos de luminosidad, así que desde esta perspectiva, los dos son intercambiables en tanto símbolo, cuando se trata de simbolizar un estado extremo: "tanto el blanco como el negro pueden expresar el vacío de la muerte" (Schapiro 1973: 47). De acuerdo con esta interpretación, la motivación se debe a la similitud entre polos extremos: polo extremo de luminosidad; polo extremo de la vida, o sea la muerte.

2. Formación de los símbolos cromáticos

Cabe entonces preguntarse ¿cómo se constituyen los símbolos cromáticos? Vale la pena analizar un poco más en detalle el ejemplo del duelo en Occidente. Un punto de partida posible es un pequeño sistema que resulta de la puesta en relación de dos oposiciones, una al nivel de la expresión, la otra al nivel del contenido: a la oposición entre luz y ausencia de luz corresponde aquella entre vida y muerte. La luz está asociada así a la vida y la ausencia de luz, o sea la oscuridad, a la muerte. Muchas metáforas descansan en esta oposición, por ejemplo "dar a luz" para significar parir, es decir llevar un ser humano a la vida. En cambio, la oscuridad está a menudo asociada con el inframundo en muchas mitologías, y con la muerte en particular. Ahora bien la etapa siguiente consiste en asociar este pequeño sistema semiótico a una oposición de colores. En este caso, es muy fácil: el blanco corresponde a la luz y el negro a la muerte. Desde esta perspectiva, decir que el negro simboliza la muerte es un manera simplificada de ver las cosas. En realidad un código cromático se incorpora al sistema rápidamente descrito, y permite asociar no tanto el negro con la muerte sino la oposición luz/oscuridad con la oposición blanco/negro y esta última con la oposición semántica vida/muerte.

El mismo razonamiento vale también para el simbolismo oriental del duelo. En este caso, el punto de partida no es tanto la oposición luz/oscuridad sino aquella entre palidez y coloreado. De acuerdo con el *Diccionario* de María Moliner, el adjetivo "pálido" "se aplica a las personas que no tienen en la cara el color rosado que es habitual en las personas sanas". Así, en este caso, la oposición pálido / rosado está asociada con aquella entre muerte y vida. Por el mismo mecanismo, a este sistema se agrega la oposición blanco/negro, de tal suerte que en Oriente, es el blanco que llega a simbolizar la muerte y el duelo. Cabe precisar sin embargo que la oposición entre el simbolismo del duelo en Occidente y Oriente no es tan tajante. A veces se ha usado el blanco como color de duelo en Occidente. Tal es por ejemplo

el caso de las reinas de Francia e Inglaterra en los siglos XIII y XIV: solían vestirse de blanco en caso de duelo[2]. Una vez instaurado este sistema, es fácil agregarle a la oposición semántica otras oposiciones. Así pasamos de la asociación de la muerte con un color (negro o blanco) a la idea más general de duelo.

En otras palabras, podríamos resumir el proceso de formación de este tipo de símbolos cromáticos de la manera siguiente:

1) en muchos casos, los colores no se presentan aislados sino que se relacionan con objetos o elementos donde domina un mismo color: el cielo es azul; la vegetación verde, la sangre roja. Ahora bien es mucho más fácil encontrar significados a los colores a partir de su asociación con objetos o elementos que de manera abstracta, es decir tomando en cuenta el color en sí.

2) una vez asociado el color a un aspecto icónico, es decir a un un referente concreto (cielo, sangre, bosque), es muy fácil atribuirle un significado relacionado con este aspecto icónico, sobre todo si se toma en cuenta que se trata de asociaciones frecuentes, regulares y consideradas como ejemplares. Debido a que el cielo está a menudo (pero claro que no siempre) azul, el azul se vuelve el color del cielo, a pesar de que existen muchos azules que no tienen nada que ver con el cielo.

3) Gracias a esta relación, la vía está abierta para una transferencia de significados, a través de un proceso sencillo. En la medida en que el cielo se opone a la tierra, a la oposición tierra/cielo corresponde la oposición entre los dos contenidos material/espiritual. Se abre así la posibilidad de transferencias semánticas: de acuerdo con la Escuela de Jung, el azul es el color del cielo, y por lo tanto, es el color que simboliza el espíritu y el pensamiento.

Esta manera de formar símbolos permite explicar muchos de ellos, por las asociaciones frecuentes que hacemos con elementos icónicos relacionados con los colores. Por ejemplo, el verde como símbolo de la esperanza se puede entender por la asociación entre el verde y la naturaleza; en este caso, podríamos decir que al verde se opone la ausencia de verde, como la vegetación que crece se opone a las ramas sin hojas. La idea de crecimiento es probablemente lo que ayudó a producir el significado de esperanza; por esta razón el verde ha sido frecuentemente asociado a la primavera, misma que después del invierno, trae la esperanza "que la tierra vuelva a nutrirnos" (Chevalier y Gheerbrandt 1982: 1002).

2.1. Motivación icónica

Lo mismo se puede decir por supuesto del rojo simbolizando la vida, la fuerza, etcétera. En este caso también, el rojo está asociado con la sangre. Propongo llamar esta motivación *icónica*, ya que se debe a las asociaciones de parecido que hacemos entre un color y un referente del mismo color que se relaciona con el (vegetación, sangre, oscuridad, palidez, carácter no manchado del blanco, etc.) Así, si aceptamos que les categorías semióticas propuestas por Peirce – índice, icono y símbolo – no son exclusivas y al contrario se pueden combinar (Eco 2004: 79), podemos considerar que muchos símbolos de color son en realidad iconos, debido a un parecido entre el signo y aquello de lo que es signo. De la misma manera,

[2] Una explicación es que en aquella época resultaba casi imposible a los tintoreros obtener un blanco puro y brillante, de tal suerte que la ropa blanca tenía a menudo reflejos grises que le quitaban parte de su brillo. Esta explicación (Pastoureau 1997: 69) apunta por lo tanto hacia una motivación relacionada a las cualidades tintóreas particulares del blanco en la Edad media, ya que el cloro para blanquear no aparece sino hasta finales del siglo XVIII.

como veremos, otros símbolos de color se forman a partir de índices, los cuales dependen de una conexión dinámica entre el signo y el objeto.

En efecto, vale la pena observar que en todos los casos que he examinado hasta ahora, *los símbolos cromáticos no tienen nada que ver con las propiedades de los colores*; se trata más bien de asociaciones que se deben a elementos icónicos estrechamente relacionados con ciertos colores: azul y cielo, rojo y sangre, verde y vegetación, etcétera.

Así, este tipo de simbolismo de los colores no toma en cuenta las propiedades de los colores; si el rojo simboliza la vida (o la muerte), no se debe a una propiedad del rojo, sino al hecho de que la sangre corre en las venas. Ahora bien, existen miles de rojos que no tienen nada que ver con la sangre. Desde esta perspectiva, es importante insistir en que el color en tanto *tinte* (*hue* en inglés) hace abstracción de sus particularidades: se toma solamente en cuenta una cualidad muy general y abstracta, que es diferencial: un tinte existe únicamente por oposición a otro; todos los rojos son rojos en tanto se oponen, digamos, a los azules o a los amarillos. La naturaleza ya de por sí abstracta de los tintes ayuda por supuesto mucho a la búsqueda de símbolos, ya que un tinte dado subsume la clase de todos los objetos que tienen este color. No cabe duda que la naturaleza abstracta de los conceptos de color en tanto tinte ayudó a difundir la idea errónea según la cual los símbolos cromáticos tendrían un valor universal.

Ahora bien, la motivación icónica de muchos símbolos cromáticos contribuye también a explicar la idea según la cual algunos símbolos cromáticos tendrían una validez universal, y la razón por la cual esta idea es falsa: la única *experiencia* universal es que en todas las culturas hay cielos azules y sangres rojas y en casi todas hay árboles verdes, es decir la motivación icónica de los símbolos. Sin embargo, el *significado* simbólico que se le atribuye varía mucho de acuerdo con las culturas. Por esta razón hay al mismo tiempo *motivación* y *relatividad*. Ahora, se puede precisar que si la motivación tiene en esos casos un carácter general, en cambio el significado simbólico que se atribuye al color es relativo y a veces un mismo color puede tener dos significados completamente opuestos. Por ejemplo, si la asociación de la sangre con el rojo es universal, el rojo puede simbolizar la vida que corre por la sangre o la muerte por la sangre que se derrama. Así, la motivación icónica no ofrece ninguna garantía en cuanto a la larga gama de significados simbólicos que se pueden generar a partir de esta motivación. Consciente de este problema, Portal trató de formalizarlo con lo que llamaba "regla de las oposiciones" que

> es común a la lengua de los colores y a todos los símbolos en general; les atribuye el significado opuesto al que poseen directamente. […] Asimismo el rojo significa al mismo tiempo el amor, el egoísmo y el odio; el verde, la regeneración celeste y la degradación infernal, la sabiduría y la locura (Portal 1996: 15).

2.2. Breve apartado retórico

Desde esta perspectiva, se podría replantear todo este análisis a partir de una aproximación retórica. Lo dicho por Portal hace pensar en una figura retórica: la antítesis. Sin embargo, muchos tropos y figuras juegan un papel en el color. El caso más frecuente de formación de los símbolos cromáticos consiste en una figura de contigüidad (que, de acuerdo con las clasificaciones, se puede entender como metonimia o sinécdoque) a partir del elemento icónico frecuentemente asociado con un color: cielo azul, sangre roja, naturaleza verde. Por extensión y derivación semántica, pasamos del cielo al pensamiento, de la sangre a la vida, de la vegetación a la esperanza. Sin embargo, existen otros mecanismos de formación de los símbolos cromáticos. Retóricamente, el significado de pureza del blanco sería una

derivación metafórica. En efecto, el blanco como símbolo de la pureza o de la virginidad (de allí su importancia en el color de la ropa de las novias en las bodas) es también fácil de entender: a la oposición puro/impuro corresponde la entre blanco/manchado, inmaculado/maculado, limpio/sucio, etc.

2.3. Símbolos índices

Sin embargo, al lado de los tintes, hay que distinguir los pigmentos a partir de los cuales se pueden obtener ciertos colores. A diferencia de los tintes, los pigmentos, sí tienen propiedades, de tal suerte que existen simbolismos particulares que se pueden desarrollar a partir de ciertas propiedades de los pigmentos[3]. Para dar solamente un ejemplo, si la púrpura llegó a simbolizar el poder de la iglesia católica, no se debe al color en tanto tinte, el cual dicho de paso es difícil de determinar, sino a sus cualidades tintóreas de saturación así como a su costo elevado que contribuía mucho a su prestigio. Existe así otro ámbito importante; las propiedades de los pigmentos (a parte de su costo y de sus cualidades tintóreas, también pueden tener propiedades medicinales, etcétera) que contribuyen a la formación de símbolos a partir de índices, ya que existe una contigüidad entre signo simbólico y referente[4].

Los símbolos obtenidos a partir de las técnicas de producción de los colores se pueden entender también como índices. Por ejemplo un medievalista especialista de los colores, Michel Pastoureau, explica que la primera función del verde en la simbólica medieval es de significar todo aquello que es inestable, efémero, cambiante, por bien o por mal: la juventud, la esperanza, la suerte, el azar, el juego, etc. (Una prolongación de esta simbología hasta nuestros días es el tapete verde en las salas de juego). Ahora bien, Pastoureau pone en relación de manera muy interesante este significado de inestabilidad del verde con la práctica de los tintoreros en la época. Resulta en efecto que el verde era en la Edad Media uno de los colores más difíciles de obtener ya que químicamente inestable, y poco saturado. Así, sugiere este autor que "el verde, color químicamente inestable, es, en el ámbito simbólico, el color de todo aquello que es inestable" (Pastoureau 1997: 73). Me parece un excelente ejemplo de un símbolo cromático basado en un índice. La transferencia semántica se hace en este caso por metáfora.

2.4. Símbolos cromáticos no motivados

Hasta ahora, me he interesado en los símbolos cromáticos que son motivados. Ya es tiempo de precisar que no todos lo son. Para abundar en este sentido, daré un ejemplo tomado de un interesante estudio de los colores en la política francesa del XIX que debemos al gran historiador recién fallecido Maurice Agulhon (Agulhon 1990). Son cuatro colores principales que se han utilizado: negro, blanco, azul y rojo. Algunos son motivados. Por ejemplo el negro asociado a la Iglesia católica contra revolucionaria y aliada al Estado de los Borbones se debe al color de las sotanas de los curas. Como ya señalado anteriormente, el simbolismo se produce a menudo a partir de una operación retórica, y aquí una sinécdoque asimilando la Iglesia al color de la ropa del clérigo. Lo mismo se puede decir del rojo, asociado al brillo de los uniformes del ejercito de Napoleón, considerado progresista; estos dos colores formaron una oposición que inmortalizo Stendhal en su libro bien conocido, *Rojo y negro*.

[3] Sobre la importancia de una aproximación al color a partir de los pigmentos, me permito remitir a unos artículos míos : Roque 2008 (existe una versión en inglés: Roque 2010) ; Roque 2012.
[4] En su conferencia en este Congreso, Jose Luis Caivano insistió también en el color como índice.

Ahora bien, se pregunta Agulhon, porque, al final del XIX, los anarquistas escogieron el negro como bandera? Primero, el hecho que fuera posible indica claramente que en aquella época en Francia, el negro había dejado de ser percibido como sinónimo de monárquico y clerical. En efecto, no pegó mucho la asociación entre negro y derecha, ya que se impuso la oposición entre blanco y rojo para simbolizar aquella entre conservador de tradición católica y aliado a la realeza (blanco), y republicano laico defensor de los valores republicanos (rojo).

Y el historiador agrega algo que me parece importante: "debido a que toda la derecha estaba percibido como blanca, y el resto de la burguesía tricolor, el negro se había vuelto disponible" (Agulhon 1990: 392-393). De acuerdo con este tipo de análisis, no está motivada la elección de este color; tampoco se debe a las propiedades del negro. Pero, sí se debe al sistema de los colores permitidos, y a lo que Bourdieu llama "campo" (Bourdieu 1992), es decir el estado de todas las fuerzas dentro de la misma zona, en este caso las fuerzas políticas en presencia (Agulhon 1990: 393). Si en Francia los colores usados para la política se limitaban a cuatro en el XIX (blanco, negro, azul y rojo), los anarquistas no podían innovar y escoger un color fuera de los colores admitidos por el sistema. (La introducción del verde es mucho más reciente).

Las reflexiones del historiador son importantes para matizar la importancia de los colores en sí en su utilización política. Por ejemplo, se pregunta porque la gran oposición entre blanco y negro no dio lugar en Francia a pugnas políticas entre blancos y negros. Cito su respuesta:

> El efecto de la pareja (negro-blanco) estaba contrariado en nuestro país [Francia] por un simbolismo más fuerte y más directo de los colores particulares, el cual, asociando el negro al campo de la Iglesia católica y el blanco al partido de la Monarquía tradicional, puso desde 1791 los Negros y los Blancos de Francia en el mismo campo, el de la Contra-revolución. (Agulhon 1990: 392)

Una lección de este análisis es que no todos los colores tienen un simbolismo motivado. Ello nos obliga a matizar la idea según la cual el símbolo, por ser motivado, se opone al signo. Otra lección es la importancia de tomar en cuenta los colores en tanto sistema. Es decir que en muchos casos es un error tratar de analizar el simbolismo de un color sin tomar en cuenta los otros colores que participan en el mismo sistema. Di el ejemplo de los colores políticos en Francia en el XIX, pero hay muchos otros, como veremos. Aun si el negro de los anarquistas no se opone al color de otro grupo o partido, sí fue escogido, así como lo analizó Agulhon, porque era disponible dentro de los colores posibles, es decir tradicionalmente asociados con la política en Francia. Esta última idea nos ayuda a precisar que si bien es cierto que no todos los símbolos cromáticos son motivados, su significado depende del sistema al que pertenecen.

3. Sistemas cromáticos

En la segunda parte, me abocaré a explorar el simbolismo de los colores desde esta perspectiva estructural de los sistemas. En otras palabras, no se trata de entender el simbolismo de un color de manera aislada, como una relación de término a término entre significante y significado o sea el color y su significado simbólico, sino de entender como se manejan las relaciones entre colores dentro de los diferentes sistemas cromáticos que las culturas han escogido. Llama la atención que estos sistemas tienen mucho que ver con *números*, en la medida en que se estructuran a partir de un número determinado de elementos, que luego se relacionan con colores.

Este tipo de sistema parte de una visión del mundo. Así, si se puede hablar de sistema, se debe a que cada cosmovisión está compuesta por un número limitado de elementos que forman una totalidad. En dichos sistemas, el número de elementos que conforman el sistema es fundamental, ya que a este número corresponde un número igual de colores. Para anticipar, desarrollaré un ejemplo que viene de la filosofía griega: la teoría de los cuatro elementos. Es parte de una cosmovisión, ya que toda la materia se componía, de acuerdo con esta teoría, de aire, agua, fuego y tierra. Como veremos, esta cosmovisión fue luego relacionada con cuatro colores.

¿Cuántos elementos mínimo se necesitan para hacer un sistema? Diría que se necesitan un mínimo de tres. Si existen solamente dos elementos, forman una oposición. Sin embargo, si las oposiciones son fundamentales dentro de un sistema, no se pueden sustituir al sistema como tal. El blanco y el negro constituyen una de las oposiciones más tajantes: se trata del contraste máximo; sin embargo no es suficiente para producir un sistema, y todavía menos un sistema cromático. Por esta razón, se requiere agregarle a esta oposición un tercer elemento. En muchas mitologías, en particular africanas, se trata del rojo. Así, a la oposición claro/oscuro, se agrega otra que se cruza con ella: cromático/no cromático; en este caso, el blanco y negro representa el polo no-cromático, por oposición al rojo, polo cromático de la oposición. Ello quiere decir que el blanco, el negro y el rojo presentan una matriz de posibilidades potenciales que se pueden usar de manera muy distinta en función de las culturas y de sus necesidades semánticas. En otras palabras, desde el punto de vista de la antropología estructural, el sistema determina lugares que se pueden ocupar de manera muy diferente de acuerdo con cada cultura. En este caso llama la atención la diferencia enorme que existe entre la concepción, digamos, universalista según la cual los colores tendrían un significado permanente, y la aproximación estructural de acuerdo a la cual los valores simbólicos atribuidos a los colores dependen de la estructura y su significado se puede invertir por completo de una cultura a otra.

De acuerdo con el *Diccionario de los símbolos*, en África negra, el blanco es el color de los muertos; sin embargo, los autores agregan al blanco otro significado completamente opuesto, cuando escriben que "su significado ritual va aun más lejos: sirve a alejar la muerte". En algunos rituales, "el blanco es el color […] de la lucha en contra de la muerte" (Chevalier y Gheerbrandt 1982: 296). De acuerdo con los mismos autores, el rojo es el color de la sangre, de la vida. En cuanto al negro, color de la noche, es el color de las pruebas, del sufrimiento, del misterio (Chevalier y Gheerbrandt 1982: 296). Es interesante hacer notar que, por lo menos en dos casos, los significados simbólicos que valdría para toda 1a África negra descansan en una motivación icónica: rojo = sangre y vida; negro = color de la noche, del sufrimiento.

Sin embargo, basta con leer un poco de antropología y de etnología para darse cuenta de que en realidad el triángulo de los colores (blanco negro rojo) es una manera de pensar el mundo en relación con elementos de la vida cotidiana en todos sus aspectos. Y difiere mucho el simbolismo de acuerdo con los aspectos que tomamos en cuenta: las temporadas de seca o de lluvia, los puntos cardinales, los cuatro elementos (tierra, agua, aire y fuego), los rituales sacrificiales, la agricultura y los oficios en general, las técnicas de teñido, las actitudes morales, etcétera (Zahan 1977). La variación es enorme y casi no tiene límite, debido a que este triángulo sirve para pensar y organizar el mundo, de tal suerte que las preocupaciones son muy diferentes de una cultura a otra. Por ejemplo, entre los Iafar (de Nueva Guinea), los tres colores sirven a pensar el crecimiento y el desarrollo de un mismo objeto en el tiempo, y más precisamente a simbolizar tres periodos de la vida: blanco = gestación y nacimiento; rojo = juventud, crecimiento; negro = adulto mayor, sénior (Juillerat 1978: 508).

Por su parte, Lévi-Strauss dio ejemplos de una estructura de oposición sencilla, el mismo triángulo blanco, negro y rojo, con inversión de los valores simbólicos, comparando los Luvale de Rodesia y tribus de Australia: según los casos, el rojo puede estar asociado a la vida o a la muerte; en algunos casos, son los valores asociados al conjunto blanco/rojo que son invertidos; en otros, el valor del blanco queda constante, y es el contenido del polo opuesto que se invierte, cuando el rojo, "súper color", está sustituido por la ausencia total de color (Lévi-Strauss 1962: 87-88).

3.1. Las tres funciones de Dumézil

Otro sistema muy antiguo basado en tres colores (los mismos, con unos matices) corresponde a la teoría de las tres funciones que desarrolló Dumézil en sus estudios eruditos de los mitos y epopeyas de las tradiciones indoeuropeas. Recapitulando este descubrimiento al final de su vida, después de haberlo estudiado en muchas culturas (Roma, la India, Irán, etc.), escribirá:

> Corroboraciones bastante numerosas inducen a pensar que, ya en la unidad indoeuropea – cualquiera que sea el modo como haya que concebir tal unidad -, tres colores eran puestos en relación simbólica con las tres funciones fundamentales cuyo juego armonioso reconocía la ciencia de la época en la vida del mundo y de la sociedad: el blanco caracterizaba el poder mágico-religioso y jurídico-religioso, el rojo la fuerza guerrera, y un color oscuro – verde, azul, negro – la fecundidad, con sus componentes, sus condiciones y sus consecuencias. (Dumézil 1989: 17)

Dumézil estudió estas tres funciones en varias culturas, y se dio cuenta del parecido existente en áreas indoeuropeas desde épocas tempranas con extensiones en zona de influencia (Irán). En la India y en Irán, las dos primeras categorías sociales, o sea funciones, son sacerdotes y guerreros, asociados respectivamente al blanco y al rojo; en cuanto a la tercera función, la de los ganaderos-agricultores, está asociada con amarillo en la India, y azul en Irán. Encontró también algo semejante en la Roma antigua, a través de una carrera con tres carruajes que correspondían cada uno a las tres tribus primitivas de Roma. Es interesante hacer notar que, etimológicamente, "tribu" significa dividido en tres, y la palabra para designar a los jefes, los tribunos, viene de la misma raíz. Ahora bien, a estas tribus correspondían tres funciones (sacerdotes, guerreros y productores), tres dioses (Jupiter, Marte y un equivalente femenino de Quirinus), y por supuesto tres colores, blanco, rojo y verde (albati, russati, virides) (Dumézil 1954: 53-55).

En conclusión sobre el tema, se hacía a sí mismo una posible objeción, es decir que el carácter tan difundido de esta simbólica de los colores es tan obvia que hubiera podido volver a inventarse por todos lados: "el rojo, color de la sangre, conviene perfectamente bien al guerrero, a Marte, así como el verde evoca naturalmente la vegetación abundante de la tierra, y por lo tanto Flores y aun Venus" (Dumézil 1954: 56), dioses de las flores y de la fecundidad. En cuanto al blanco del brahmán, simboliza la pureza de los sacerdotes. En otras palabras, Dumézil ya encontraba una motivación a los símbolos para justificarlos. Su respuesta a esta objeción es que, si bien es cierto que el uso simbólico de los tres colores parece natural, en cambio, lo que es específico al mundo indoeuropeo es la agrupación de estos tres colores (blanco; rojo; azul o negro o verde) en un sistema simbólico estrechamente relacionado con la tripartición fundamental de las sociedades indoeuropeas y de ellas solas (Dumézil 1954: 56-57).

Agregaré a este análisis dos comentarios. El primero es que Lévi-Strauss siempre reconoció la importancia de Dumézil y de su aproximación a la historia comparada de las religiones como un precursor de la antropología estructural (Lévi-Strauss 1958: 319). El otro comentario es que Dumézil notó que este sistema tripartita es muy primitivo y fue después sustituido, tanto en Roma como en la India, por un sistema cuadripartita que tuvo también una gran importancia. En la India, agregaron un cuarto grupo funcional, los no-arios, asociados al negro. (Dumézil 1954: 45). En Roma, de acuerdo con algunas fuentes, la redistribución, por le pasaje de tres a cuatro, dio lugar a las asociaciones siguientes: el verde pertenece a Roma misma, bajo el nombre de Flora; el blanco al aire, el rojo a Marte y el azul a Saturnio o a Neptuno.

3.2. Sistemas con cuatro colores

Estas consideraciones nos permiten hacer una transición entre el sistema con tres elementos al con cuatro. En efecto, uno de los sistemas antiguos más importantes es la teoría de los cuatro elementos de Empédocles: aire, agua, tierra y fuego. Podemos suponer que la influencia de esta teoría es una de las razones del cambio de sistema en Roma: llama en efecto la atención el hecho de que, de los cuatro colores del nuevo sistema, dos son relacionados con elementos: el blanco con el aire y el azul con Neptuno, dios del mar, es decir del agua.

Si la teoría de los cuatro elementos de Empédocles tuvo una importancia enorme, parece ser que al principio, no estaba directamente relacionada con colores. La asociación con cuatro colores se hizo a través de otro sistema: la teoría de la escuela hipocrática de medicina, según la cual existen en el cuerpo cuatro humores, cada uno relacionado con un color: sangre (rojo); flema (blanco), bilis amarilla y bilis negra. Después, estos humores dieron lugar a cuatro tipos de temperamentos: flemático (blanco), ictérico (o biliar) (amarillo), sanguíneo (rojo), y por fin melancólico (negro). Así, es solamente a partir de Galeno y sus contemporáneos que, de acuerdo con especialistas, existe un consenso para considerar que a los cuatro elementos debían corresponder los mismos colores de los humores (Gage 1993: 29). Uno de los primeros textos otorgándole claramente un color preciso a cada elemento es del segundo siglo ante Cristo y se debe a Antiochus: negro = tierra; rojo = aire; blanco = agua y amarillo = fuego (Gage 1993: 32).

Este esquema tuvo una importancia enorme más allá de la medicina, imponiendo la idea según la cual existen solamente cuatro colores fundamentales correspondiendo a las de las cuatro humores. Así, en un texto célebre y muy discutido, Plinio el viejo (primer siglo después de Cristo) considera que los mejores pintores griegos habían limitado su paleta a cuatro colores solamente, blanco, negro, amarillo y rojo (Pline 2002, XXXV-32). En este esquema, el azul y el verde brillan por su ausencia.

Los pintores del Renacimiento fueron muy atentos a esta teoría, por dos razones: primero, les importaba saber cuáles eran los colores principales que tenían que utilizar. Y luego, les interesaba saber cuál color convenía mejor para representar al cielo, al mar, a la tierra y al aire. De allí la importancia que tuvo este sistema con cuatro elementos. Sin embargo, no lograron ponerse de acuerdo. Para Alberti, rojo = fuego; azul = aire, verde = agua y negro ceniza = tierra (Alberti 1992: 95). En este esquema, no hay amarillo, y en cambio aparece el azul. La razón podría ser que su punto de partida fue la observación empírica de los elementos, además de consideraciones que facilitaron la relación entre color y elemento, como el azul celeste (la palabra latina para designar este azul claro, *celestis*, deriva de *caelum*, el cielo). De la misma manera, consideraba que el color de la tierra es ceniza.

De una cierta forma, podríamos decir que Alberti hace un compromiso con las teorías antiguas. Por una parte, dice claramente que existen solamente cuatro géneros de colores, "en conformidad con el número de elementos" (Alberti 1992: 95). Sin embargo, difiere de la tradición en dos aspectos: 1) los cuatro colores no son exactamente aquellos propiciados por la tradición antigua; y 2) hace una distinción entre género de colores, y especie; así para él, los cuatro verdaderos géneros de colores pueden producir, a partir de mezclas, un número casi infinito de especies.

Leonardo, en cambio, tenía una opinión distinta. Para él, había seis colores sencillos, ya que tomaba en cuenta el blanco y el negro. Seguía así la tradición aristotélica según la cual todos los colores resultan de una mezcla de blanco y negro en proporciones diferentes (Roque 2009: 24). De manera interesante, integra la teoría clásica de los elementos dentro de esta concepción de seis colores sencillos. Así, explica que el blanco corresponde a la luz, el amarillo a la tierra, el verde al agua, el azul a cielo, el rojo al fuego, y por fin el negro a las tinieblas (Kemp 1992: 268). Esta construcción ingeniosa es otro compromiso que hizo Leonardo entre dos tradiciones, la del *De Coloribus* (atribuido a Teofrasto) y la de los cuatro elementos. Vemos así claramente que lo importante no es tanto los colores sino el *número* de los colores, y este número depende de lo que se considera como básico, es decir en este caso: los cuatro elementos.

Una vez establecido este esquema, se agregaron otros grupos de cuatro, que tienen también una larga tradición en la Antigüedad tardía, como las estaciones. Para Alberti, la primavera es verde; el verano, rojo, el otoño blanco y el invierno oscuro (*fuscus*) (Gage 1993: 33). No hay que asombrarse si tampoco hay acuerdo entre los autores acerca de la relación entre estaciones y colores. Podría seguir así examinando los sistemas con cinco, seis y siete elementos. Sin embargo, los que he examinado bastan ampliamente para mi propósito.

4. Conclusiones

Para concluir, diré que existen varias maneras de construir un simbolismo de los colores. He insistido sobre lo que he llamado la motivación icónica de varios símbolos cromáticos, a partir de asociaciones hechas con elementos, objetos etc., frecuentemente relacionados con un color dado, pero he señalado que existen también símbolos producidos a partir de índices. También vimos que no todos los símbolos cromáticos son motivados; algunos dependen de un sistema dado que le otorga un lugar y un valor. Ello me llevó a matizar la diferencia que se hace desde Saussure entre símbolo (= motivado) y signo (= inmotivado).

A diferencia de los símbolos constituidos a partir de índices, los otros, en la mayoría de los casos, no descansan en las propiedades de los colores. Sin embargo, ¿qué significa "propiedades" de los colores? Ya mencioné las propiedades químicas de los pigmentos con las que se enfrentaron los tintoreros y que constituyen une fuente importante de producción de símbolos cromáticos. Existe un ámbito enorme que he dejado de lado: el misticismo. En su estudio sobre el simbolismo del color, Faber Birren puso en evidencia que el misticismo constituye una fuente fundamental de la formación de los primeros símbolos cromáticos (Birren 1989: 11), de la misma manera que la magia. Así, estos ámbitos proporcionan muchos elementos para estudiar lo que Lévi-Strauss propuso llamar la "función simbólica" (Lévi-Strauss 1958: 224).

El descubrimiento de las propiedades físicas del color gracias a Newton merece ser señalado. Como sabemos, Newton propuso un sistema basado en siete elementos, por razones

que no son científicas: una es la analogía que quería hacer entre la armonía musical y la armonía cromática; la otra es la importancia simbólica del número siete en la alquimia (Roque 2009: 447-448). Cabe notar que existían sistemas simbólicos con siete elementos; el más conocido en el Renacimiento es el de Lomazzo, quien se inspiró de la tradición astrológica mística del Renacimiento (Kemp 1992: 270), asociando siete colores a siete planetas (entre otros elementos): negro y Saturno, azul y Jupiter, púrpura y Marte, rojo y sol; amarillo y Venus, verde y Mercurio, y finalmente blanco y la luna (Kemp 1992: 272).

Para terminar, diré que la concepción científica del color no acabó con el simbolismo. La ventaja de la tradición inaugurada por Newton es que se pudieron cuantificar los colores, atribuyendo así a cada uno un valor en una escala. Una de estas clasificaciones se hace a partir del grado de refrangibilidad; otra a partir de sus frecuencias vibratorias. Curiosamente, esta clasificación científica dio lugar a la atribución de propiedades simbólicas a los colores, con la idea de que menos refrangible es un color, más fuerte es. En efecto se consideró la refrangibilidad como una "debilidad" y una falta de fuerza de los colores (Roque 2006).

Hoy en día prevalece un sistema de siete menos uno, es decir seis colores, después del abandono del índigo, que Newton había agregado para llegar a siete colores y debido, dicho de paso, a la importancia económica y simbólica del añil en la Inglaterra de principio del XVII. Nuestro sistema actual de seis colores se divide en dos, como todos sabemos: tres primarios y tres segundarios, tanto para la mezcla aditiva como para la mezcla sustractiva. Ahora bien, esta idea básica de que a partir de algunos colores se pueden producir otros, que es una propiedad de las mezclas, también dio lugar a un simbolismo. Desde que apareció la ideas de colores primarios para los pintores, es decir en el siglo XVII, se consideró que si son primarios, tienen más importancia simbólica que los otros. En la estética pictórica, llama la atención el hecho de que los pintores empezaron a utilizar los colores primarios (rojo, azul y amarillo) para los personajes principales del cuadro, dejando los colores segundarios precisamente para los personajes secundarios de la composición. De la misma manera, el artista y teórico Philipp Otto Runge asoció los tres colores primarios a la Santa Trinidad: azul = el Padre; rojo = el Hijo; amarillo = el Espíritu Santo (Décultot 2007: 39). La capacidad de simbolizar siendo una característica del ser humano, no hay que asombrarse si seguimos produciendo símbolos de color, aun a partir de sus atributos científicos.

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The Universe of Meanings of Color in Mexico: From the Pre-Hispanic World to the Present

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Everything that surrounds men is color, and it is
the captivating symphony of nature to the
metaphor contained in their language
(Ferrer, 1998)

Background

Many authors consider color as a language, however, the color is not a coherently structured language, it is a conventional coded language that is recoded and expanded in a great polysemy of signals or symbols that is difficult to understand outside the community where it emerges and that use color as form of non-verbal communication that can be understood by the people of that community.
For this reason, we can say that humans live in a symbolic world of color, where the meanings related to natural processes become social meanings that are constantly modified though interpretative processes that occur internally in the individual.
Many of these meanings and symbols that emerge every day in the different human groups are represented and transmitted in different ways creating much of the culture.

In spite of this symbolic growth, it is possible to use color as a communicative element since many of the meanings and symbols are remembered and recognized through rituals, festivals, ceremonies, fashion, etc., while others are in the collective unconscious so, although they cannot be explained, its origin and development can be recognized.

The objective of this work is to relate different cultures through the meanings of the colors. It is pertinent to recall some of the different theoretical perspectives dedicated to the culture that have focused in deepen their meanings, which include the structuralism, the symbolic anthropology and the symbolic structuralism. The latter will let us interpret the results of this research.

The structuralists consider the culture as a set of structured signs organized according to the principles that govern the human intellect that generates it (Roosi and O'Higgins) and with this background emerges the symbolic anthropology, so, as indicated by Geertz (1995), "*it is in the symbolic world where we can really find the culture"* therefore, the culture are structures with an established social meaning under which people do many things and have different psychological behaviors.

Another existing guideline in the explanation of the cultural interpretation related to the meanings, the one of the symbolic interactionism, a field of Social Psychology, is based in their interpretations of their surroundings and experiences since through the social interaction, people learn meanings and symbols that allow them to execute their ability to think and act and interact in a human way, leading to a process of socialization. Their representatives are Blumer, Goofman.
This theory emphasize that, while the formation of the human behavior is a process derived of the social interaction, we must not forget that many components influence in and through the individuals in such development, such as, among others, the structure of the society or different psychological factors like the desires, needs, emotions, etc. which influence the interpretation of symbolic interaction itself understanding culture as the network of relations and meanings between the natural and social environments that produce an interpretation that allows people to interact easily.

From this psycho-cultural theory, we will analyze the presence of meanings of colors from the pre-Hispanic world to the present in order to know the meanings of color that have endured through time and the reasons why they continue today, assuming that, as it was mentioned before, the language of color is very elastic and due to its relationship with other words that represent objects and situations that lead to other (figurative) meanings that sometimes, instead of making more complex their understanding, enrich the possibilities of interpretation.

For this task, we use the holistic method, which is frequently used in the transcultural researches because it allows to obtain the information of different documents made by other researchers that cover diverse cultures and allow to know the common features in these cultures and to compare them among others (Ortiz: 2004).

The procedure with the selected colors and cultures is to locate the common colors with their meanings and then, to try to correlate those meanings taking into account their similarities and differences which will serve to find categories that produce some of the meanings of the different analyzed cultures, that, as we mentioned before, in this case are the Maya, the Colonial and the Modern urban (with results of different researches by Ortiz from 1966 to 2013).

We also use Surik procedure (2011); he says that the better way to know the meaning (of the colors) is by isolating the word and identifying all the meanings that are built form the name of the color and an external reference through different kinds of associations that lead to a conceptualization.

And finally, based on the meaning-color relations that we found with the documentary method which show us the colors white, black, red, yellow, green and blue as the most important, we elaborate the so called by Ortiz (1982) as chromatic patterns, in which various colors are related to different meanings that have a semantic relation. This relation ranges from two colors that rate a concept to several meanings linked with a single color.

To achieve our objective, we must first know the meanings of the colors in the Maya, Aztec, Colonial and Modern Urban cultures.

The color in Mexico

Mexico is a multicultural country; one of the reasons is that there are still living pre-Hispanic cultures that the mestizo word accepts gladly, especially from a cultural point of view.

Mexicans descend from some of the following cultures: Tarasca, Aztec, Toltec, Zapotec, Maya, Tlahuica, Chichimeca, Totonac, Tehotihuacan, Mixtec, Huastec, Tlatilco, and Cuicuilco, among others. Each one of them has its own symbolic wealth which can be observed in their everyday artifacts such as pottery; in their paintings, buildings, personal ornaments etc. In many of these manifestations, we found color as a symbolic element.

Olmec culture is considered the major civilization of the region during the Pre-Classical period in 1200 b.C. It ended on the year 200 b.C. This culture settled in Veracruz and Tabasco and they are known for their colossal heads sculptures.

In their researches, Karl A. Taube found that the meaning-color relations were related to the cardinal points and the agriculture, their main daily activity. He says that the tools which they used to clear weed, made of jade and jadeite, had the form of corncobs, and that is why the meanings of the color green are related to the agriculture and the agricultural fertility. We must highlight that the most valuable jade was the translucent green one called "quetzalitzli" due to its chromatic relation with the feathers of the quetzal.

Maya culture

This culture dates back to the year 100 b.C. and it is believed that it ended in 1550 A.D. although at present day yet there are people who speak Maya and continue several ancient customs. The Maya civilization settled in Chiapas, Tabasco, Quintana Roo, Yucatan, Campeche and in Central America.

This polytheist cultural group was dedicated mainly to the agriculture, for this reason, the nature and their effects were very important for them so it is not surprising that they cosmogony and their gods were related to it. Their social structure was pyramidal, like all Mesoamerican cultures, with a hereditary aristocracy.

The splendor of the Maya civilization occurred during the Classic period; between the years 1 and 1.000 a.C and their greatest achievements are evident in writing, mathematics, and astronomy. This allowed them to predict eclipses and equinoxes and they deduced the spherical form of the Earth. They created a highly accurate calendar system in which the week had 13 days and there were 20 days and 20 months. They also discovered the zero and they expressed it graphically. They excelled in the world of architecture and in their murals they represented scenes ranging from the creation of the world to events of the daily

life, as well as historical and mythical facts of the man and the Gods, the war, the self-sacrifice, rituals related to the dynastic families and celestial events, funerals, etc., and therefore, their iconography refers to the levels of the cosmos, to their Gods and to their ancestors, thus "the symbolic thought establishes relations between elements of the reality and concepts" (Dehouve, 2003: 64).

Landa (1985) says that colors are omnipresent elements covering different aspects both from the religious practices and the daily life. Some examples of this are the ceremonies that took place three months before the New Year's Eve, where the people painted their entire body with the color black as a sign of penance.

Sanja Savick (2011), based on Brent Berlin and Paul Kay (1969) analyzed the language of color in the Maya culture and she found two groups of words about color; the basic and the derivative ones. The derivative ones are compound words based on the terms of the basic colors which are derivate from meanings related to all their activities and nature: vegetables, animals, minerals, diseases, the creation of the Earth and therefore, with the space and the cardinal points: red to East, black to West, white to North and yellow to South; a fifth point is the center, identified with the green-blue color (yax).
Sanja *op. cit.* says that in the Maya language the names of the five basic colors are sak (white); ek' (black); chak (red); k'an (yellow), and ya'ax (green-blue). These colors are highly polysemic because they combine with different morphemes thus generating the derived colors and making difficult the comprehension of their meanings due to the great number of meanings found.

Based on Sanja (*op. cit.*), the dictionary Maya Cordemex Thesaurus by friar Thomás de Coto, the dictionary of friar Francisco Ximénez (Memorial de Sololá, 2006: 56), Figueroa (2002), Salazar (1999) and MINEDUC (1996), we will present the basic colors and their meanings, which are organized according to their relation with nature, their social, personal and symbolic meanings like the creation of the world and their gods. For a better comprehension and ease of analysis, the meanings were classified as related to nature, social, personal and symbolic.

Sak: white (a white thing)

RELATED TO	MEANINGS
Nature	Dawn; the day; when the sun wants to come out; morning; clear or sparse clouds; white things as with gloss that glitters like silver; a very clear moon; soft and delicate fresh wind; it comes from the east; a frost; snow; fog; a very cool thing; flint; gypsum.
Social	Money; silver coin; step child; a hand-made thing; step mom; a road; a good flint; uncooked; bread dough; undercooked; wash and clean the maize; an artificial thing; fabric in a loom; fabric in general; weave; an inferior class; false; something half done; feigned and fictitious.
Personal	Grey hair; diligent; slick; wise; to look furtively; pretend not to see; dirty dreams; half broken; be discolored; pale; someone with the face whitish for some disease; perturbation or fear; disfigured; dead; lungs.

Symbolic	It is life; a resting place for the dead; a place to rest and recover energy after work; energy recovery; and hope. A symbol of pain, penance and death.

Ek': black

RELATED TO	MEANINGS
Nature	Darkness; smoke; smoked; lead (metal); rainy weather; twilight; penumbra; sunset; night; nightfall; conch; skin; shell; bark; a cave with water; blood.
Social	Gloomy; tenebrous; path; a narrow trail; rough road; with little use or unused; a dirty thing; black ink; overcooked; sadness; mourning; death; anger; dreadful; absence of light; to kill; to uglify; cloud the water; to fade; black candle; a fast ending.
Personal	Unsociable; angry; uncaring; strange; indomitable; coarse; intractable; rebel; someone that does not allow to be touched; blind; hair; the black part of the eye; moles; alone; relax; perverse; gingerly; slowly; strong; bad ideas.
Symbolic	It is life; a resting place for the dead; a place to rest and recover energy after work; energy recovery; hope. A symbol of pain, penance and death.

Chak: red

RELATED TO	MEANINGS
Nature	Fire; hot; heat; fever; copper; plum; macaw; parrot; firefly; sun; sunlight; blood; red maize; temperature; the feathers on the tail of a macaw; rain; hurricane; land exhaustion.
Social	Cooking with water; seasoning; to lit; rough; dry; just between the black and white; a female color (for the menstrual bleeding); big; strong; a big thing or deal; a serious thing.
Personal	Rage; anger; to get angry; shame; robustness; get naked; get excited; get old; irritation; rabid; cruel; impatient; fever; envy; hatred; itching; to grieve; lustful; avarice and greed; malicious; to have envy; jealous; roguish; evil.
Symbolic	Greatness; majesty.

K'an: yellow

RELATED TO	MEANINGS
Nature	Rotting maize; florid; yellow field; flowers; the state of maturity of the corncob; ripe fruit; gold or gold coin; gemstone; value stones; yellow shells; an excellent harvest; pregnant; the color of the sun; the color of the day energy; dry season and honey rains season.
Social	The feathers of the “raxon” bird that were used by the dignitaries.
Personal	To sweat; to witness; to deny; bloated; decadence.

Symbolic	To sacrifice men; a state of glory; prosperous; glory; paradise; wealth.

Ya'ax: Green-blue (Used indiscriminately at a semantic level)
Green

RELATED TO	MEANINGS
Nature	Nature; green feathers (quetzal); snake; fruit falling from a tree; vegetables; unripe; a growing bird; moist; a gemstone (probably Jade); unripe fruit; uncooked meat; to become green again (the plants); serene time.
Social	Jewels; freedom; a fresh thing.
Personal	Maiden; dead; to fall.

Blue

RELATED TO	MEANINGS
Nature	Clarity; celestial; a light or turquoise blue thing; the color of the sky; time; to clear; clouds; rainbow; big rivers; lakes; the space in the Earth; depth water.
Social	High value; precious; a beautiful thing; a time of bonanza.
Personal	Young and fresh; sickly man heathy man; fever with cold; to get cold; to paint the body with colors; serene
Symbolic	It indicates the origin and the beginning. Possibly; the blue and the green indicate an up-down relation and the creator deities as Ah Raxá Lac and Ah Raxá Tzel; apparently with male deities (Lord of the green dish and Lord of the blue gourd); a state of glory; the lords of the land before the creation of the word; the sky and the land were joined and the deities were under the green and blue feathers.

As we can see, the color with the greatest number of meanings is the white; which, along with the black contain a great number of symbols that still exist in our daily language.

Aztec culture

This culture receives its name upon the people of Aztlan which means “white country”, or “country of the dawn”, or “country of the early times”. The Aztecs transformed the bed of the Texcoco lake; that was shallow; in chinampas (fertile gardens; constructed with a frame

of logs that held sand; gravel and planting soil that were tied with ixtle ropes) to obtain artificial islands where they cultivated vegetables and flowers and raised poultry.

Although the Aztec culture settled in the valley of Mexico in the year 1250 A.D., vestiges of that culture have been found from the coast of the Gulf of Mexico to the Pacific and from the Bajio to Oaxaca. Their language was the Nahuatl, which still exists in different regions of the country.
The Aztecs built huge temples with the shape of stepped pyramids covered with limestone and stucco of bright colors, such as the Great Temple, with Teotihuacan influence, which was entirely painted in red, with figures that have been associated with the god Huitzilopochtli.
They were polytheists and their main gods were:
Huitzilopochtli (god of the sun): he was depicted with a red face, crowned with green and yellow (smoke symbol) feathers and his body was blue.
Coyolxauhqui (the goddess of the moon): according to the Aztec mythology; she was murdered by her brother, the God of the Sun.
Tlaloc (god of rain): we can always find the color blue in the sculptures dedicated to this god.
Quetzalcoatl: inventor of the writing and the calendar; associated with the planet Venus and with the resurrection; lord of the black and red and symbol of knowledge: "… the black and the red inks belong to him; as well as the codices; he is the owner of the painting books" (León Portilla:1963) although he has also been associated with the white, blue and green (Ferrer. 1999) p 55.

In the Aztec cosmogony, the celestial couple, Citlalatonac (the brightest star) and Citlalicue (the one with a skirt of stars) fathered four gods associated. Paz considers these gods four representations of the god Tezcatlipoca that unfold and confuse with each other and thus we have: the Red Tezcatlipoca also known as Xipe Totec, god of the East; the Black Tezcatlipoca, god of the North, of the night and the cold and of the night sky; Quetzalcoatl, the feathered serpent, white god of the West and sunset, and Huitzilopochtli, the god of the South, a warrior painted in blue, triumphant at noon, eponymous god of the Aztec capital (Soustelle cited by Ortiz 2011).

Iztac: White

RELATED TO	MEANINGS
Nature	The Milky Way; white snake; birth; west.
Social	Decadence; antiquity.
Personal	Illness.
Symbolic	Milky Way, white snake; victory; origin and end mysteries; Quetzalcoatl; white god of the west and the sunset.

Tliltic: black

RELATED TO	MEANINGS
Nature	Night; dead; cold; darkness; drought; north.
Social	War.

Personal	None was found.
Symbolic	Home of the god of dead (Mictlantecuhtli); where the moon Tezcatlipoca lives.

Tlatlauqui: red (known as Teotihuacan red)

RELATED TO	MEANINGS
Nature	Dawn; light rays; sun; east; fire; blood; achiote
Social	The writing and knowledge
Personal	None was found.
Symbolic	War (Huitchilopoztli; Tezcatlipoca).

Zacatazcalli: yellow

RELATED TO	MEANINGS
Nature	Sun; fire; spring.
Social	Beauty.
Personal	Woman; love
Symbolic	Salvation.

Xiuhuitl: blue-green (the name of the color green is the same as the blue one since for this culture these colors are very similar. They had the term **Chalchíhuitl** (green-blue).

RELATED TO	MEANINGS
Nature	Green gemstones: jade an emeralds; water drops; liquids; good harvest; forests.
Social	Valuable.
Personal	Human heart.
Symbolic	Divine essence; Iztaccihuatl; Chalchiuhtlicue: the one with the jade skirt; goddess of the green and the live water; human heart (in a symbolic way)

Meaning of colors in the Colonial era

The period known as Colony or Viceroyalty began in the sixteenth century; when the Spaniards conquered Mexico Tenochtitlan, and it lasted until the year 1821 when Mexico declared the Independence.

In this era the miscegenation and the syncretism of the two cultures; the Spanish and the pre-Hispanic; began with an eminently religious-catholic approach; insomuch that we can talk about a military and a spiritual conquest; marked by the power of the main religious orders who came from the old continent.
During this period; the Catholic Church was the most powerful institution for the transmission of cultural values; and that is why the meanings of the colors came from the liturgical colors and they continue until our days.
It is said that the Pope Inocencio III instituted the meanings of the five ecclesiastic colors based in the allegoric interpretations of the colors in the book "Song of Solomon" and they are basically symbolic.

White
It was used in the festivities of the Virgin Mary, the angels and the saints who were not martyred; in the joyful and glorious mysteries of the Lord, and in the administration of some sacraments (first communion, confirmation and weddings among others)

RELATED TO	MEANINGS
Nature	None was found.
Social	Love; faith; charity; penance.
Personal	Joy; triumph; humility; purity of life; innocence.
Symbolic	The glory and immortality; purity; divine light of Christ

Black
It is reserved for Friday, the Mass for the Dead, and Ash Wednesday.

RELATED TO	MEANINGS
Nature	None was found.
Social	Penance, grief, mourning.
Personal	Sadness, wisdom, constancy.
Symbolic	The death of Christ.

Red
It is used for the Palm Sunday, Good Friday, Pentecost, feast of the cross. It is used in the celebrations of the Holy Spirit, apostles, evangelists and martyrs.

RELATED TO	MEANINGS
Nature	Fire, blood.
Social	Charity.
Personal	Love.
Symbolic	Divine love, heroism in the martyrdom or sacrifice for Christ.

Yellow
This color is not used, perhaps because it was replaced by the golden.

RELATED TO	MEANINGS
Nature	None was found.
Social	None was found.
Personal	None was found.
Symbolic	None was found.

Green

It is used on Sundays and days of week of the ordinary time.

RELATED TO	MEANINGS
Nature	Life, freshness.
Social	None was found.
Personal	Hope, love, happiness, eternal life.
Symbolic	Renaissance, immortality of the regenerated creature, desire of eternal rest, healthiness of the Christian soul, sap of the divine grace.

Blue

It is used for the celebrations of the Virgin Mary, especially for the Immaculate Conception.

RELATED TO	MEANINGS
Nature	None was found.
Social	None was found.
Personal	Purity and virginity.
Symbolic	None was found.

Meaning of the colors in the Urban modern culture

For the analysis of this section, we will present the associations found in the lapse of more than 40 years of investigation, mainly through five studies made from 1968 to 2011, published in "The meaning of the colors" by Ortiz (2011), and reinforced by other investigations by the same author.

During this time, Ortiz used different methods and instruments (which can be found in the different works of the author) with the same objective: to know which are the meanings of colors in different populations and in different times with different analysis variables.

Thus, the chromatic patterns were obtained. The chromatic patterns are defined as the different shades that have the same meanings. To obtain them, the non-parametric statistical lambda was used; it gave greater certainty to the obtained results since the lambda correlation test measures the dependence-independence of the values.

The meanings presented below are those found in five studies which were developed in a systematic way, i.e. those that occurred constantly and, therefore, were the most significant. Those that did not cover the requirements of each investigation were removed; this shows that the meanings have remained over time and gives the certainty that they really are the most vigorous color-meaning associations found.

The selection of colors presented in this paper was given by their importance in the first culture studied: the Maya, which, although in Ortiz (1992-2011) are more colors found with their meanings and the chromatic patterns. That's why in the latter proceeded to remove those nuances that did not correspond to established criteria.

White

RELATED TO	MEANINGS
Nature	Day, cold.
Social	Peace, silence, lightweight, to create, justice.
Personal	Innocence, health, rest, goodness, charity.
Symbolic	Hope, charity, eternity, virtue

Black

RELATED TO	MEANINGS
Nature	Death, night, infinite, darkness, hard, deep.
Social	Vice, to destroy, wickedness, contempt, steadiness, unpleasant, tough, death.
Personal	Pain, hatred, fear, aggressive, wickedness, unhappiness.
Symbolic	Vice, strong.

Red

RELATED TO	MEANINGS
Nature	Hot, energy, strong, breaking dawn, twilight.
Social	Attractive, active, danger.
Personal	Aggressive, sex pleasure, love, happiness.
Symbolic	Aggressive, exciting, war, ostentatious.

Yellow

RELATED TO	MEANINGS
Nature	Day, breaking dawn, acid, energy.
Social	Wealth, rare, indifference.
Personal	Cheerful.
Symbolic	Happiness, sweet, lightweight.

Blue

RELATED TO	MEANINGS
Nature	Cold, day, breaking dawn.
Social	Masculine, fraternal, friend, attractive, fast.

Personal	Sad, nice.
Symbolic	Doubt, indifference, lightweight, movement, to create, eternity, sweet, happiness

Green

RELATED TO	MEANINGS
Nature	Life, nature.
Social	Abundance, hope
Personal	Goodness, an old age.
Symbolic	Fertility, sterility.

Method

Objectives

- To know the relation between the colors and meanings given by different cultures: Maya, Aztec, Colonial and modern urban.

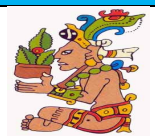
- To know if there is a relation between colors and meanings in the Mayan, Aztec, Colonial and modern urban cultures.

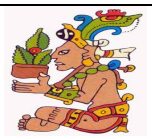
- To know the chromatic patterns in the aforementioned cultures.

Meanings of colors through time and cultures

Once the meanings were located, such meanings were compared with each other. Only those that that coincided in two, three, or four cultures are presented.

Meanings found in two cultures

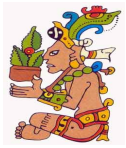
Meaning		
Illness	White	White
Water	Blue	Blue
Valuable	Blue	Blue
Meaning		
Penance	**Black**	**Black**
Wealth	Yellow	Yellow (golden)
Sky	Blue	Blue

Meanings		
Cold	White	White
Bad	**Black**	**Black**
Hot	Red	Red
Anger	Red	Red

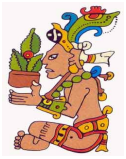
Meanings		
Peace	White	White
Innocence	White	White
Love	Red	Red
Hope	Green	Green

Meanings found in three cultures

Meanings			
Night	**Black**	**Black**	**Black**
Sun	Yellow	Yellow	Yellow

Meaning			
War	**Black**	**Black**	**Black**
Purity	White	White	White

Meanings found in four cultures

Meaning				
Death	**Black**	**Black**	**Black**	**Black**
Darkness	**Black**	**Black**	**Black**	**Black**
Fire	Red	Red	Red	Red
Blood	Red	Red	Red	Red

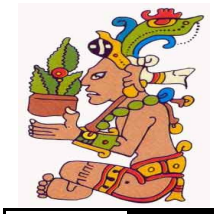
CHROMATIC PATTERNS

We must remember that in some of the chromatic patterns of the present day, the colors that were not present in the different cultures where eliminated so a comparison of the color-meaning relations with the Mayan, the Aztec and the Colonial eras can be made.

Also, the variables used in the original researches were not taken in account (Ortiz 2011).

The **chromatic patterns** found in every culture were:

MAYA



		Death	
		Gemstones	
		Sun	Feathers
			Feathers

The color yellow is the most present; it is related to wealth.

AZTEC

		Fire, sun
		Gemstones, water, valuable, human heart

Only two patterns in which any color match were found, however, the first one is associated with the God Huichilopoztli.

COLONIAL

		Penance
		Purity
		Love, divine
		Happiness, renaissance

URBAN

With two colors:

		To destroy, hard, heavy
		Sterility, silence
		Vice, aggressive
		Wickedness, hatred, pain, death
		Night, mystery
		Sweet, fertility, motherly

With three colors:

			Fear, war
			Night-poverty
			Breaking dawn-eternity
			Masculine, sex
			Abundance, cheerful
			Health, rest, life
			Pleasant, happiness, friend

			Infinite, eternity

With four colors:

				Innocence, sex
				Virtue, motherly
				Night, old age
				Unhappiness-sad
				Charity-danger
				Cheerful-motherly-nice
				Masculine-hope–peace-steadiness

With five colors:

					Warm-cheerful

As we can see, although some meanings are the same, there are different shades in the chromatic patterns and, as the rule was that the same colors qualify the same concepts, we did not find, at least in the consulted references, a coincidence in any of the compared patterns.

DISCUSSION AND CONCLUSIONS

This work was initiated with the hypothesis that every human group generate a series of meanings of colors, originated in their vocabulary that is related to the physical and natural environment and their socio-cultural experience and that are not modified through time. These meanings, a product of culture, are transmitted through different shared codes and they are generalized by the interactions of the members of the shared culture.

It begin with the idea that, although the language of color is very elastic and its relation with other words that represents objects or situations which in turn produce other (figurative) meanings that sometimes rather than complicate their comprehension enrich the possibilities of its interpretation, it can be compared.

The holistic methodology was used to achieve the initial objective: to know the meanings of color that have endured over time. The meaning-color relations found only in one culture were eliminated.

Ortiz (2011) has found that colors not necessarily need to be present or have the same characteristics to be recognized and that there are meanings that transcend time, which in the case of her research were over forty years.

With these results, it was assumed that in the different cultural groups selected, it exists an historic and territorial link that has exceeded the temporal evolution, generating an historic dimension that has continuity.

We also used Surik procedure (2), who says that the best way to know the meaning (of colors) is by isolating the word and identifying all the meanings that are built form the name of the color and an external reference through different kinds of associations that finally lead to a conceptualization.

It is important to clarify that when modern culture was analyzed, the variables used in the original researches (Ortiz 2011) were not used and that some chromatic patterns that were not present were eliminated so the color-meaning relations of the Maya, Aztec and Colonial cultures can be compared.

The colors that, according to the terminology of Berlin and Kay (1999), met the following characteristics were used: those with only one lexeme (its meaning is not predictable when their parts are analyzed); those which meaning is not included in that of another term; those which its application should not be restricted to one limited class of objects; and those that must be psychologically significant to speakers (page 6).

As we know, the pre-Hispanic and the Colonial cultures were ruled by a worldview that generated gods and rites based on nature, so it is not rare that many meaning- color relations were related to their worldview making that the nature, their society and their religious beliefs were confirmed reciprocally.

By analyzing the different cultural groups, we found four dyads. The first one corresponds to the cultural groups Mayan and Aztec where three meanings of color match: illness with the color white and the blue with water and valuable.

In the second, the penance matches with the color black and the blue with the sky and richness (perhaps because of their association with the gold) in the Aztec and the Colonial cultures.
Four of the meanings of the Aztec culture matched with the Modern Urban culture from Mexico, they were: the cold with the color white, the bad with the color black and the anger with the color red.

While the relation with the modern urban and the Colonial cultures is based on peace and innocence with white; love with red and hope with green.

The meanings related in the three cultures are related with the nature (night-black and yellow-sun); a social symbol, the war, with the color black, and meanings with a high symbolic value as purity with the color white.
And finally, we have color-meaning relations that have transcended time forming new chromatic patterns:

Death and darkness with the color black
Fire and blood with the color red

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ARCHITECTURE

Significance And Creation: Emotion And The Primacy Of Colour In Art (Architecture And Painting)

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Abstract: Introduction

The present research paper aims at exploring the primacy of colour as a meaningful phenomenon that defines an emotional condition in art. For this, firstly an analyses of art as an 'emotional' and 'meaningful' condition is defined; also, a clarification of the idealizing nature of art is conducted as the main driving ideal inherent to the creative process. The research problem arises from the lack of a critical understanding of colour as significance and meaning in a work of art (be it in painting, or in the physical spaces of architecture), as well as understanding it as emotion that is felt by the artist (creation ideals) and by the experienced work that embodies those values, emotions and properties. The relevance of the research is thus to construct a clearer understanding of the problematic of colour within the creative process as a vital tool for composing and defining the emotional and meaningful experience. According to Birren (1970), colour aesthetics and colour studies may be approached from three directions: Impression (visually), Expression (emotionally), Construction (symbolically). (Birren 1970:13). The present research paper aims at establishing connections between the three realms of 'colour' understanding. For this, the methodology applied is an analysis of atmospheres observed in three main categories: the corporeal atmospheres, the immaterial atmospheres and the theory underlying both. The first defines physical colour spaces and atmospheres as lived architecture, the second analyzes colour focused on intangibility and abstracted atmospheres, through painting and thirdly, the underlying theory that sustains the creations. These three field atmospheres connect to each other in multiple ways, as a link between them is also a three part categorization: firstly, the primacy of colour, being colour the main tool for the creation of such works of art, the definition of its atmospheric condition; secondly, the consciousness and significance contained in the works, observed in a two sided coin, the construction and creative process where the artist defines the colour qualities, and the felt and lived end result, where the significance and the consciousness emerges in the user; and thirdly, the perceptual emotional fields defined and observed as a spiritual condition. The research will show that the common ground between them, allows for different mechanisms of significance and emotion to emerge according to the ways by which it is conceptualized and idealized. As an example of all spheres of interaction, the research work concludes with an analysis on the spiritual dimensions of the atmospheres of Luis Barragán, his underlying

ideals and visions that sustained his creation principles of creating 'emotional' connections and spiritual atmospheres.

Key-Words: Significance, Colour, Emotion, Art, Meaning, Painting, Architecture

'Dead Art'

Wassily Kandinsky (1977) in 'Concerning the Spiritual in Art' claims that each epoch creates an art specific of its time, and that this kind of art becomes 'still-born' (dead art) when it relies on revivals and imitations; thus the work becoming devoid of meaning and "(…) remaining soulless for all time." (Kandinsky 1977: 1). This, he claims, is a reflexion of the 'minds of today' that are 'infected with materialism', 'unbelief', 'lack of purpose', 'ideals' and in a 'constant doubt'. He also emphasizes: "Art ministers to lower need, and is used for material ends." (Kandinsky 1977: 8); it seeks in 'reality' instead of aspiring for nobler principles and issues and as consequently loses her soul. For Saarinen (1948), in the same way, 'quality of art' means 'quality of culture', so the loss of artistic impulse and creativity, the absence of significance and meaning, echoes the corresponding cultural condition, an epoch that has lost the 'stamina' essential for its own existence[1]. Wassily Kandinsky continues explaining that in opposition to the 'still-born' art, the non-significant creations, there is another art. This 'other art' is indeed capable of 'educating the future'; it springs from contemporary feeling too but "is at the same time not only an echo and mirror of it, but also has a deep and powerful prophetic strength." (Kandinsky 1977: 4).

Art: The creation of meanings and communication to inner sensitiveness

Art = Emotional Meaning

Art as the construction of meanings is intimately connected to the emotional spheres of perception. Joyce Carey (1984) explains that art is the 'creation of meanings' and is directed to the 'sensibilities' of the whole man [2]; art's 'immense power' lies in its dealing with the " (…) fundamental passions and reactions common to all humanity." (Cary 1984: 163), connecting man in its sensitiveness and emotional realms of existence. This connection provokes what he defines as a 'shock of pleasure': "(…) a shock of pleasure which makes life valuable." (Cary 1984: 163) and is in itself associated with the 'emotion of beauty' [3].

[1] Reference to: "In other words, quality of art is the infallible barometer of quality of culture. Consequently then, if art has lost its creative vitality and has declined into doctrinal sterility, this only shows that the corresponding cultural epoch has become tired, indolent, and lacking in that stamina which is so essential for its existence." (Saarinen 1948: 96)

[2] Reference to: "Art is the creation of meanings for the senses and the sensibility, of the whole man." (Cary 1984: 164).

[3] Reference to: "For that enjoyment has no relation to appetite or self-satisfaction. It is something freely given, a good, a grace, a belonging simply to existence, to reality itself. For that minute, the meaning of existence is this special pleasure, the emotion of beauty." (Cary 1984: 163)

Also of reference is Saarinen's (1948) understanding of 'true' art and as a meaningful ideal that approximates religion. According to Saarinen (1948), to be able to create 'true art', art must be based on the fundamental principles that are 'innate to all things'. In this sense, art approximates a religious existence, echoing Goethe's vision, when he claims that 'he who has art, even religion has'[4]. Art in this sense, be it in a painting or in a space, provokes a psychological and emotional connection with the viewer. The artist (the creator) therefore, creates a world of meanings that is captured by the artwork, and then is apprehended and perceived by the viewer. This is what Pallasmaa (1996) refers to as the 'ultimate task' of art and architecture, and of the artist himself: that of reconstructing an experience of an 'interior world' and making the observer belong to it, rather than merely being a spectator and observing it from the outside. Pallasmaa (1996) believes that art and its expression are rooted in the meanings of the world – deep meaning that are lived and not understood theoretically [5]. These apprehended and portrayed emotions and 'ideals', belong to a 'pre-verbal' meaning, have an innate condition, and can only be 'lived', perceived and felt, rather that 'intellectually' understood.

The artwork, endowed with 'meanings' and 'emotions' contains what could be understood, in Saarinen's (1948) words as 'spiritual qualities'; these are contained and considered within the creation of the artwork and exist as 'form' within its proportions, configurations and rhythms, being through them, that the 'aura' of the work is conveyed. Using a 'room' as the most basic form, a space of protection that 'everyone' establishes around himself, Saarinen explains, that the 'environment' defined by the room, by means of proportion and rhythm, defines the aura of the form (of the room) and 'bestows' upon man its 'spiritual atmosphere': "As such, the room radiates its influence." (Saarinen 1948: 127). In the same way, every creation, every piece of Art, radiates its influence upon man. Whereas language, for example, communicates to the intellect and through his intellect communicates to his 'inner sensitiveness'; the language of art, communicates directly to man's inner sensitiveness [6]. Of reference of art, as space and as painting, communicating as an atmosphere to man's inner sensitiveness in the Bruder Klaus Chapel by Peter Zumthor, and the painting 'Gold Leaf on Wood' (1959) by Mathias Goeritz, where a parallelism can be established between both, both visually and emotionally (Image 1 and 2).

[4] Reference to: "After all there is not much difference between religion and art, for the artist's state of mind at the moment of creation – when sincere, and at its best – is a religious state of mind. Goethe says: "He who has art, even religion he has; He who has no art, let him religious be." (Saarinen 1948: 43)

[5] Reference to: "Artistic expression is engaged with pre-verbal meanings of the world, meanings which are incorporated and lived rather than intellectually understood." (Pallasmaa 1996:15).

[6] Reference to: "It is that silent tongue, which – at best and when honest – brings to all mankind its 'expressive' message of the deepest and most precious achievements. This expressive message has sounded, sounds and will continue to sound as an inspiring stimulus – through centuries, millenniums and ages. And during these same centuries, millenniums and ages, every single piece of art – at best and when honest – has had, and has, and will have its part in this expressive message" (Saarinen 1948: 133).

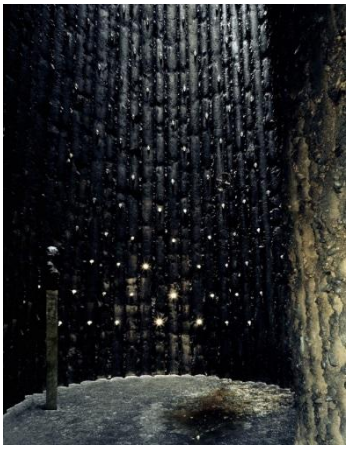



Image 1: *Bruder Klaus Chapel by Peter Zumthor; Source: http://www.artecapital.net/arq_des-39-a-forma-bonita-peter-zumthor-em-lisboa;*
Image 2: *Mathias Goeritz, Gold Leaf on Wood, 1959; Source: http://www.thecityreview.com/s08clat.html*

The creation of emotion

For Leo Tolstoy (1988), art possesses an eternal and immutable essence, "art is a form consciousness" and the essential role of art is that of being a 'means' of communication and generating empathy. His views are connected to the 'emotion', believing that what matters in art is the 'emotion' it carries and the feeling conveyed and expressed by the artist. Tolstoy describes this property of true art as "infectiousness" or "contagiousness"; referring to art's ability to transmit and provoke the same feelings and emotions in the viewer, as those originally felt by the artist. Art, for him, is this activity that of transmitting feelings once felt by the artist, by means of expression, to others. It is this notion of infectiousness that allows for a distinction between 'good art' and 'bad art', and this degree, or levels of 'infectiousness' that separates good art from excellent art; in his words: "The stronger the infection the better is the art as art, regardless of its content, and regardless of the value of the feelings transferred." (Tolstoy 2013: 194) [7]. Good art and excellent art provokes in the viewer a sense of unity, to the artwork being observed and to the artist that created it; furthermore, the artwork destroys the notion of 'separateness' and 'individuality' and creates a 'shared' realm of 'emotions'. Art, in this sense becomes the unity between people and 'eras' and conveys a certain 'timelessness' and a kind of 'immortality', from man to man.

For Pallasmaa (1996), the experience of art, is a 'private dialogue' between the viewer and the art itself, with it, this 'private sphere', 'excludes' other relations and exchanges.[8] Furthermore: "Art is memory's *mise-en-scène"*, and "Art is made by the alone for the alone", as Cyrille Connolly writes in *The Unquiet Grave.* Significantly these are

[7] Original quote: "Quanto mais forte for o contágio, melhor é a arte enquanto arte, independentemente do seu conteúdo, ou seja, independentemente do valor dos sentimentos transferidos." (Tolstoy 2013: 194)
[8] Reference to: "Experiencing a work of art is a private dialogue between the work and the viewer, one that excludes other interactions." (Pallasmaa 1996: 37)

sentences underlined by Luis Barragán in his copy of the book (Pallasmaa 1996: 37). A memorable experience of art and architecture, for Pallasmaa (1996) is when 'space', matter and time, fuse into 'one single dimension', thus permeating consciousness.[9] In the process, he explains: "We identify ourselves with this space, this place, this moment, and these dimensions become ingredients of our very own existence." (Pallasmaa, 1996: 50). Pallasmaa further emphasizes that the artistic image 'touches' the sensory existential field, causing an impact on the bodily being, before it reaches the 'mind'; a work of art, thus, can communicate and have a deep emotional impact, and yet still remain a mystery 'intellectually'. However, with every artistic image, the 'viewer' projects emotional content and mental significance.

Merleau-Ponty (2009) also speaks of art as an 'expression on an interiority'. He continues explaining that Art, and specially painting 'draws upon this fabric of brute meaning which operationalism would prefer to ignore.'[10]; from the philosopher, is the need to advice; from music, the other extreme, depicts only the 'schemata of being'; thus, only the painter can understand the 'world suspended' without being obliged any duties of 'appreciation' or appraisal'. Upon the painter is a sense of urgency, 'drawing' from the world, with nothing other than his 'eyes', 'hands' and his 'painting'. For Merleau-Ponty (1960) painting (as with other arts) never consisted only of representation, in spite of being a representation, but instead, there operates a 'metamorphosis' that searches within signs and significances. What makes art an 'organ of the spirit', according to Merleau-Ponty, is that it contains a 'matrix of ideas', providing 'emblems' whose meaning and significance is never finished and is always constantly developing. This allows a constant assimilation and retransmission of contents, senses, meanings and significances. The painter reflects in his work his 'feeling' and has to conquer it by his own forms of expressions. He further emphasizes, that the 'expressive gesture' by which the unity of painting is rooted is precisely a 'sense of genesis'.[11]

Experimenting emotional content, thus implies an identification with the object and a projection from the viewer; describing a relation and deep connection between object and subject, but for this relation to occur, there needs to be a 'projection' and an 'identification' with the artwork in order for the emotions and the feelings to be conveyed and understood – both in the creative process and in the experiencing of the work.

Colour meaning created

Art = Spirit = Emotional Content as Colour

[9] Reference to: "In memorable experiences of architecture, space, matter and time fuse into one single dimension, into the basic substance of being, that permeates consciousness." (Pallasmaa 1996: 50)

[10] Original quote: "Ora a arte e especialmente a pintura bebem nessa camada de sentido bruto da qual o activism nada quer saber. Elas são as únicas a fazê-lo em toda a inocência." (Merleau-Ponty 2009: 16)

[11] Reference to: "O sentido do gesto expressivo no qual fundamos a unidade da pintura é por principio um sentido em gênese. " (Merleau-Ponty, 1991: 72, 73) ; English translation: "The sense of expressive gesture in which we established the unity of the painting is by principle a sense in genesis." (Merleau-Ponty 1991: 72, 73)

Emotions are closely linked to the way colour is used to convey meaning and substance through atmospheres in both art and architecture. Colour is the fundamental principle that defines the underlying 'ideals'.

On the evasive qualities of colour, Faber Birren (1970) explains that colour is a fleeting and intangible essence, a resonance that escapes mental formulations and cognitive understanding. In his words: "The primeval essence of colour is a phastasmagorical resonance, light becomes music. At the moment when thought, concept, formulation, touch upon colour, its spell is broken, and we hold in our hands a corpse." (Birren 1970: 8). Colour in this sense is understood as a tool that is in itself meaningful pertaining qualities that are elusive to conscious thought, belonging to the realms of emotion – just like art. Furthermore, Birren (1970) explains that the artist is interested in colour effects from both physiological and psychological aspects, 'mediated' by the eye and the brain; the artist uses colour from both perspectives. Furthermore, he explains that for the artist there is an interdependency between the 'visual, mental and spiritual' phenomena's and these interrelate in the realms of colour[12].

Colour, for Saarinen (1948) is a fundamental principle pertaining to all things, just as Form. Colour, Saarinen explains, like music, communicates to the sensibility of man, explaining that the "Receptiveness of colour is entirely dependent on one's inner sensibility." (Saarinen 1948: 226); it is this 'inner sensibility' that guides and defines all 'understanding and employment of colour'. Saarinen emphasizes that the richness of colour in nature is associated to the 'underlying life': "Thus, the seasons constitute a continuous colour-symphony – rich, animating, and with expressive colour-movements." (Saarinen 1948: 227).

Colour, Saarinen says, is the 'significant language', that speaks for its own sake. Thus, as a synthesis: " (…) human art must be a humanly creative expression by means of colour – just as much as it must be by other means of expression." (Saarinen 1948: 234). In this regard, Saarinen identifies two types of colour uses: one the desire for 'colour expression', and second, 'the ability to produce colour as means of expression'. The world of colour, he emphasizes, is essential for 'cultural growth'.

Wassily Kandinsky (1977) in 'Concerning the Spiritual in Art', unites color and form to the concept of 'meaning', explaining that they serve as expressions of 'inner meanings' and resonate spiritual values. Art, for Kandinsky (1977) should be a purely abstraction of thought and for this use a purely 'artistic composition' (expression used to refer to the artistic creation). Kandinsky (1977) further explains that Colour and Form are painting's 'two weapons', but whereas form can represent an object alone, colour cannot. However, it is the colour that when seen by the mind, Kandinsky (1977) explains, " (…) exercises at once a definite and an indefinite impression on the soul, and produces spiritual harmony." (Kandinsky 1977: 28) But for this, the colour in a painting, must possess: a 'definite shade' (a specific shade within the many) which is the subjective component and a 'limited surface' (divided off from the other colours) which is an objective realm (of limits between colours). This defines a connection between colour and form, and the influence of

[12] Reference to: "Visual, mental and spiritual phenomena are multiply, interrelated in the realm of colour and the colour arts." (Birren 1970: 12)

form on colour. Quality and value, continues Kandinsky (1977) emerges from these different connections between colour and form (each geometrical form possesses its own spiritual values, despite being abstract they provoke an 'inner suggestion'). Each aspect of form has its specific aim, however, the 'outline' the external form, is well applied when and only when it expresses inner meaning. As a conclusion he claims: "So it is evident that form-harmony must rest only on a corresponding vibration of the human soul; and this is a second guiding principle of the inner need." (Kandinsky 1977: 29).

Spiritual Connections = Colour + Form

The 'idealization' of art: the 'ideal' of the creative process

The configuration of form and colour, in the artistic and creative process, contains the essence of the emotions that the artwork carries within itself. It is the artist, in the decision making phases, that defines the character and the aura of the 'atmosphere' he is creating, and that allows for the 'inner needs' (as explained by Kandinsky) to emerge. This establishes within the creative process what can be defined as an 'idealizing essence' and 'ideal' that is first defined by the artist, then embodied in the artwork and lastly conveyed to the viewer.

Alain de Botton (2013) and Louis Armstrong (2013) in their book 'Art as Therapy' explain the mixed views related to the problematic of 'idealization' in art. They clarify, that idealization has a 'bad name' and is seen as something negative, because it " (…) seems to involve endowing something or someone (a profession, a person) with virtues more glowing that they actually possess, while disguising any imperfections with polish and subterfuge." (De Botton and Armstrong 2013: 20). This notion, in modern and current use, carries a negative charge, exactly because all the negative aspects of what is being portrayed or created, are occult and only the positive is left to be represented. However, idealization has been the central role of art's aspiration for centuries, the authors continue. And this is because the 'idealist' aspirations of art, are part of its nature; ideal images define 'aspirations' and help us be in touch with the values we so much wish to possess. Furthermore, the ideal nature, doesn't imply a negation of reality, there is a place for both: "We can love the ideal while being perfectly aware of the fallibility and imperfect (…)." (De Botton and Armstrong 2013: 22).

On this issue Pallasmaa (2011) also explains that architecture existed as part of multiple spheres of existence: " (…) between the cosmic and the human dimensions, eternity and the present, the gods and the mortals." (Pallasmaa 2011: 19), playing a vital role in the idealized 'auto image' of a certain culture. For architecture to create a 'cosmos', an 'order', which is to say, that in order for it to create an 'idealizing objective' it must embody a certain 'metaphorical' existence of an 'ideal' life itself. Pallasmaa (2011) defines this as an 'idealizing objective', part of architecture's central role.

In this sense, and in continuation of the ideas raised and defined by Alain De Botton (2008), Pallasmaa transposes the same notions into the realms of Architecture. According to him, Architecture in order to be 'an ideal', it must incorporate what he defines as a

'metaphor of life'; this is a condition of 'Art', a prerequisite for a 'meaningful' creation and communication. Furthermore, Pallasmaa clarifies that artistic and architectural images are "(…) metaphorical representations of the world and of the human condition." (Pallasmaa 2011: 103), in these images, the whole world is reflected and can be defined as 'existential metaphors'. They provide 'orientation' and 'condition' the experience and the perception. Iconic pieces of architecture, such as Casa Malaparte, Casa Melkinov, and The Glass House, are "(…) condensed metaphorical microcosms, alive and habituated metaphors, self-sufficient and closed universes by the closed walls of those structures." (Pallasmaa 2011: 104). They exalt a metaphysical atmosphere, beyond the mundane concerns of consciousness. Pallasmaa (1996) also emphasizes that in all artistic experience, in the emotional connection with an 'idealizing' work, a 'sorrow of beauty' is felt in a kind of 'immaterial temporality', characterized by an 'unattainable ideal' portrayed by the artistic object. This establishes a link with the 'eternal'. In his words: "A sense of melancholy lies beneath moving experiences of art; this is the sorrow of beauty's immaterial temporality. Art projects an unattainable ideal, the ideal of beauty that momentarily touches the eternal." (Pallasmaa 1996: 37).

Idealizing Nature = Spiritual and Emotional Connections

Zumthor's creative process as idealizing emotional connections

Zumthor (2006) explains that the development of a work of architecture depends on the one side of 'objective and rational criteria' and the other side, the 'subjective and unconsidered ideas' that intervene in the work that reflect the 'significance of personal feelings'. Thus, "The design process is based on a constant interplay of feeling and reason. The feelings, preferences, longing and desires that emerge and demand to be given a form must be controlled by critical powers of reasoning, but it is our feelings that tell us wether abstract considerations really ring true." (Zumthor et al. 2006: 21). Designing is based, he clarifies, on establishing an order, however, the essential 'substance' proceeds from 'feelings and insight'. Furthermore, "Precious moments of intuition result from patient work." (Zumthor et al. 2006: 21). Zumthor (2006) further explains that when he works on a design, he allows images and 'moods' that he remembers to guide his work. Most of these images, come from his subjective experience. While in his design process, he tries to uncover what these images really mean so that he can learn "(…) how to create a wealth of visual forms and atmospheres." (Zumthor et al. 2006: 26). The object he is designing takes on the 'qualities' of the images, and furthermore, "If I can find a meaningful way of interlocking and superimposing these qualities, the object will assume a depth and richness." (Zumthor et al. 2006: 26). The qualities of the design, must merge and blend together, with the overall form and structure, until all the parts are no longer separate, but belong together to form a whole, and eventually, "Everything refers to everything." (Zumthor et al. 2006: 27). At this point, Zumthor explains, the initial images fade away, and the new design emerges with a history of itself.

In this sense, the creation of an atmosphere, is a quest for the emotional 'qualities' that emerges as **'substances' and 'atmospheres',** a reflexion of the principles of 'inner contents' and 'meanings'.

Emotional and psychological connections: inner wholeness

On these emotional connections contained and devised from the work of art, Alain de Botton (2013) and Louis Armstrong (2013) in their new book 'Art as Therapy' explain, that our encounters with art 'fills emotional lacks'. Drawing from the ideas of 'beauty as a promise', the authors explain, that art has the power to extend our capacities beyond those endowed by nature. Art 'balances' our emotional needs and psychological 'necessities', because of this, our attractions to types of art, differ; as each person has their own specific needs; in the author's words, they clarify: "Since we are not all missing the same things, the art that has a capacity to rebalance us, and therefore arouse our enthusiasms, will differ markedly." (De Botton and Armstrong 2013: 32). This notion, that art 'rebalances' our emotional needs, answers the question of why peoples aesthetics tastes vary so much, the authors clarify. The tastes of people (weather attracted to minimalism or to a 'baroque style) depends on the spectrum of 'emotions' that is in need of 'stimulation'. This is linked to the fact that every work of art possesses its own mood, 'feeling' and 'emotion' in itself: "(…) a painting may be either serene or restless, courageous or careful, modest of confident, masculine or feminine, bourgeois or aristocratic, and our preferences for one kind over another reflects our varied psychological gaps." (De Botton and Armstrong 2013: 34). We 'need' artworks that will compensate for the emotional and inner fragilities, thus, an artwork is 'beautiful' when it grants us the virtues we are missing. As a synthesis: "Art holds out the promise of inner wholeness." (De Botton and Armstrong 2013: 34).

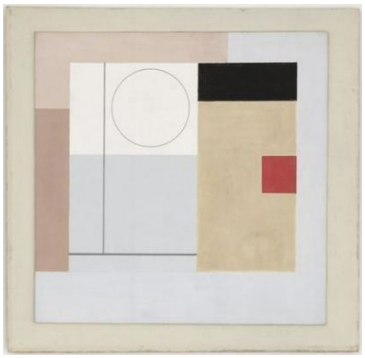
Art in this sense, is seen as a means of 'compensation' for our innate 'weaknesses' (understood here as psychological faculties). Because 'Art' leads the way, and shows the way, compensating for what is 'missing' it enables 'us' to become 'better versions of ourselves'. In this regard, the authors continue, "To discover the purpose of art, we must ask what kind of things we need to do with our minds and emotions, but have trouble with. What psychological frailties might art help with?" (De Botton and Armstrong 2013: 5); just as man creates a glass of water to carry water and fill that necessity, so too, art does the same in a psychological, intellectual and spiritual level. There is the underlying conviction that the main point of our interactions with art, is to 'lead better lives' and to " (…) access better version of ourselves. If art has such power, it is because it is a tool that can correct or compensate for a range of psychological frailties." (De Botton and Armstrong 2013: 64).

Seven frailties are identified, and to 'compensate' for them, their own seven functions of art. The authors clarify these are the most common 'functions' and do not extinguish in their selves the totality of the functions that could and should be associated to art. The psychological frailties the authors announce can be summarized as follows: (1) we forget what matters, (2) we lose hope and are oversensitive to the negativities of our surroundings, (3) we suffer and are inclined to feelings of isolation,(4) we are unbalanced and lose sight of the best qualities of life, (5) we are not aware of our own existence and self-knowledge is not clear, (6) we reject experiences and what we do not understand, and lastly (7) we are desensitized by familiarity. For each of these, then emerge the each of the functions of art, also summarized as follows: (1) a correction of memory – Remembering - ,

(2) a purveyor of hope – Hope - , (3) a way for dignified sorrow – Sorrow - , (4) a balancing agent – Re-Balancing - , (5) a guide to self-knowledge – Self-Understanding - , (6) a way to extent experiences – Growth - , and (7) a re-sensitization tool – Appreciation [13].

On the first function of art, that of Remembering (1), art is a way of 'preserving experiences' and moments; as an example, the authors use John Constanble's 'Study of Cirrus Clouds' (c.1822) (see Image 3), to explain, that such a scene captures significance and meaning, and that the artist wished to " (…) intensify the emotional meaning of the soundless drama that unfolds daily above our heads, making it more readily available to us and encouraging us to afford it the central position it deserves." (De Botton and Armstrong 2013: 12).

Image 3: *John Constanble's 'Study of Cirrus Clouds'; Source: http://www.fineartprintsondemand.com/artists/constable/study_of_cirrus_clouds.htm;* ***Image 4:*** *Van Gogh's sunflowers; Source: Source: http://www.daydaypaint.com/van-gogh-ainting-032-p-385.html*;



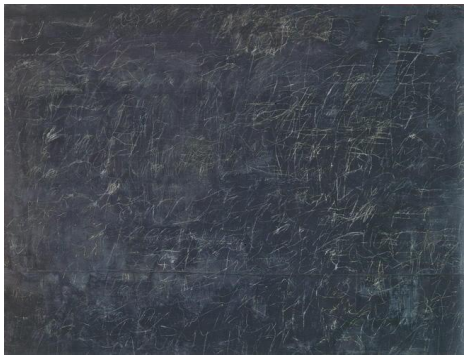


Image 5: *Ben Nicholson '1943 (painting) ' (1943); Source: http://pictify.com/592225/moma-the-collection-provenance-research-project-ben-nicholson-painting-1943-1943;* ***Image 6:*** *Cy Twombly, specifically 'Panorama' (1957); Source: http://en.wahooart.com/@@/8XXSDB-Cy-Twombly-Panorama*

[13] Reference to pages 64 and 65 of the book Art as Therapy, where the authors present a summary of the functions of art and the psychological frailties it addresses.

On Hope (2), the authors clarify that beauty is more appreciated and felt amidst the awareness of the troubles of the world; and to paint or create beautiful things (giving an example of flowers in a vase), is, as the authors explains, to be aware of life's ''tragedy of existence''. In this sense, the creation of the emotions of 'hope' is associated with an understanding of beauty and with an 'idealizing nature'. As an example of function 2, Hope, the authors make a reference to Van Gogh's sunflowers (see Figure 4). On the function of Sorrow (3), the authors explain that associated with the emotions of sorrow is the 'sublime'. The sublime in the Romantic sense (depictions of mountains, stars, heavens and clouds), allows for understanding of our own nothingness, of our own 'insignificance' by exciting a 'pleasant terror' and " (…) a sense of how petty man's disasters are in comparison with the ways of eternity, leaving us readier to bow to the incomprehensible tragedies that every life entails." (De Botton and Armstrong 2013: 30).

The fourth function of art is the function of 'Rebalancing' (4), on this function, art would re-balance the emotional dispositions of the self; they further explain: "Art can put us in touch with concentrated doses of our missing dispositions, are thereby restore a measure of equilibrium to our listing inner selves." (De Botton and Armstrong 2013: 32). The Farnsworth House (1951) Illinois, by Ludwig Mies Van der Rohe, for example, would be a house to 'rebalance a nervous soul', a house to restore from too much intensity, stimulation and distractions. As an example to the re-balancing nature of art, the work of Ben Nicholson (see Figure 5), that echoes principles of harmony and peace.

Explaining the function of Growth (5), the authors clarify that elusive and not so clear parts of our thinking and of our own existence, become clear in works of art. These elusive thoughts and experiences are specific ''moods'' or ''states mind or of soul'', to which works of art become mirrors of. As an example the authors speak of the works of Cy Twombly, specifically 'Panorama' (1957) (see Figure 6), explaining that it " (…) pictorializes a moment in reflexive life suggestive of ambition and confusion; (…) Whatever they are, what matters is that we don't get to see them precisely, so we are held in the moment of being on the cusp of something." (De Botton and Armstrong 2013: 47); it captures a moment where one hasn't quite understood, and an abandonment of reflexion.

As an example of the seventh function Appreciation (6), the authors announce the work of Ben Nicholson '1943 (painting)' (1943), where he emphasizes the 'basic pleasures of simple things' in the search for an innate harmony of forms and proportions. It is the power of art, to "(…) honour the elusive but real value of ordinary life." (De Botton and Armstrong 2013: 62); thus doing the opposite of 'glamourizing life' bringing us closer to the 'real' and genuine aspects of 'normality'.

Inner Wholeness = Colour Apprehended

Colour as emotions conveyed

On each of the functions and its examples identified by Alain de Botton (2013) and Louis Armstrong (2013), colour plays a crucial and central role, both for the artist and for

the observer. The completion of the functions of each work of art, not only depends on the use of colour, but by colour, its emotional conditions are portrayed and a connection is achieved with the viewer. Colour is the agent that allows for each specific emotion, of hope, of sorrow or of an idealizing nature of immortality to emerge and come into being. Through the identification of each specific function, links are established between the art work itself, the emotions it embodies within itself as a result of the creative process and the bridge towards the observer that connect with the artwork in deeper psychological and emotional ways. The symbolic nature of colour and the psychological associations of colour emerges in the examples above directly associated to the functions of each work of art. As an example of the idealizing nature of colour, it is of reference the work of Mark Rothko (see Image 7).

Image 7: *Rothko Painting; Source: http://colourchroma.files.wordpress.com/2011/08/rothko-violet-green-red-orange.jpg*

Emotions of warmth, hope, joy and happiness emerge with the use of colour palettes that are warm and vibrant (yellows, reds and oranges), emotions of nostalgia and calmness emerge with the use of cooler colours (purples, blues and similar tones), emotions of sorrow and pain emerge from the use of dark tones and hues (blacks, greys and dark browns), and emotions of calmness, stillness and soothing feelings emerge with the use of whites, light shades (ocres, and light yellows and pinks). In a more complex example of colour associations and their embodied emotions, it is of reference the work of Mark Rothko that portrays a colour field and an atmosphere, that combines both the warm and vibrant colour of red and the soothing colour of blue and green; this echoes an 'idealizing' nature of an atemporal condition, and allows for aspirations of completion and balance between two of opposing forces, the energy of the red (passion, strength, movement and love) and the calmness of the blue (soothing, peaceful, and still); through colour harmony and balance, a powerful ideal is conveyed.

In the closest representations of nature, of the atmosphere of nature through the landscape, the emotions of timelessness and of the endless is characterized and portrayed by the use of colour contrasts of blues and blacks with whites in its most intense manifestations (such is the example of The monk and the sea (1808) by Caspar David Friedrich) (see Figure 8). These colours, although aspiring to the idealizing nature of the

emotion of the endless and of timelessness, are deeply rooted in the colours of nature and of the landscape of the ocean and the sky combining light blues, dark blues and black, with ocres and whites; its exacerbation and emotion is increased and intensified with the use of colour, granting an immaterial feeling and the evasive qualities of the absence of time. Another example of this kind of idealizing ideal and colour combination is the paintings by William Turner with Snowstorm (1842), (see Figure 9).

Image 8: *The monk and the sea (1808) by Caspar David Friedrich; Source: http://holocaustvisualarchive.wordpress.com/tag/caspar-david-friedrich/;*
Image 9: *Snowstorm 1842; Oil on canvas, 91.5 x 122 cm; Source: http://www.ibiblio.org/wm/paint/auth/turner/i/snwstorm.jpg*

Also of reference is the atmospheric space of Peter Zumthor, Bruder Chapel (Image 1), that possesses multiple muted colours from the burning of the wood of its construction process. The interior colours that remained are greys, dark greys, browns, sand, ocres and blacks. These colour create a sense of introspection, contemplation and meditation, a place of interiority and reclusion from the outside world; echoing a 'cocoon' like place, that only finds its counterpoint of light by the small holes of light (white) that come in from the outside, mirroring little stars in the great open darkness of the heavens; and from the open small headlight that brings light from above.

Colour as emotional spirituality in Bárragan's atmospheres: Case study

Luis Bárragan (2000) when asked about the art of architecture, replied that he believes in an 'emotional architecture', that he considers very important for humanity, that architecture moves people by its beauty [14]. He continues claiming that although there might be a number of solutions for any project or space, the one that brings the message of beauty and emotion for those who live in the spaces is the one that is Art is all its form: "(…) ésa es arte." (Barragan and Riggen 2000: 91). On this 'emotional architecture' he further explains that he pursues the causes of 'emotions', those causes interest him deeply

[14] Original Quote: "Creo en ça 'arquitectura emocional', es muy importante para la humanidad que la Arquitectura emocione por su belleza." (Barragan and Riggen 2000: 91).

[15]. Also, he explains that any work of architecture that is not capable of expressing serenity is a mistake; as an architect, he clarifies that his purpose is driven by the desire to create a 'formula' that would allow man to 'rest' and find tranquillity in his own home, where he could "(…) find repose after the aggressions of the city." (Barragan and Riggen 2000: 112). [16] When asked what the ideal space should be, he replies that an ideal space needs to contain elements of 'magic', 'serenity', 'enchantment' and 'mystery': these elements, he clarifies can indeed inspire the ''minds of man'' [17]. Barragán also clarifies the importance of art and religion in granting 'meaning to life'; he claims: "Art and religion help to bring her out and give meaning to life. Without religion, without myth, there would be no cathedrals, no pyramids, and there would be no art history." (Barragan and Riggen 2000: 134) [18]. Another 'emotional' element that he claims to be of the utmost importance is the quality of 'leisure' and 'passing of time': "A beautiful house with its garden should invite the most perfect 'Leisure' and give the most poetic and beautiful idea possible of the passing of time." (Barragan and Riggen 2000: 29) [19]. Another idea, he explains further, that is the most 'beautiful idea' ever is the idea of 'beautification by time'; for him, this 'concept' is linked and associated with 'Interiority' as 'lived time' and 'Leisure' as 'enchanted time', being that both of these concepts are associated to the 'idea of depth' [20].

Durão (2012) in her paper 'Colour as Pathway of Light: Searching the Shadow in Luis Barragán' explains the correlations between colour, beauty and spirituality in the work of Luis Barragán, and clarifies the links his intentions and his use of colour. In her words: "For Barragán, beauty is a source of spirituality that mingles the colours with Gods, art and Mexican nature, in a choreography of shadows and the implications of the sun." (Durão 2012: 1). Explaining that Barragán's work was indeed an echo of an 'introspective' search, and that for him, the roots of the artistic phenomena is linked to spiritual concerns[21]. Furthermore, his studio-house in itself reflects an 'introspective' dimension, creating a sense of an 'inner being' and encouraging 'meditation' [22]. It is also of reference, the co-

[15] Original Quote: "Caminar en una cathedral provoca en mí una emocion. Yo persigo las causas de esta emoción; por los espacios cerrados que nos llevam de una sorpresa a otra, de un misterio al otro..." (Barragan and Riggen 2000: 133).

[16] Original Quote: "(…) quisera encontrar una formula para que el hombre se tranquilizara en su casa, se repusiera de las agresiones de la ciudad. Este es un problema que me importa muy profundamente." (Barragan and Riggen 2000: 112).

[17] Original Quote: "Penso que el espacio ideal debe contener en sí elementps de magia, serenida, embrujo y misterio. Creo que estos elementos pueden inspirer la mente de los hombres." (Barragan and Riggen 2000: 129).

[18] Original quote: "El arte y la religión aydan a salir con ella y darle sentido a la vida. Sin religión, sin mito, no habría catedrales, ni habría pirámides, no habría historia del arte." (Barragan and Riggen 2000: 134).

[19] Original Quote: "Una casa bella con su jardin debe convidar al Ocio más perfecto y dar la idea más poética y bella posible del paso diel tiempo." (Barragan and Riggen 2000: 29).

[20] Original Quote: "La idea más bella posible, en el sentido de preparión para el embellecimento por el tiempo, está intimamente ligada a la idea de Interioridad (tempo vivido) y de Ociosidad (espacio encantado) ambos relacionado con la idea de profundidad." (Barragan and Riggen 2000: 29).

[21] Reference to: "Barragán confirmed that his search was introspective, in his acceptance speech of the Pritzker Architecture Prize in 1980, when he claimed that it 'is impossible to understand art and the glory of its history without avowing religious spirituality and the mythical roots that lead us to the very reason of being of the artistic phenomenon." (Durão 2012: 1)

[22] Reference to: "The studio house of Barragán is situated in Tacubaya, which means 'place where water comes together'. It develops inwards, underlining the sensation of inner being, and encouraging 'meditation',

relations between the atmospheric work of Barragán and the work Josef Albers, that both use colour as an emotional experience (see image 10 and 11).

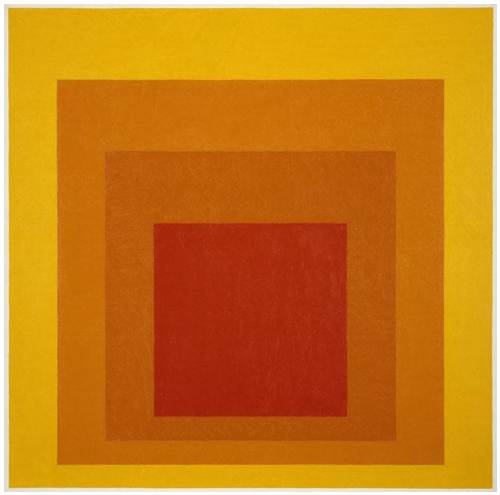


Image 10: *Barragán's House and Studio; Source: http://archi-learner.blogspot.pt/2014/01/luis-barragan-house-and-studio-1947.html;*
Image 11: *Homage to the Square, Josef Albers; Source: http://www.designishistory.com/1940/joseph-albers/*

Barragán echoes the concerns expressed by Kandinsky: where the inside mind, the 'inner quests' is reflected in the outside world and is shaped into an 'art' object; thus, in this process a 'transcendental dimension' comes into being derived from 'inner needs' that provoke by their own 'form-harmony' corresponding vibrations and echoes of the human soul. Durão (2012) also explains that for Barragán "(…) the corporeal has the transcendent mission of representing the spirit and 'the more intimate a human being is, the greater his nullification, which means that his body will talk more of his soul'." (Durão 2012: 4). This, she clarifies, is known as the 'sublime', a specific experience 'space' or 'energy' "(…) that is so overwhelming, that the individual diminishes, in order for revelation to take place." (Durão 2012: 4).

Art, in this way, is a form of revelation rather than imitation. In Barragán's spaces, Durão (2012) refers to Barragán's works as 'three-dimensional paintings', the body finds a 'communion' between the physical and the metaphysical dimensions. The form, she explains, to achieve this, works as a 'mythologem' (a well known tale, still open for futher reshaping like mythology); the spaces, like the myths, do not need explanations of 'causes' they are, what Durão describes as 'aetiological' "(…) to the extent that, according to Aristotle, the *aitiái* are *archái*, i.e. 'the beginnings or first principles such as primary states like water, fire, or the boudless'." (Durão 2012: 4). On the *archái* concept, she further explains: "To Jung and Kerényi, the happenings of mythology are the *archái* to which everything individual and particular goes back and out of which it is made, while they remain ageless, endless, timeless and primordial (…)." (Durão 2012: 4). In this sense, it is

as Barragán intended. The sense of intimacy was picked up by Louis Kahn when he visited the studio house and remarked that it was not just a house: it is the house." (Durão 2012: 3)

of reference the paintings that inspired the colour pallets of Casa Giraldi by Chucho Reyes (see images 12, 13 and 14); Barragán searched for the emotional essence that emulated from the colour combinations, and used what can be referred as emotional references.



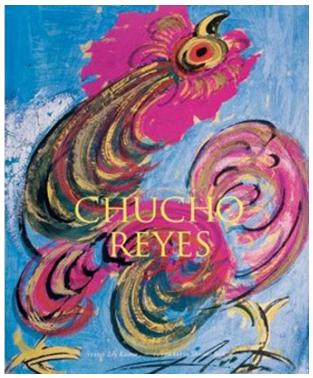


Image 12: *Casa Giraldi by Barrágan; Source: http://www.cosasdearquitectos.com/2011/11/casa-gilardi-de-luis-barragan/;*
Image 13: *Paintings by Chucho Reyes that inspired Barragán; Source: http://www.invaluable.com/auction-lot/jesus-reyes-ferreira-chucho-reyes-,-gallo,-sin-f-14-c-9e0f0afbff;* ***Image 14:*** *Paintings by Chucho Reyes that inspired Barragán; Source: http://www.amazon.co.jp/gp/product/images/9685208115/ref=dp_image_z_0/375-2509975-9256557?ie=UTF8&n=52033011&s=english-books;*

About his constant use of colour, Barragán himself, explains that in nature there are fewer colours, so he creates with colour to have the pleasure of being around them [23]; furthermore, that is the reason why he never uses green (and blue), because it is the colour of nature, and ‘’green will always compete with nature’’. On the colours of casa Gilardi, he explains that he was inspired by a painting of Chuchu Reyes [24]. Clarifying that Chucho Reyes had an ‘incredible eye for colour’, and had dedicated his life to beautiful things.
Durão (2012) also clarifies that “For Barragán, light and colour qualifies and transforms space and he used it with the same freedom as a painter, trying out different solutions.” (Durão 2012: 9). His work was a ‘source of experimentation’, and each space, each colour is a result of multiple experiments in determining the ‘right’ colour for each specific ‘surrounding’ and ‘location’. As a result, each ‘colour composition’ is complex depending on a multitude of factors [25] and achieving simultaneous and successive contrasts. Thus, the expression of colours through the work of Barragán is partly due to the way by which he

[23] Original quote: “ Por el placer de ver los colores, para disfrutarlos. En la natureza existen menos colores.” (Barragan and Riggen 2000: 132)
[24] Reference to: “ Los colores los tomé de una pintura de Chucho Reyes. Ahora de la ensenaré: es un gallo. De ahí salieron el magenta y el azul turquesa.” (Barragan and Riggen 2000: 133)
[25] Reference to: “Barragán made his work a source for experimentation, changing colours as the work developed as a painter would do. It was therefore the result of experiences that determined the colours and also their alterations as a function of surroundings and interplay of light and shadow, location and other influences so that the ‘colour compositions’, as he named his work, are always complex, depend on the surface material as well as neighbouring ones that may reflect or absorb the light.” (Durão 2012: 8).

deals with the 'interactions', Durão explains; he was greatly influenced by Joseph Albers's work [26].

Barragán's house and studio, considered his masterpiece, is an echo of all his 'ideals' and 'visions'; it is the materialization of his 'principles'. The house blends naturally with its surroundings, the exterior is a simple concrete wall, transforming the experience into an inward experience rather than an exterior one. In the interior, each room fulfils its own purpose and 'perceptual' objectives, flooded with its own colours and atmosphere. Most of the rooms on the ground floor are open to a quiet garden, allowing for the colours of nature (the greens and the blues) to become part of the interior too, mostly painted in yellows , reds, and pinks. Barragán's work is both 'emotive' and 'spiritual': "Mathias Goeritz considered the work of Barragán 'emotive' and the spiritual values above all function and aesthetics, (…)." (Durão 2012: 11). To achieve this, and to 'integrate the body in physical and metaphysical dimensions' he used the energy of colour, bringing serenity for 'the body and spirit'[27].

Spiritual Atmospheres = Emotion + Colour = Body + Spirit

Ending remarks

Art is understood as a creation that possesses its own 'spiritual qualities' and emotional meanings through its being. With a reference to the work of Alain de Botton (2013) and Louis Armstrong (2013), the 'functions' of art as an emotional tool was clarified as well as its correlation to the use of colour originally defined by the intentions of the artist in the creative process stage. The authors, as well as Pallasmaa (2011), clarified the 'idealizing nature' of art, as a mirror of an 'inner world' and an 'emotive' and 'valuable' state of existence.

Colour, thus was analysed in a twofold way: firstly as meaning and significance in itself, and secondly as a 'vital' tool to the definition of 'meaning' and significance; firstly as an essence than contains emotion and secondly as being emotion in itself. A reference to the studies of Faber Birren (1970) was conducted, in order to clarify 'colour' as a 'meaning' in itself, and its links to the creative expression of painting, as a way to clarify the different types of 'colour' methods that can be applied such as those of colour contrast and colour harmony. Colour meaning was also clarified with reference to the works of Wassily Kandinsky (1977) where he explains colour as an expression of an interiority, of the 'vibrations of the soul'.

[26] On these Colour Interactions, she further clarifies: "Althought Alberti and Leonardo had reported the effect of simultaneous contrast, Chevreul first formulated the theory in 1804 and explains different kinds of contrasts and interactions. Yet it is Albers who probably inspired Barragán mostly and went as far as making a copy of Alber's paintings." (Durão 2012: 9).

[27] Reference to: "Barragán knew there is an inherent energy in colour and that it is colour that forces the character of something to reveal itself and so he used it in all its extent to unify cultures and integrate the body in its physical and metaphysical dimensions as to seek for a possible serenity for the body and the spirit." (Durão 2012: 14).

Throughout the studies, it was understood that the Impression (visual impact), the Expression (emotional impact) and the Construction (symbolical understanding), become coincidental. Through the use of colour as meaning, as an emotional tool, the artwork or the atmosphere constructed is apprehended and understood as a cohesive whole, blurring the lines between the visual, the emotional and the symbolical perceptive understanding. The atmosphere becomes a lived experience, containing in itself from the early stages of creation, from the very beginning of its origin in the artist's mind, the seeds that grants it its own specific emotive existence and its own spiritual qualities.

Finally, to clarify colour as a 'vital' tool to the definition of 'meaning' and significance as an emotional spirituality, the research continued with a reference to the works of Luis Barragan (2000) that uses 'colour' freely as a painter and creates atmospheres endowed with emotions of contemplation, meditation and spirituality, his own idealizing objective.

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Color And Cladding For A New Reclamation-Architecture

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Abstract

The approach to the landscape's project can be included in the concept of valorization and requalification of the natural and built environment. This can be through study, design and use of materials, processes and technical solutions related to the color and its application. In this context, closely linked to the landscape's perception and its interaction with the user through the senses, the operations that can be planned for the development and qualification of environment and landscape of a particular area can take advantage of the knowledge of bright and colorful materials.

Inside the huge area of the design and landscape enhancement are taking special interest the valorization of the areas where built the reclamation-systems inside the Venetian plain and extending to the neighboring provinces of Trentino and Friuli.

In a recent research carried out at the University IUAV of Venice in cooperation with Reclamation Consortiums of these territories have emerged needs to valorization and requalification of the reclamation systems. Among them there are: hydraulic supports, pumping stations, water towers, etc.. built after World War II. The reclamation systems made in this age can be seen in the landscape plants as like as functional systems. They are without any design approach from the point of view of design and technology. Often these systems will degrade the quality of the landscape.

The Directors of the reclamation consortiums were asked to me to write the guidelines for improve the design of the reclamation architecture to valorize the surrounding landscape. This can be done with an innovative low environmental impact, where the priority is given to the appearance, visibility and perception of the artifacts and the environmental quality.

The paper will report the progress of this first research approach in which the theme of the color will be addressed with particular regard to the treatment of the surfaces with innovative coatings (paints, panels, smart materials).

Above all, it will be dealt with the issue of valorization of landscapes with bright and color technology by low environmental impact. This research will be done with the aim of achieving concepts: sustainability, reversibility, usability, security, visibility.

Keywords: color, landscape, smart materials, reclaiming-architecture.

Reclamation Architecture (*)

In the last century, the reclamation of the Veneto region has been a very profitable business from the economic and social development point of view. It has been a profitable business thanks to the expansion of agriculture on the drained areas of the swamps and because there were built many drainage systems which were designed to ensure public safety from flooding. This activity also had a very important role for the development of reclamation tools and technologies. For example, have developed systems for hoisting of water, for the construction of large reclamation collectors and for the realization of the related reclamation constructions (Bixio, [1992]).

The land reclamation of the Veneto swamps was crucial to properly address the floods that occurred in the past two centuries, for the defense of the inhabited territory (Bixio, Tosini [1989]).The operations of drainage of flooded districts have been made stemming the leaks created by the flood with the means available at the time. The operations were conducted with the contribution of Reclamation Consortia who have restored the damaged construction. The activities carried out by the Reclamation Consortia of the Veneto have made an extended heritage of hydraulic construction, spread over vast areas. Now the Veneto region has a hydraulic network that extends for thousands kilometers and which includes hydraulic constructions of considerable complexity and value, among which in particular the constructions for the water pumps.

For the purposes of the current research, reclamations constructions can be classified into broad categories that identify the functions of the plant: such as pumping stations, hydraulic supports (Fig. 1), the water towers (fig. 2) and small artifacts for the protection of control panels for hydraulic supports, located along the banks of the canals. Within these categories are included the most representative buildings such as the historical institutional headquarters (Fig. 3) or contemporary (fig. 4), and the artifacts that surround the pumping stations (Fig. 5).

Fig. 1 – Hydraulic Support of "Ponte Rosso" place, 1970 (photo © A.Piva)

The "pumping station" is a technological system equipped with a particular mechanical device adapted to move large quantities of fluids from a lower level to a higher one in a given time, in order to extract renewable energy without large energy consumption for the functioning of the hydraulic system (Jones [2008:42]).

Fig. 2 – Water Tower, Ponton place, Domegliara (Vr) (photo © K.Gasparini)

Fig. 3 – Cà Vendramin pumping station, 1900-1905, now houses of the Reclamation Regional Museum (photo www.fondazionecavendramin.it)

The research, still in progress in partnership with Unione Veneta Bonifiche, came by some remarks of some members of the Associazione Triveneta Dirigenti della Bonifica. The engineers have realized the great difference that exists between the architectural design of structures built in their territories (Veneto) and projects of contemporary artifacts built in

other European countries, with innovative technologies and materials. In a special way, have emerged the different approaches and the different identity of design of the artifacts built in Italy in the first half of the twentieth century, compared to those built after World War II to the present.

Fig. 4 – New headquarthers of Consorzio di Bonifica Veronese, 2011 (photo © K.Gasparini)

Fig. 5 – Small pumping stations contemporary building, Castelnuovo del Garda, VR (photo © A.Piva)

For example see pictures in Fig. 3-6-7. These photos illustrate the implantation of Cà Vendramin, now become museum of Reclamation and headquarters of the same Foundation. The other is the plant called Chiusa di Ceraino (Sciorne taking) situated in Rivoli Veronese, on the Adige Valley, which is still active.

Both artifacts are characterized by the modularity and proportion of the facades, the historical style, the modularity of the windows, the texture of the facade and the use of materials (size, texture, laying etc..) such as brickwork and stone.

The colors of the landscape and the architecture of the reclamation of the early twentieth century are the colors of natural materials, essentially, locally available: red brick, white or pinkish stone, black or gray paint of the mechanical equipment of the plant: the facilities of the first industrial era when the mechanisms were produced into unique pieces in iron casting (fig. 7).

Fig.6 – Chiusa di Ceraino, Rivoli Veronese, VR. Cladding system in pinkish stone, with different textures, iron frames with glass panels such as "cathedral" with blue inserts. The floodgates are made of metal rusty reddish in color. The original floodgates were made of wood. (foto © K.Gasparini)

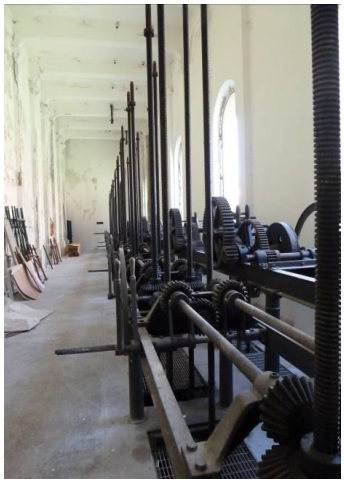

Fig.7 – Chiusa di Ceraino. Focus on the plants originating in iron casting: in the white color of the wall paint the emerging the color of black paint and rusty metal (foto © K.Gasparini)

Looking at the artifacts built in the second half of the Twentieth Century is possible to observe an "involution" in design, especially as regards the representative buildings and the "containers" of pumping stations (fig.5).

Currently the artifacts are treated as anonymous building envelopes, without a specific design study and identity: it lacks the design proportions, the architectural project, the integration and dialogue with the natural landscape, the study of the materials and the design of the cladding. Artifacts are built on a rectangular plan, the outer walls are rough plastered or painted with white paint, the roof is built with tiles or corrugated metal plates of gray colour, with two pitched. Also the area on which the artifacts insist, identified in parking areas, maneuvering, processing areas or buffer zones are not covered by the project.

It should be noted, finally, the lack of a culture of environmental quality.

Reclamations Architecture on the international scene: color, innovation and cladding (**)

The case studies selected were categorized into two types: the artifacts for pumping stations and bridges. The category of bridges has been chosen by analogy with the "hydraulic supports" and the hydraulic structures that are placed on the irrigation canals, since one of the objectives of this research is to draw up guidelines for the enhancement of color and light of these artifacts. There is currently no design approach in this regard. The only type of construction that could be used for an approach in this direction seemed the category of bridges.

Hydropower plants and pumping stations that were analyzed are distributed largely in the European region and specifically in the Nordic countries (Germany, Netherlands), some plant is located in England and one in Spain, one in Italy, South Tyrol, a few cases in the United States or in the East. This spatial analysis showed a different approach to the cladding of the artifacts, to the texture and colors.

As a general rule, for the construction of the envelope of these artifacts are almost always used dry building techniques, with steel structures and glass cladding, metal or wood. In some cases, the walls are made from cast concrete. In this situation, therefore, the color that identifies the artifact and the place remains light gray with smooth surface.

As for example, the hydroelectric power plant in Kempten (Germany) designed by Becker Architekten, built on the left bank of the river Iller. The sinuous shape of the building and the area on which it stands, similar in some respects to certain architectures designed by Zaha Hadid, is characterized by its light gray almost luminous concrete surfaces that emerge from the context of industrial archeology identified by the colors of the materials of tradition: brown, reddish, black.

On the contrary, in the hydroelectric plant of Valdoies, Bolzano, the small building is made of smoothed white concrete panels, interspersed with real cleaved surfaces covered with transparent glass. The clear glass let see the light and the color of the interior at night.

Then, in general, when the wet construction technique is linked to contemporary tradition is always to use the material in its original size, free from cladding and colors, which is concrete.

A different approach is used in the Anglo-Saxon countries where emerges a widespread use of the steel frame and clear glass panels.

So it would seem that the concept of this region is linked to transparency, to the concept of the window and the showcasing that characterized the turning point of the modern era marked by the construction of the Crystal Palace in London, the "big window".

In projects such *London Olimpyc* by John Lyall Architect or in the pumping station of St Germain (fig. 8) the systems are exposed. The building envelope is only a transparent limit in a dialogue with the landscape, without damaging it, visually disappearing during the day between the reflections of the surrounding environment.

At night the lighting system highlights the existence of the building and exhibits to the place a symbol of the post-industrial era. In this region it seems that the project is still affected by the influence of the industrial revolution and the styles of certain currents of thought that characterized the modern movement.

The Nordic countries, Germany and the Netherlands for the most part, are relying more on the color of natural or artificial materials and on opaque textures. There are very few interventions that rely on the dematerialization of glass.

In this regard, a remarkable intervention is the artifact built in Cologne, the Flood Water Pumping Station designed by Kaspar Kraemer (2008). The building, consisting of a metal grill and glass façade, is illuminated within by a LED system with variable color according to the water level of the river. When the water level is normal the light is white, when the water is at alert level it turns red. The light is projected on the transparent walls of the building that becomes a landmark on the river, but also a sign of security for the city.

Other interventions disseminated in Germany and the Netherlands are characterized by metallic claddings. In this case, the goal is always to integrate, with different approaches, the building in the natural or man-made context. Sometimes it has been used an aluminum cladding in gray colour or mirror-treated stainless steel in urban centers. In both cases, the color and surface treatment adapt the building to the gray colors of the city and of the asphalt. The mirrored treatment reverberates the surrounding environment and making the building completely disappear. When the artifact is located within a natural environment then the cladding adapts itself and tries to integrate it visually. Here the colors are the ones of burnished corten steel, green roofs or wooden slats.

Fig.8 –St German pumping station, London (photo © A.Piva)

Conclusions (*)

From the analysis summarized here emerges a highly innovative approach to new artifacts for the reclamation, in an international context, in which the project and the technology adapt to both new building techniques and new materials, and to the consequent problems of management and maintenance of the same and, above all, to the landscape.

The water system in Italy seems designed for itself, it does not interact with its surroundings, there is no attention to the project, just to the functionality of the machine. In the European culture, there is a greater focus and collaboration between the skills involved in the project and greater environmental sensibility. In addition to dry building techniques, materials that are adopted are aimed to integrate the artifact with the environment, imitating the colors, but with contemporary technologies.

There remains the problem of the interventions on the existing constructions, to enhance and redevelop those artifacts disseminated in the lowlands and Italian landscapes that have a poor dialogue with the context, and often they disfigure it.

In these cases we are analyzing various assumptions, for example non-invasive interventions, low cost, made with paint or adhesive coatings that exploit the chromatic potential of these materials to redevelop sites. They can also be photo luminescent or dichroic paints or lighting interventions on historical buildings to enhance their presence and identify an area with landscape law bonds.

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Fractal Objects and Probabilistic Color Distribution in Architecture

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Abstract

With the publication, in 1975, of *Les objects fractals: Forme hasard et dimension*, Benoît Mandelbrot created the foundations of a new geometry that, since then, played a crucial role in the way how natural shapes can be perceived and described.

Free from the strict understanding of form and space, as defined by its Cartesian dimensions, or strictly based on Euclid's postulates and common notions, this new geometry provides new languages, new concepts, new techniques and, above all new instruments of reflection.

With the research we started for our PhD thesis, through the design of specific algorithms, written in AutoLISP, under the AutoCAD environment, where probabilistic colour distribution characteristics were introduced, this relatively new geometry continues to exhibit its potentiality, and ability, to generate objects with very interesting features that can be used in architecture, as well as in design.

Introduction

For architecture, geometry is measure, is concept and is, above all, order. Since it is an activity that reflects on the problems of form and space, architecture is naturally linked to geometry, pursuing, on the one hand, its ideal shapes and, on the other, institutionalizing it as a system of representation and justification of the architectural shapes.

Yet, geometry hasn't stayed a static and immutable area of knowledge. Along with other sciences, such as physics, geometry, particularly in the last hundred years, has been extending its horizon as the result of the development of new theories, like relativity, quantum physics, non-linear dynamics and chaos, providing architecture with new instruments of reflection, new languages, concepts, methods and techniques, fundamentally based on the development of informatics.

Supported by the principle that simple rules can generate very complex results, it is, then, legitimate to question about if is it possible, using the concepts and techniques related to fractal geometry, along with the introduction of color distribution characteristics, to create coherent integration instruments of the composition elements of architecture.

Mandelbrot´s geometry

In *The fractal geometry of nature* [1], Benoît Mandelbrot, refering to the inability of Euclidian geometry to describe the irregular shapes produced by Nature, invokes a new way of seeing the surrounding world.

From the study of some mathematicians´s work like Besicovish, Bolzano, Cantor, Cesàro, Hausdorf, Koch, Lebesgue, Levi, Osgood, Peano and Sierpińsky, and with the help of computers, Mandelbrot understood the richness and importance of patterns and techniques common to the work of these mathematicians and created the foundations of a new geometry able to describe many of the irregular and fragmented patterns that surround us.

In 1975 [2], this new geometry was coined *fractal geometry. Only a* few years later, Falconer [3, 4] gave a clear definition of fractal object:

> *When we refer to a set F as a fractal, therefore, we will typically have the following in mind:*
> *(i) F has a fine structure, i.e. detail on arbitrarily small scales.*
> *(ii) F is too irregular to be described in traditional geometrical language, both locally and globally.*
> *(iii) Often F has some form of self-similarity, perhaps approximate or statistical.*
> *(iv) Usually, the 'fractal dimension' of F (defined in some way) is greater than its topological dimension.*
> - *In most cases of interest F is defined in a very simple way, perhaps recursively.*

Fractal objects, self-similarity and I.F.S.

One of the most recognizable attributes of a certain class of fractal objects lies in their recursive character, i.e., in the fact that they are generated by an infinite repetition of a same rule over the result of a previous operation where this same rule has already been applied, fig. 1.

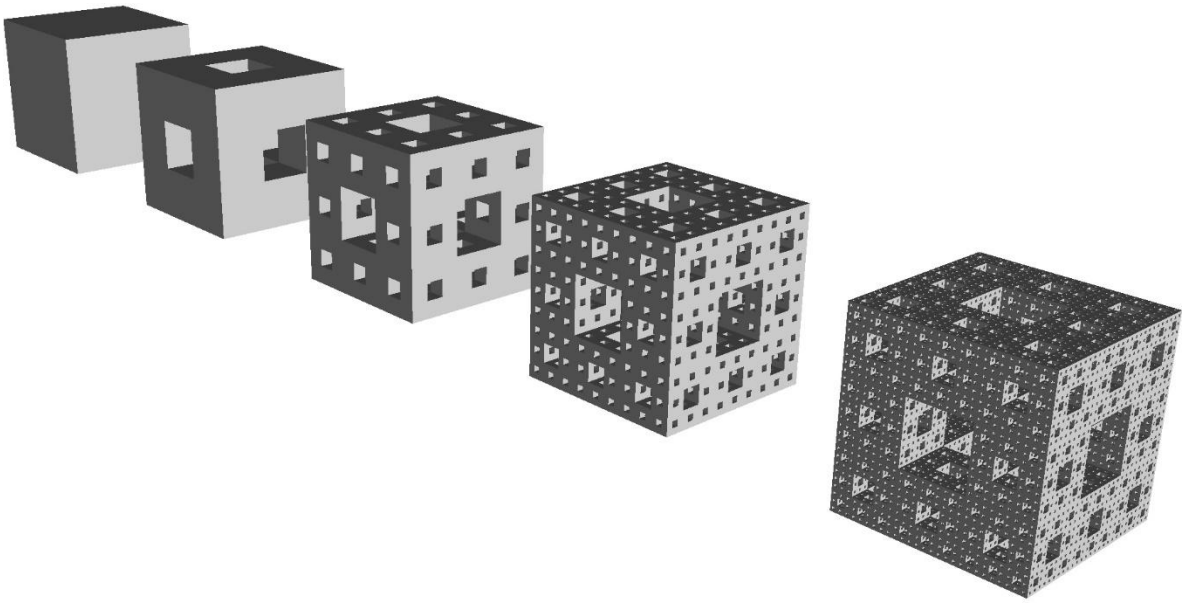

Figure 1. 1st four iterations of a Menger sponge progression.

As a consequence of this recursive character, emerges *self-similarity*, another important characteristic of fractal objects. This characteristic refers to a class of objects that, in the whole or partially, strictly, fig.2 (left), or statistically, fig.2 (right), are composed by parts that are similar to the entire set.

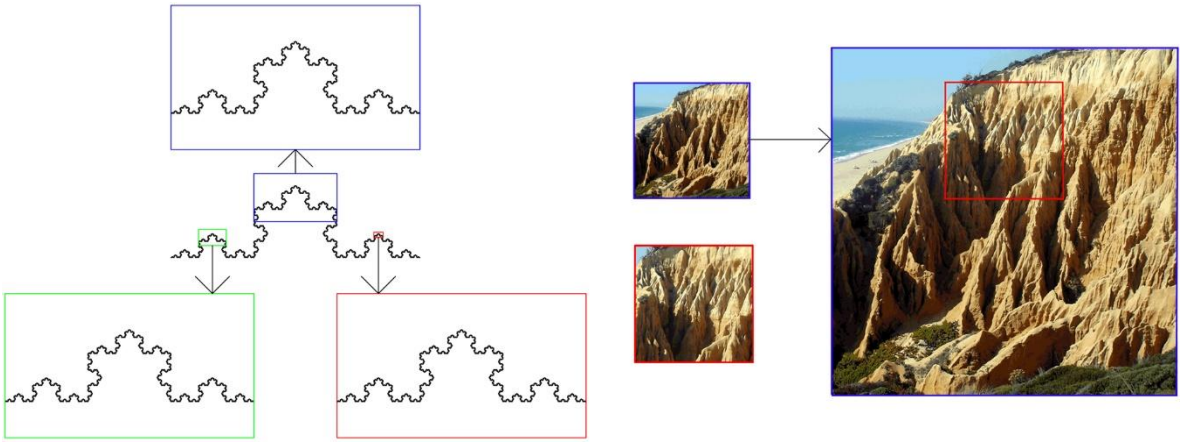

Figure 2. Strict self-similarity on a Koch curve (left) and statistical self-similarity on a natural fractal (right).

This characteristic evokes an iterative process of objects generation named *Iterated Function System*, or *I.F.S.*.

This process starts with an *initiator*, in many cases a segment of a straight line, and a *generator* composed by a predefined number of reduced copies of the initiator, submitted to a predefined order. A specific *rule* determines how the initiator is replaced by the generator and how, in any iteration, each segment is replaced by reduced copies of the generator, also giving their respective orientations, if, and when, applicable, fig. 3.

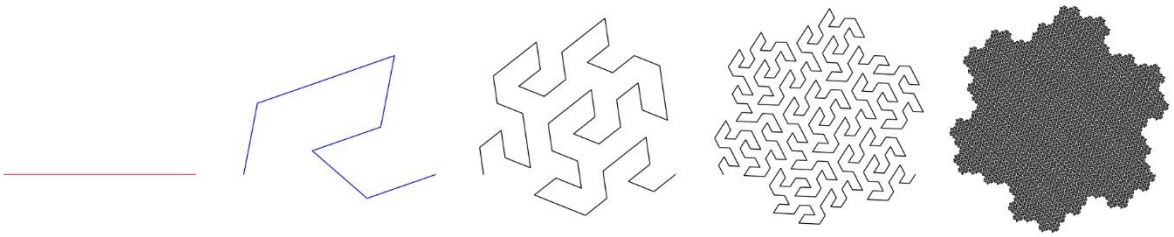

Figure 3. 1st four iterations of a Gosper curve, revealing the initiator, in red, and the generator, in blue.

Fractal geometry and architecture

Starting with a deterministic object, the *Menger sponge*, and ending with a probabilistic one, these new instruments were presented by stages where, in the final stage, using the AutoCAD´s 255 colors palette, we introduced probabilistic color distribution characteristics to the algorithm, where, from a single color to an interval of 255 colors, a large variety of

sequences are available.

Later, in a project for a house in the southern region of Portugal, the Algarve, we started to explore the use of these same concepts in architecture, using a two iterated fractal approximation object, based on a probabilistic colored fractal cube but with altered edge proportions. With this first approach we intended to demonstrate that fractal geometry, through the use of fractals along with the introduction of probabilistic color distribution characteristics, can be an integrating tool of architecture composition elements, giving them a coherent unity, creating new encouraging mechanisms of reflection about these issues.

Fractal geometry and its connection to chaos theory can, through the application of some of its concepts, establish a new paradigm of complexity in architecture, as well as in design, as a valid and dynamic operative tool, able to define and generate new models, new shapes and to establish new languages within which color communicates.

A few characteristics of fractal geometry, like the repetition of a same base shape at several scales, have been used in architecture throughout history and among many different cultures, from Asia, to Europe and to Africa5 [6].

Before the theorization of this geometry, such characteristics were used in an intuitive way. Only after the publication of Mandelbrot's first book on fractal geometry [2] we can declare the intentional use of fractal characteristics in architecture.

The work of Peter Eisenman on the Cannaregio Town Square project [7], Daniel Liebskind on the Victoria & Albert Museum extension [8], Steven Holl on the Woningbouwvereniging Het Oosten building [9] or Ashton Raggatt McDougall on the RMIT Storey Hall [10] are, among others, good examples of the intentional use of fractal characteristics and of fractal objects in architecture.

Thus, if in the first examples, fractal characteristics related to the shape repetition of some building elements at different scales were used, these contemporary architects also made use of fractal objects, like the *Menger sponge* [9], or even fractal patterns, like the *Penrose fractal* [10], to generate architectural forms or surface pavements.

With the research we started for our PhD thesis [11] new instruments that enable the effective utilisation of concepts directly connected to fractal geometry were presented through the implementation of specific algorithms written in AutoLISP, under the powerful AutoCAD environment, both developed by Audodesk, and working as an automatic shape generator tool with probabilistic color distribution characteristics.

Starting with a deterministic object, the *Menger sponge* (fig. 1) and supported by the idea that simple rules can generate infinitely complex structures and behaviors [2], these new instruments were presented by stages, from the understanding of how to write the specific deterministic fractal algorithm, to the introduction of multiple probabilistic characteristics.

If in a second stage, the introduction of probabilistic characteristics was carried out over this object's generative process, and according to its original rule, i.e. maintaining the proportions of its components, fig 4 (left), in a third stage, changes were introduced in its relative proportions in order to obtain a new object featuring more complex and dynamical characteristics, fig. 4 (right).

In a final stage, using the AutoCAD´s 256 colors palette, we introduced probabilistic color distribution characteristics to the last version of the algorithm, fig.5, where a large variety of color sequences is available, starting on a single color and ending on a maximum interval of 255 colors.

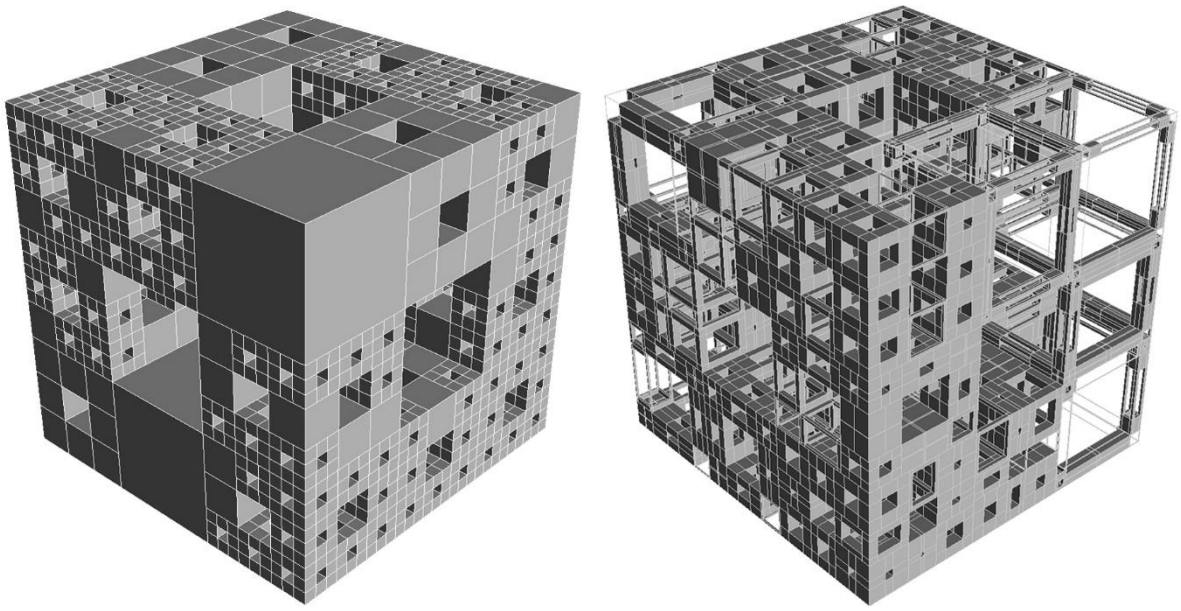

Figure 4. 3rd iteration of a probabilistic Menger sponge (left) and of a probabilistic cubic sponge (right).

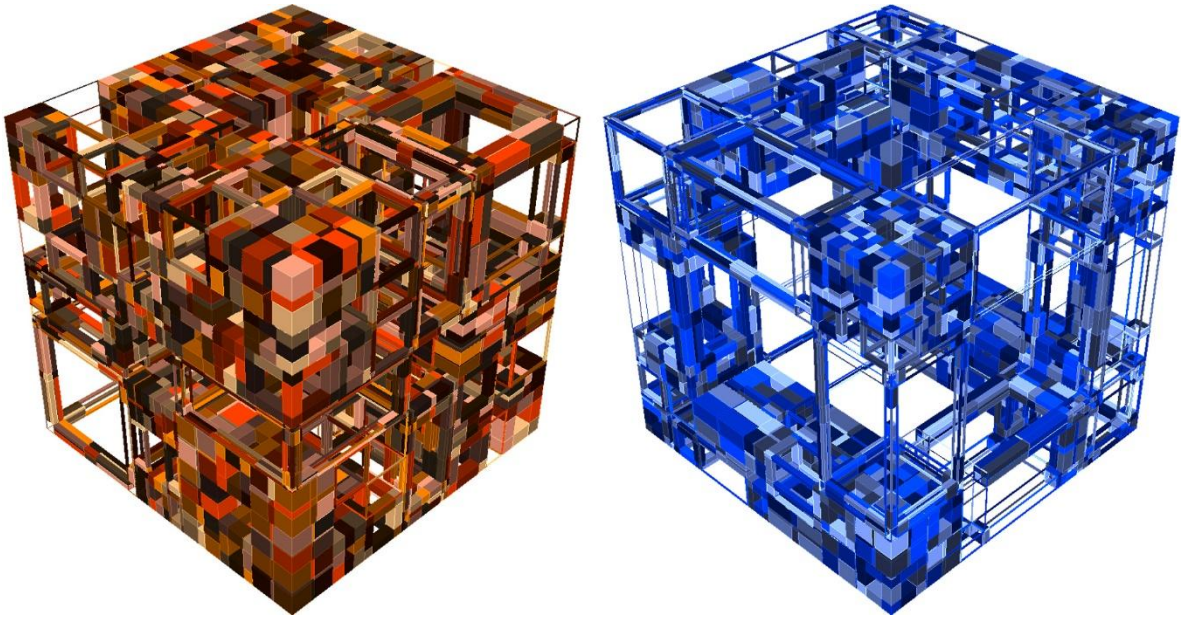

Figure 5. 3rd iteration of two different color probabilistic distribituion cubic sponges.

However, and due to the complexity of the instructions and symbols used on all these objects definition, the present paper is far from being a complete presentation of the way how these algorithms were written under the AutoLISP programming language. Nevertheless, it is important to understand some basic features and the generative mechanism invariants there used, somewhat similar to the one we presented with the example for the I.F.S. generative process, fig. 1.

Linear fractal objects are usually drawn using *turtle graphics*. This method of programming vector graphics makes use of a relative cursor, named turtle, embedded in a three dimensional Cartesian coordinate system where a dimensional unit and two angles define the turtle position in the Cartesian space.

In these conditions, the turtle can perform four basic functions:

(i) Draw a one unit lengthen line and update the turtle's position (F – forward).

(ii) Go ahead one unit without drawing (G – go).

(iii) Rotate to the left or to the right by the first angle, in the 2D plane (+ or -).

(iv) Rotate to up or to down by the second angle, the *elevation angle* (/ or \).

If we use a von Koch snow flake as an example, fig.6, we have the axiom (F (- 120.0) F (- 120.0) F), corresponding to the drawing of an equilateral triangle, and the set of rules '((F F (+ 60.0) F (- 120.0) F (+ 60.0) F)), corresponding to the set of segments that will replace each side of the triangle to obtain the first level of this object generation and every resulting segments of the subsequent levels of this infinite generative process.

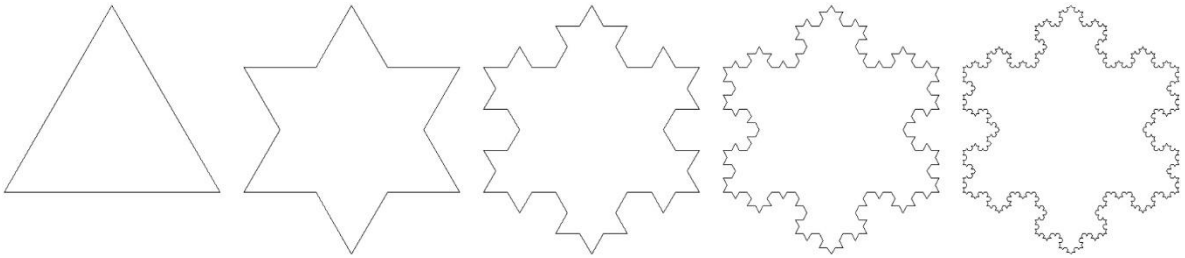

Figure 6: 1st four iterations of a von Koch snow flake.

In this specific case, the set of rules has one single rule where *F* is an instruction, an operator, which acts also as a symbol for substitutions, and *(+ 60.0)*, or *(- 120,00)*, are rotation instructions, exclusively processed by the turtle graphics drawing part of the algorithm.

However, the turtle graphics interpreter was extended to support a wide range of other features, including stacks and mesh drawing, used to define the three objects presented in fig. 4 and fig. 5. This way, specific algorithms had to be written to define them. Nevertheless, and in a way or in the other, these algorithms are always composed by an axiom and a list of rules, whose complexity depends on the specific characteristics of each object.

In the case of the deterministic Menger sponge presented in fig. 1, it was geometrically defined by the faces of each cubic component, using the algorith (fractal '(K) and '((K (@ I 3) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K] G (+ 90) (/ 90) G (\ 90) [K] G G [K] (+ 90) G G [(- 90) K] (+ 90) G G [(- 180) K] (+ 90) G G (+ 90) (/ 90) G (\ 90) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K]) ((K D) M[[G (+ 90) M[[G (+ 90) M[[G (+ 90) M[[G (/ 90) G M[ ] (/ 90) G M[ ] (/ 90) G M[ ] (/ 90) G M[ ] (MD (7 6 4 5)) (MD (6 5 0 1)) (MD (7 6 3 0)) (MD (7 4 3 2)) (MD (5 4 1 2)) (MD (3 2 0 1)) M]])) l) to write the list of rules that define the object.

From this list of rules, (fractal '(K) is the axiom and the rest o the algorithm(K (@ I 3) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K] G (+ 90) (/ 90) G (\ 90) [K] G G [K] (+ 90) G G [(- 90) K] (+ 90) G G [(- 180) K] (+ 90) G G (+ 90) (/ 90) G (\ 90) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K]) ((K D) [F (+ 90) [F (+ 90) [F (+ 90) [F (/ 90) F] (/ 90) F] (/ 90) F] (/ 90) F] (> Z 1) (# 0) (~ 0) F (+ 90) F (+ 90) F (+ 90) F)) is the list used to construct the entire object.

(K (@ I 3) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K] G (+ 90) (/ 90) G (\ 90) [K] G G [K] (+ 90) G G [(- 90) K] (+ 90) G G [(- 180) K] (+ 90) G G (+ 90) (/ 90) G (\ 90) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K]), is the initial position of the cubic components to be represented, in *Drawing Time*, by AutoCAD.

((K D) M[[G (+ 90) M[[G (+ 90) M[[G (+ 90) M[[G (/ 90) G M[ ] (/ 90) G M[ ] (/ 90) G M[ ] (/ 90) G M[ ] (MD (7 6 4 5)) (MD (6 5 0 1)) (MD (7 6 3 0)) (MD (7 4 3 2)) (MD (5 4 1 2)) (MD (3 2 0 1)) M]])) is the graphic representation process of the object in *Drawing Time* where each set of four numbers represents the face construction sequence for each component, fig 7.

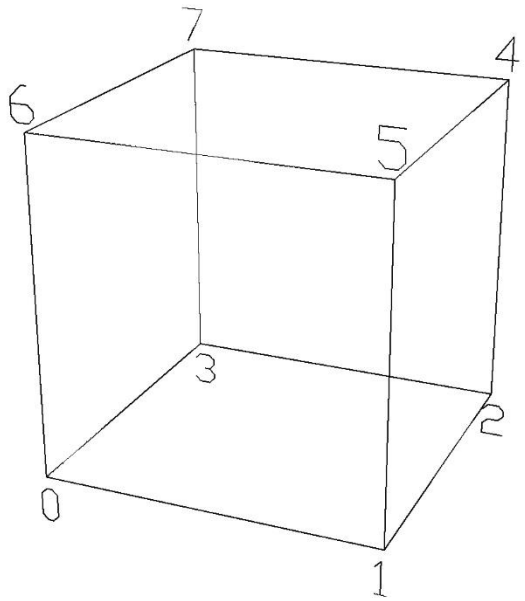

Figure 7. Scheme used for positioning the faces of each Menger sponge cubic component.

From there, in order to define objects with probabilistic features, fig. 4, two totally different approaches were used, the first, based on the deterministic Menger sponge algorithm, where the components are defined by its respective faces, and the second, based on the direct definition of its polyhedral components.

In the first case, the algorithm (fractal '(K) and '(((K E < (u1 1) 0.5) (@ I 3) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(- 90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K] G (+ 90) (/ 90) G (\ 90) [K] G G [K] (+ 90) G G [(- 90) K] (+ 90) G G [(- 180) K] (+ 90) G G (+ 90) (/ 90) G (\ 90) [K] G [K] G [K] (+ 90) G [(- 90) K] G [(-

90) K] (+ 90) G [(- 180) K] G [(- 180) K] (+ 90) G [(- 270) K]) (K K) ((K D) M[[G (+ 90) M[[G (+ 90) M[[G (+ 90) M[[G (/ 90) G M[ ] (/ 90) G M[ ] (/ 90) G M[ ] (/ 90) G M[ ] (MD (7 6 4 5)) (MD (6 5 0 1)) (MD (7 6 3 0)) (MD (7 4 3 2)) (MD (5 4 1 2)) (MD (3 2 0 1)) M]])) l) is very identical to the one used to generate the Menger sponge but the addition, inside the set of rules, of (K E < (u1 1) 0.5), introduces its probabilistic characteristics.

In the second case, the algorith (fractal '((E setq dx 1.0 dy 1.0 dz 1.0 tunit 1000000.0) CUBE) and '((CUBE (E setq q (u3 1)) (E setq rx (/ (* (- 1 q) dx) 2) ry (/ (* (- 1 q) dy) 2) rz (/ (* (- 1 q) dz) 2) dx (* q dx) dy (* q dy) dz (* q dz)) PUSH [(E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (E setq dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (E setq dx rx dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+Y ry) (+Y dy) (E setq dy ry dz rz) CUBE RESTR ^ (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+Y ry) (E setq dx rx dz rz) CUBE RESTR] (+Z rz) [(E setq dx rx dy ry) CUBE RESTR ^ (+X rx) (+X dx) (E setq dx rx dy ry) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (+Y dy) (E setq dx rx dy ry) CUBE RESTR ^ (+Y ry) (+Y dy) (E setq dx rx dy ry) CUBE RESTR] (+Z dz) [(E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (E setq dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (E setq dx rx dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+Y ry) (+Y dy) (E setq dy ry dz rz) CUBE RESTR ^ (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE POP] (+Y ry) (E setq dx rx dz rz) CUBE) (PUSH D) (E tupush dx) (E tupush dy) (E tupush dz) (E tupush q) (E tupush rx) (E tupush ry) (E tupush rz)) ((POP D) (E setq rz (tupop)) (E setq ry (tupop)) (E setq rx (tupop)) (E setq q (tupop)) (E setq dz (tupop)) (E setq dy (tupop)) (E setq dx (tupop))) ((RESTR D) (E setq rz (turest 0)) (E setq ry (turest 1)) (E setq rx (turest 2)) (E setq q (turest 3)) (E setq dz (turest 4)) (E setq dy (turest 5)) (E setq dx (turest 6))) ((CUBE D) (E tqbx dx dy dz)) (PUSH PUSH) (POP POP) (RESTR RESTR)) l) was used to write the list of rules that define this kind of objects.

From this list of rules,(fractal '((E setq dx 1.0 dy 1.0 dz 1.0 tunit 1000000.0) CUBE) is the axiom and the rest of the algorithm is the list of rules used to construct the entire object.

Still from this list, ((POP D) (E setq rz (tupop)) (E setq ry (tupop)) (E setq rx (tupop)) (E setq q (tupop)) (E setq dz (tupop)) (E setq dy (tupop)) (E setq dx (tupop))) ((RESTR D) (E setq rz (turest 0)) (E setq ry (turest 1)) (E setq rx (turest 2)) (E setq q (turest 3)) (E setq dz (turest 4)) (E setq dy (turest 5)) (E setq dx (turest 6))) ((CUBE D) (E tqbx dx dy dz)) is the graphic representation process of the object, equivalent to the *Drawing Time* representation process used in the two previous sponge algorithms, and (PUSH PUSH) (POP POP) (RESTR RESTR) is a refreshing rule.

Finally, in a last version, the third version presenting probabilistic features and the second defining the set of componentes by polyhedrons, we introduced a new and very important functionality associated with the insertion of color on the surface of the object´s components. This insertion refers to the list of 255 available standard colors in the AutoCAD Color Index, A.C.I., palette, fig. 8.

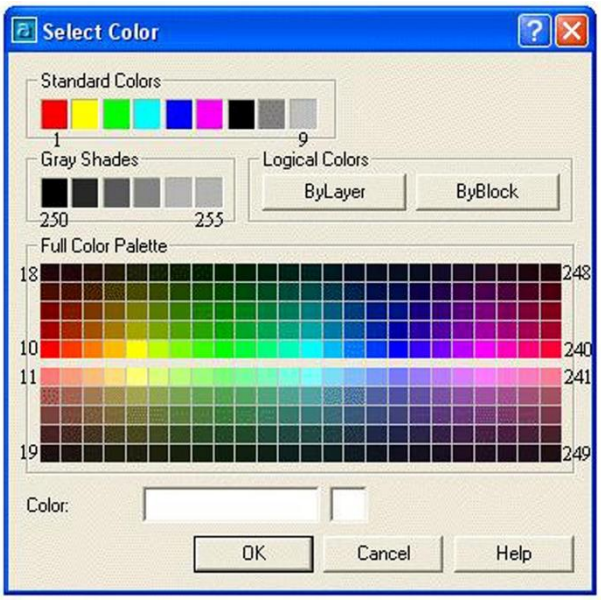

Figure 8. AutoCAD Color Index window chowing its 255 available standard color palette.

In this final case, the algorith (fractal '((E setq dx 1.0 dy 1.0 dz 1.0 tunit 1000000.0) CUBE) and '((CUBE (E setq q (u3 1)) (E setq rx (/ (* (- 1 q) dx) 2) ry (/ (* (- 1 q) dy) 2) rz (/ (* (- 1 q) dz) 2) dx (* q dx) dy (* q dy) dz (* q dz)) PUSH [(E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (E setq dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (E setq dx rx dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+Y ry) (+Y dy) (E setq dy ry dz rz) CUBE RESTR ^ (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+Y ry) (E setq dx rx dz rz) CUBE RESTR] (+Z rz) [(E setq dx rx dy ry) CUBE RESTR ^ (+X rx) (+X dx) (E setq dx rx dy ry) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (+Y dy) (E setq dx rx dy ry) CUBE RESTR ^ (+Y ry) (+Y dy) (E setq dx rx dy ry) CUBE RESTR] (+Z dz) [(E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (E setq dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (E setq dx rx dz rz) CUBE RESTR ^ (+X rx) (+X dx) (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE RESTR ^ (+X rx) (+Y ry) (+Y dy) (E setq dy ry dz rz) CUBE RESTR ^ (+Y ry) (+Y dy) (E setq dx rx dy ry dz rz) CUBE POP] (+Y ry) (E setq dx rx dz rz) CUBE) ((PUSH D) (E tupush dx) (E tupush dy) (E tupush dz) (E tupush q) (E tupush rx) (E tupush ry) (E tupush rz)) ((POP D) (E setq rz (tupop)) (E setq ry (tupop)) (E setq rx (tupop)) (E setq q (tupop)) (E setq dz (tupop)) (E setq dy (tupop)) (E setq dx (tupop))) ((RESTR D) (E setq rz (turest 0)) (E setq ry (turest 1)) (E setq rx (turest 2)) (E setq q (turest 3)) (E setq dz (turest 4)) (E setq dy (turest 5)) (E setq dx (turest 6))) ((CUBE D) (E tcol (itoa (+ (fix (u1 15)) 20))) (E tqbx dx dy dz)) (PUSH PUSH) (POP POP) (RESTR RESTR)) l)) was used to write the list of rules that define the new kind of objects.

This algorithm is very similar to the one used in the previous version but, with the introduction of (E tcol (itoa (+ (fix (u1 15)) 20) inside the part of the algorithm dedicated to the graphic representation process, color distribution characteristics were introduced.

The color insertion on the object components surface is possible according to diferent color intervals, ranging from one unique color to a maximum interval of 255 colors,

enabling the possibility to define how many and which set of colors can be probabilistically inserted on the surface of the entire set of components everytime a new object is generated.

In all the presented cases, the sponge construction sequence is identical, fig. 9.

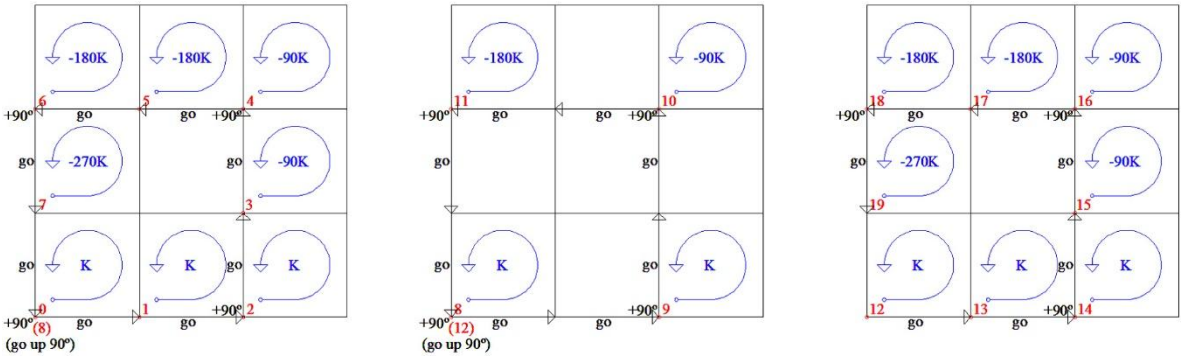

Figure 9. *The three levels of a probabilistic sponge generation sequence (from left to right).*

A first approach to further applications

Although we are convinced that these concepts, and techniques, can be used in a more extensive way, from the city scale to a small daily object, in a project for a house in Corotelo, in the southern region of Portugal, the Algarve, we started to explore the use of these same concepts, not yet in a global object scale but in two different building walls, using a two iterated fractal approximation object based on the probabilistic colored sponge, fig. 5, but with altered edge proportions, fig. 10 and fig. 11.

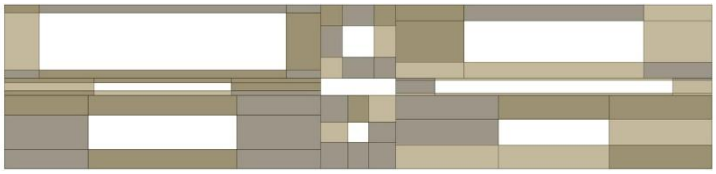

Figure 10. 2D conceptual fractal approximation used in a project for a house in Corotelo.

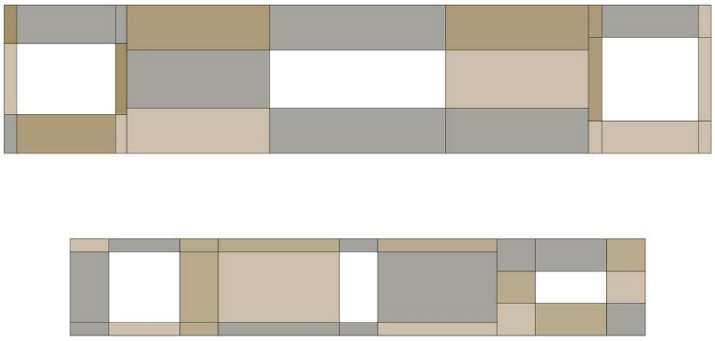

Figure 11. Sections of two 2D fractal approximations used in a project for a house in Corotelo.

The two main parts are the North elevation, fig. 12 and a parallel inside wall that connects the East to the West facade, turned into a 14,45 meters wide window placed on the South elevation, fig.13 and fig. 14.

Both are relatively extensive elements, the first, being a twenty two meters long facade, the other an almost eighteen meters long inside wall, either of them with very few openings.

Anyway, and not taking in consideration the reasons to use the presented language, neither considering the future location and the surrounding environment of this unbegun building, with this first approach we intended to demonstrate that fractal geometry, through the use of fractal approximations along with the introduction of probabilistic color distribution characteristics, can be an integrating tool of architecture´s composition elements, giving them a coherent unity.

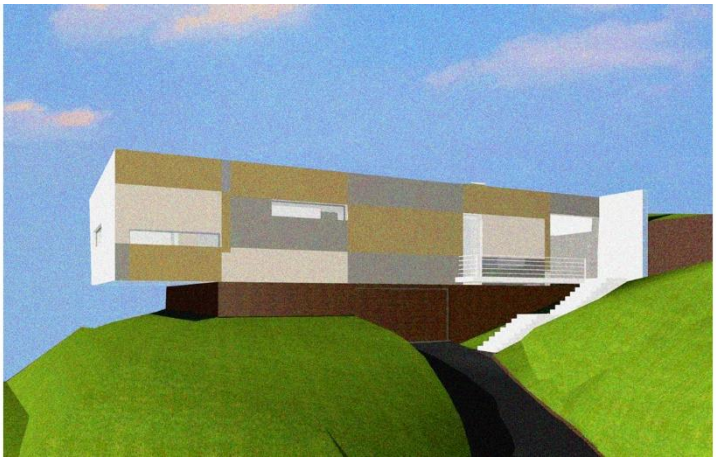

Figure 12. Digital model of a project for a house in Corotelo, Algarve (North side).

Figure 13. Digital model of a project for a house in Corotelo, Algarve (South and East side).

Figure 14. Digital model detail of a project for a house in Corotelo, Algarve (South side).

Conclusions

To the questions raised by complexity and by a family of patterns, many of them natural, that standard Euclidian geometry wasn't prepared to describe, Mandelbrot answered with the creation of a geometry that, introducing a few concepts like self-similarity and non-integer dimension, extended Euclidian geometry's ability to describe and generate such kind of patterns showing its potentiality to be implemented in many different fields of science.

From the point of view of its application in architecture, creating new instruments doesn't infer the intentionality to find universal solutions or recipes for solving the integration of architecture elements or other composition issues. The main intention of this research was to create new encouraging mechanisms of reflection about these two aspects.

Fractal geometry and its connection to chaos theory can, through the application of some of its concepts, establish a new paradigm of complexity in architecture as a dynamic operative instrument able to define and generate new models and new ways of perceiving form and space in architecture.

Exploring the self-similarity concept, allied to Iterated Function System generative mechanisms, enables a new approach to the architecture language and to the integration of its elements from the point of view of composition.

Consequently, and from the point of view of conscious and intentional use of such concepts, we intended to demonstrate that architecture can use a large set of possible fractal geometry applications and that, once again, they can constitute dynamic and valid tools to create new shapes, establishing new languages, where the problems of unity between the compositional elements and its connection to the issues raised by complexity have a coherent and effective answer.

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Colours For a Sustainable Innovation in Architecture: Materials, Technologies, Products

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Abstract

When we should consider the colour of a building a sustainable feature? In the contemporary architecture old and new materials, technologies and products are complying to the new rules of sustainability by providing the architectural project the means to adapt to the new challenges of contemporary innovation. Of course colour seems to play a strategic role in this scenario adapting to the choices of the different points of view, sometimes ideological, of contemporary architecture.

The paper wants to sum up the results of a recent research conducted among the "Eterotopie" Research Group by the author with the precious contribution of V. Brustolon, A. Dehò, C. Gregoris, A. Martini, P. Zennaro and K. Gasparini. The researchers, dealing with various specialism, studied the use of colour of 12 families of materials, technologies and products with the aim to assess their real impact on the environment and the possible solutions based on a scientific and rational approach. The colours of architectural materials, technologies and products can change over time by aging and the surrounding environment is very important for choosing the colour of a building. For this reason, a specific methodology of research aimed to analyze the entire life cycle of the colours of the architectural materials and products (LCA) has been chosen. The paper summarizes these specific contributions with the aim of providing a descriptive overview of the state of the art and the possible future evolutions.

1. Introduction

In most of the researches that are focused on the environmental sustainability of buildings colour is often overshadowed. As we well know, however, colour plays a strategic role not only from an expressive point of view, but also in the control of the internal and external environmental quality of buildings and also for their micro-climate. Indeed, we can think about the colour of the surfaces of the building as a tool for the integration with landscape and for the environmental quality or as a tool for controlling the heating of the surfaces irradiated by the sunlight. This survey carried out within Eterotopie Research Centre, a spin-off of the Research Unit "Colour and Light in Architecture" of Iuav University of Venice, tried to go further.

The research started with a question that we probably could define very complex: when innovation in architecture can be considered sustainable?

First of all it is necessary to clarify that the term innovation here is focused on materials, technologies and products used in contemporary constructions. Trying to give an answer to this question, we decided to consider the entire life cycle of twelve large families of materials, technologies and products, without neglecting some of the lessons from the past of the art of building. The analysis of the entire life cycle of products or processes (Life Cycle Assessment), often known by the acronym LCA, is regulated by ISO 14040, 14041 etc. Applied to materials, products or technologies it allows us to get an overall view of their impact on the environment from the moment you extract the raw materials up to the "end of life" which may result in the disposal, reuse, recycling, incineration, and so on. But colour what does this have to do with all these things?

Obviously materials, technology and products have a strategic role when they characterize the external walls of buildings. Each "family" of materials is characterized by a more or less extended colour range: maybe the colour range of plants or wooden surfaces will likely be smaller compared to the infinite possibilities of paints and plastic surfaces. Every surface, exposed to the weather, is then subject to a decay that has different times in relation to the materials and technologies that are used. Therefore, also the colour fastness (for example for textile) becomes a very important aspect. But, when we should consider "sustainable" the color of a building?

To assess the sustainability of a material or a product we must be aware of the period in which it fails to provide the maximum of its performance and their decay all over the years. In this sense the colour fastness can be an indicator of the health status of the material. When we deal with colour, however, this aspect cannot be separated from broader evaluations that frame the colour of architectural surfaces in a relationship of harmony or contrast with the surrounding environment. Basically it means we consider colour as a design tool to achieve certain effects that influence the perception of the building in its context. The colour of architectural surfaces will be more "sustainable" when it will succeed in time to keep or positively change the relationships with the environment so that the project idea will keep its full effectiveness.

In order to simplify the synthesis of the research we propose a reading that separates, at least virtually, the so-called “natural materials (or naturalized) from the artificial ones that dominate the contemporary world of construction” (Zennaro 2000 [2000: 92]), knowing well that this distinction is now very unstable given the continuous hybridization starring the various materials used in buildings and the related technologies. In this paper we propose a synthesis of the results obtained from this research in relation to “the chromatic aspects of materials, products and technologies analyzed by the authors of the research: A. Premier, V. Brustolon, A. Dehò, C. Gregoris, A. Martini, P. Zennaro and K. Gasparini” (Premier 2014 [2014: 5]).

2. Natural And Naturalized Materials

Among the first materials used in construction certainly we find those most easily found in nature which needed a relatively small number of processes: wood, stone and even clay.

As it is well known, wood and stone have a very important tradition in architecture: it seems useless to enumerate the countless number of buildings that were built, from the ancient world to the present, with the technologies related to these materials. “Clay was used mainly in vernacular construction” (Bertagnin 1999 [1999: 14]). The term *naturalization* means “to realize the process of human elements and procedures existing in nature in addition to the techniques acquired by man and used in the action of urbanization” (Cetica 2003 [2003: 20]). It means a natural camouflage or ecological make-up which sometimes becomes "ornamental hypertrophy to hide the otherness of the architectural object" (Repishti 2008 [2008: 34]) which is well identified with the term *green architecture*. Term that contains the name of the green colour inside. Among them, examples of recent architecture such as the green walls built by Jean Nouvel and Patrick Blanc for the Quai Branly Museum in Paris (2006) or the "vertical forest" by Stefano Boeri in Milan.

2.1 Clay

Green building and certain ideological sectors of the construction industry are supporting the recovery of certain traditions of the past such as those related to the use of clay. The colour palette on the earthen buildings, now mostly made with compressed blocks or rammed earth, is closely linked to the colours of the materials available on the construction site. The colours of the rammed earth, rich in clay and aggregates, range from gray to beige to red ochre. These surfaces are subject to erosion and weathering of time, so to preserve the original appearance of the building as long as possible they need strong projections of roofs to limit the negative action of the rain. Surfaces are often "naked", sometimes covered with plaster made of lime or earth. In the latter case the colour may vary from what is listed above. Today, the clay, the aggregates and the fibres of the dough can be integrated with smart materials (phase change materials) which can improve the performance of the thermal insulation of walls. However, they are not going to affect the colour of the material. In addition to these innovative aspects, the critical aspect of these buildings seems to be the necessary maintenance during their operative life. Researches on LCA we have analyzed seem to indicate high maintenance costs that affect embodied energy throughout the life cycle of the product. The maintenance of the exterior colour is one of these problems.

2.2 Vegetation

The vegetation as a wall cladding for buildings, once conceived almost exclusively as roof garden or climbing plants (ivy, jasmine, etc..), it is now identifiable in green roofs or green walls.

Despite Le Corbusier’s *toit-terrasse*, the green of the vegetation, the main colour of green architecture, comes back in buildings after the birth of the slums, the poorer suburbs of the globalized world, where the people try to recreate in their own terrace that portion of green that concrete and asphalt have took away. “In the vision of green people find a new psycho-physical well-being” (Blanc 2008 [2008: 86]): at least this is what is claimed by the botanist Patrick Blanc in explaining the birth of his idea of vertical garden. In these technological solutions green grows in harsh conditions with little earth (extensive green roof) or even on pockets of felt attached to PVC panels fed through a system of artificial

irrigation. Green proliferates as it can, but to keep alive its colour, which is closely linked to its health, it requires constant maintenance. This is demonstrated by many contemporary architectures where the colour of the surfaces is affected by the presence of water: not only the green must be taken care of in order to proliferate the best, but also the other surfaces should be kept clean and maintained. For example, the metal surfaces may soon have the colour of the oxidation or even corrosion. The decay of vegetation, if not constantly maintained, seems to undermine the whole building that becomes yellow, corrode and lose the basic features of the original design. So many doubts remain about the alleged benefits of green vegetation in architectural surfaces especially as regards the cost of maintenance of manufactured products covered by these "new" technologies.

2.3 Wood

As we all know wood was one of the first materials used by man to build shelters. Today it remains one of the most popular materials used in the construction industry even though in many applications it has been replaced by artificial materials. Timber is conceived as a renewable resource, therefore, in certain sectors of contemporary building it is seen as a highly sustainable material. However it is essential to take into account the importance of constant replacement of cut trees (forestry) and do not forget the devastating exploitation of this resource in our more remote past. Exploitation that has led to the complete conversion of entire regions and their climate (e.g. the entire southern Italy deforested by the Romans after the Punic Wars).

Wood is a highly expressive material: the colour range includes, among others, "the yellow honey of fir, the gray stone of the oak, the copper black of chestnut, the light red of cherry, the ivory white of pear, the velvety black of ebony" (Natterer, Herzog, Volz, 1991 [1998: 10]). Wood is well preserved when protected inside the buildings. It has a relatively rapid decay when exposed to the weather. Rough fir, for example, has a yellow colour that soon takes on a gray colour. In the worst conditions it rots and therefore it must be treated with resins and varnishes. Also in this case the maintenance must be performed providing the periodic repainting of the artefact at more or less constant distances. Exotic woods, generally denser and darker, longer retain their colour. In this case, however, attention should be paid to the origin of the raw material that must take into account the conservation of rainforests. As part of the LCA the use of timber, its colours and its treatment have to be evaluated from time to time in relation to the context in which the building is placed. It should not be forgotten what it is most important: wooden architecture belongs to the tradition of some places (alpine ones for example) but not to others (urban centres). Wood will be used in contexts where its use is part of the local culture. In this sense, the colours of the wooden architectural surfaces become sustainable only when used in the appropriate places.

2.4 Stone

Stone is the material of eternity. The Pyramid of Cheops, built entirely of stone, was completed approximately in 2,560 BCE. The stone has many variations in colour, from white to black, there are stones of any colour and shade. Today stone is essentially a

cladding material. To save the resource, that is exhaustible, we use slabs of increasingly small thicknesses, sometimes a few millimetres glued on a metal or fibre-reinforced support. Its use cannot be separated from the preservation of the areas from which it is extracted (quarries), remembering that for certain applications whole mountains have been dismantled. Some stones are consumed over time, others remain almost unchanged. The colour fastness is threatened primarily by air pollution. The dark dust is deposited on porous surfaces of some stones that need to be thoroughly cleaned to return to their original condition. Today we might consider more "sustainable" stone surfaces designed to be self-cleaning and therefore require virtually no maintenance. As it is for clay, the traditional use of stone is linked to the availability of on-site material. Therefore, the more sustainable colours will be those of the typical stones of the place where the building is placed (there is a link to the local culture yet). In Italy, for example, many regions are characterized by the presence of stones with typical colours.

3. Artificial Materials

The term artificial, from Latin *artificialis* comes from *artificium*: obtained with art, as opposed to what is by nature. The colour of artificial materials thus derives from one or more transformations brought by man. Among the materials here we define artificial there are colours that may arise from the nature of the base component, or colours obtained by several processes. Ceramic tiles are often glazed and then coated with protective vitreous base of any colour; the colour of conglomerates derived from the base material prevalent in the dough; metals may have a detectable colour in nature or a colour obtained by different processes; glass may be translucent, transparent or coloured; textile materials, composites, and smart materials have the most disparate colours obtained by the use of the endless chromatic ranges of synthetic pigments and lighting systems. These are the materials in which research and refinement of techniques related to the provision of the colour appearance have a strategic role.

3.1 Ceramic materials

Ceramic materials in buildings are used since ancient times: bricks, ceramic tiles, etc. Their colour can derive from the clay used and from the level of cooking (temperatures reached, cooking time, number of firings, etc.). For example, the bricks used in Italy have a reddish colour while those of the Nordic countries have a colour tending to black (clinker bricks). Ceramic tiles can be glazed getting any colour. The current production techniques are the evolution of the traditional ones: today with the use of metal oxides and other components we can obtain mirror finishes, dichroic finishes and other finishes not achievable in the past. The current materials can be installed with dry or wet techniques that allow a good durability of the products. The excellent state of preservation of some artefacts of the past (you may think for example to the Ishtar Gate built in 575 BCE) demonstrates its effectiveness in many environmental conditions. The raw materials used seem to be inexhaustible, e.g. at least for the next hundred years.

Since ceramics are also traditional materials, often linked to certain places (e.g. in certain regions of Spain), it seems important for the sustainability of the intervention to

produce a chromatic study and analysis of the colours of the place in order to harmonize the most possible those of the project.

3.2 Binders

Among the application fields of the binders the most interesting one is probably concrete. The binder used in concrete is cement, a component obtained by the reduction of powdered rock materials. Concrete will last for approximately one hundred years. Its base colour, light gray, can vary over time due to pollution, dirt, mould and erosion to which it is subject. For added protection from the elements special paints may be used. Today we have a lot of innovations in colour related to this widely used material: aerated concrete, fibre reinforced concrete, translucent concrete, light concrete, stamped concrete, photo-etched concrete and so on. The research is moving towards a progressive increase of recycled materials in the production of the binder "because the production of the binder seems to generate the greatest environmental impact" (Lemay 2011 [2011: 3]). In any case, in order to preserve it efficiently over time, even concrete must be periodically cleaned, checked and possibly patched or repainted if necessary. The use of concrete is now widespread in all cultures. Crucially, its grey colour. Grey is the colour that characterizes most of the anthropic environments of our globalized world: the gray of the suburbs, slums etc. Although in many situations we cannot avoid by the use of concrete a meditation on the use of gray colour and the influence of this material on this so important phenomenon is needed.

3.3 Metals

For nearly one hundred years metals are used, in addition to roofing, on facade claddings. As it is well known, the colour of metals can vary in time due to the phenomenon known as oxidation. Some materials may even completely degrade due to corrosion (e.g., cor-ten steel may be consumed when used in too thin slabs). In metals, perhaps more than in other materials, the colour is a direct symptom of their state of "health". The oxidized copper, green in colour, can last for over a hundred years; zinc alloys remain almost unchanged over time in their light gray colour; steel oxidizes to red rust; "stainless steel instead has a durability that can exceed one hundred years without maintenance" (Premier 2012 [2012: 93]). Today, through processes of artificial oxidation we can get multiple colours (as well as those we may find in nature) of the alloys of copper and zinc. Stainless steel and aluminium can be electro-coloured for interference. Steel and aluminium can be painted with dichroic and iridescent paints. The most important issue is, as always, the design of the building and the correct choice of materials for the context in which it is inserted. Context and design features lead to a greater or lesser sustainability of the intervention: choice of recycled material (most of aluminium today comes from recycling); colour and surface treatment to prevent glare and overheating of the surrounding environment; design of the cladding system to avoid problems of comfort.

3.4 Glass

Glass is considered to be the material of transparency and translucency. Glass is also the material of continuity between inside and outside (see for example many architectures of

Mies van der Rohe). Glass is also a surface full of reflections of the surrounding environment. Such as metals or ceramics, glass can be coloured with any other colour: by dough or by means of films and coatings with various pigments, metal oxides or other. Glass can change colour through the use of specific chemicals in double-glazing and turn also into an opaque material. If it is not damaged or scratched, glass can be almost eternal and can be recycled with relative ease. Glass is one of the most significant contemporary materials. Glass can be used to dematerialize the building envelope. The use of glass and its colours, today, seems strategic in relation to this specific goal.

3.5 Plastics

Plastics are "camouflage materials such as Woody Allen's Zelig character" (Manzini 1986 [1986: 66]) famously mentioned by Ezio Manzini. They adapt to any shape and have an almost inexhaustible range of colours. The prevailing derivation from petroleum has relegated them, for a long time, among the symbols of the environmental pollution. A material that will last a long time if released into the environment. Today, most of the plastics have probably the highest degree of recyclability and reuse capabilities. Their fusion requires, contrary to metals, relatively low temperatures.

One of the main factors of degradation of polymeric materials is the photo-oxidation (yellowing due to UV exposure that occurs normally in PVC, polystyrene and in many other materials) and "which can be braked by the introduction of antioxidants, UV absorbers or external protection" (Magnus 1988 [1988: 34]). Plexiglas ® (PMMA) instead retains for a long time the original colour and the original degree of transparency so that many companies offer a 30 year warranty on the product.

Plastics can be considered highly sustainable materials from the point of view of their durability and recyclability. From the point of view of colour we should analyze the colour durability of the single product. The extremely wide range of colours instead requires a very careful study of the chromatic harmonies or contrasts with the surrounding environment that will result, from time to time, from the goals of the project.

3.6 Textile materials

When we talk about fabrics, colour plays a central role. In architecture fabrics have a decorative and protective function (sun shadings, awnings, curtains, membranes and facade claddings). Colour fastness has always been an important issue for the fabrics used outside the buildings, forced to suffer the negative effects of weathering and pollution. Currently we have technical fabrics made of synthetic fibres that meet high technical and quality requirements (mechanical and thermal performance, durability etc.). Polyester, PVC, glass fibre, metal wires etc. are guaranteed for more than twenty years of lasting colour and with micro-perforated screen you can get excellent relationships between matte surface shielding, privacy and permeability of sight. Furthermore, fabrics can be integrated with other technologies such as photovoltaic, LED and other light devices. The durability of the textile materials must be related to their use in the low-cost ephemeral constructions (shields, marquees, pavilions, etc.) where the cost of the intervention and the possibility of dismantling and quickly moving, make these technological solutions (and thus colours) sustainable. In an ephemeral textile structure with a scheduled duration, we can use highly saturated colours or contrasts sharply with the surrounding environment, since the

intervention will modify the context for a very limited time. For structures whose expected duration is longer (for example, the Millennium Dome in London) white colour is preferred, not only to take advantage of the filtering natural light, but also to absorb as much as possible the impact on the chromatic context.

3.7 Composite materials

Composite materials are one of the leading solutions in the research for highly sustainable products. These are products that employ mostly recycled materials, combined together to exploit the best performance of the individual components. They are high performance and durable materials (think, for example about Corian® and polymer matrix composites or certain ceramic matrix composites). Obviously in this case, the availability of colours is virtually unlimited and the tightness of the colour over time is specially designed to offer security guarantees. In multilayer composites (e.g. Alucobond® or honeycomb stone panels) the durability of the cladding, and then the colour itself is instead entrusted to the characteristics of the outer surface (metal, stone etc.). As for other contemporary materials the chromatic sustainability of the intervention depends on the relationships that the building has with its environment. In this regard, the reader is invited to refer to other research works developed by this group. One of the most easy reading can involve the analysis of "chromatic contrasts" (Itten 1961 [1961: 33]) or chromatic chords produced by the surfaces and the surrounding environment. As noted in the introduction such choices depend on the goals of the project: mimesis with the environment, strong contrast, shock effect, and so on.

3.8 Smart materials

Smart materials and smart technologies are probably the outcomes of cutting edge research in innovation in the field of materials and products for the construction industry. They are mainly designed to consume very little energy in their use (e.g. shape memory alloys or shape memory polymer), to reduce the consumption of certain technical elements (e.g. phase change materials), or even to produce energy (e.g. photovoltaic). As in many previous cases, the colour rendering of these materials is variable. "If you introduce materials that change colour (photo-chromic, thermo-chromic etc.) and some lighting technologies, the colour range reaches millions of colours" (Gasparini 2012 [2012: 151]). While these materials can provide high performance solutions (dynamic sun shadings systems, coatings with high insulation etc.) on the other hand, given the recent introduction on the market, we cannot have reliable data on their relative durability and colour fastness. Therefore, their use should be calibrated according to specific needs, taking into account the maximum yield that can give you a good time defined by the project. With regard to the chromatic integration with the context (and thus the chromatic sustainability of the intervention) various colour relationships that exist between the elements of the building envelope and the possible variants (artificial lighting, movement of components etc ...) should be analyzed, taking into account the many possible goals of the project: colour-light enhancement of the building, creating a *Landmark*, mimesis, dematerialization of the building envelope etc.

4. Conclusions

From the situation that emerges from this reading, we may say that the colour of materials, products and technologies used in contemporary architecture is probably one of the most effective parameters for assessing the sustainability of an intervention. The colour, however, can not only be a test of the state of health of a material or a product (colour fastness, aging, durability...) as it emerges from the data on the LCA analysis. The sustainability of colour (and materials) cannot be separated by the project as a whole and it is intimately linked to cultural factors (location, traditions, etc.). This seems to be true especially for the traditional materials (wood, clay, stone, wall paintings, etc.). For what concerns materials and innovative technologies more complex factors are involved (changing colours, dynamic surfaces, lighting technologies etc.). For this reason a more complex study of the colour relationships that the building establishes with the context is needed: contrast, harmony, shock, dematerialization etc. Maybe, colour will be much more sustainable as it will be able to provide the benefits for which it was designed. A planned useful life (e.g. ephemeral architecture) could help to better understand the chromatic effects on the environment of the contemporary artefacts and calibrate accordingly the use of these technologies in order to bring the least impact to the environment.

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Guide for Maintaining the Color of Plants on a Green-wall

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Abstract

The modern city which rapid urbanization has taken place has neglected the environment element of nature and resulted in a lack of green space. Consequently, interest on increased on artificial ground greening that is able to effectively ensure green land, and the interest for Green-wall in particular is increasing even more, as it is spatially efficient and gives a great visual impact by ensuring the insufficient green space vertically. Seoul Metropolitan Government which is the capital of Korea, has newly built an eco-friendly building, Eco Plaza which is a maximization of nature energy utilization, and created a massive vertical garden Green-wall at the indoors. Green-wall, the vertical garden of Eco Plaza, is not a Green-wall for ensuring simply ensuring green land, but it has various meanings and functions as a design Green-wall using the colors expressed by the plant itself. The color has been arranged by using green, the basic color of plants, pink and red those are the colors of flowers and fruits, and plants should be well grown for the Green-wall color design of these color plans to be maintained. Temperature and humidity is very important in order to maintain an environment which plants can grow well, and a difference of temperature and humidity is expected between the internal temperature and humidity controlled by big buildings and the Green-wall surface where actual plants are implanted. Thus, this research is to compare the temperature and humidity difference between the central control room of Eco Plaza and the surface of the Green-wall, analyze the change of growth status of the plants by this, and propose management plants suitable for the growth environment of each of the plants able to sustain the plant color plan of the Green-wall. The data measured at the central control room, and automatically measuring temperature/humidity meters were installed on the 1st floor with a large floating population and on the terrace of the 5th floor where a lot of business takes place, and the daily peak value, the lowest value and the average were found, and the temperature and humidity differences by zones were analyzed. As the result, the humidity at the central control rooms of the 1st and the 5th floor showed a very big difference and the growth status of the plants of the interior Green-wall without any appropriate humidity control during July to September became very poor. Through this study, it could be known that a separated management system was necessary which is able to control and measure the temperature and humidity from many different places in order to well maintain the intrinsic colors of the plants, as there is a difference in temperature and humidity between inside of the building and the surface of the Green-wall.

1. Introduction

Due to the growth and development of cities, vulnerability of natural environment elements and lack of green space is being raised as a problem (Bongho Han, 2014). Thus, the local governments are striving to improve the problems mentioned above (Eunjin Park, 2012), Seoul, the capital of Korea and the largest local government at the same time, has solved the urbanization problem by constructing Eco Plaza in the year 2012 which was an eco-friendly building which maximized the utilization of natural energy and ensuring spaces through constructing a massive indoor vertical garden, Green-wall, and attempted to give practical helps to improve the quality of lives of the citizens such as stabilizing mind and body by nature space, providing resting areas, improving aesthetic values of surrounding space (Soobong Kim, 2012).

The Green-wall, the vertical garden of Eco Plaza, is not a green wall simply for ensuring a green area, but it is a color planned design green wall that improves the work efficiency of the civil servants of Seoul and provides a resting area for the citizens and tourists by utilizing the colors expressed by the plants themselves (City and Forest, 2012)., and the colors of the Green-wall should be maintained to enable the sustainability of the colors. In humid conditions like in summer, the growth environment of plants should be well considered to maintain the colors of the plants as they are likely to become brown or die (Jaemyun Byun, 2002), thus, it is important to create a suitable interior environment for the plant growth as the indoor green space is an artificial environment (Hobong Bae, 2006). In particular, for the case of Eco Plaza where there is a large floating population with a massive vertical garden Green wall created, it is necessary to check the temperature and humidity difference data between the temperature and humidity at the inside and that of the green wall surface, in order to maintain the growth condition of the plant.

Therefore, this study has analyzed the difference of the temperature and humidity of the inside of the Green-wall of Eco Plaza and that of the green wall surface, and proposed the management guidelines by analyzing the change of plant growth status by this.

2. Method

2.1 Investigation on the target land

In year 2010, Seoul Metropolitan City has established an energy saving government office (Eco Plaza) which was acknowledged as the highest energy efficiency class, Class 1 (City and Forest, 2012). Eco Plaza which most of its inner walls are made of glass to enable the incoming of natural light and exploit the most of photovoltaic energy, is designed to allow the growth of plants throughout the whole year even in winter seasons by using the greenhouse effect. The Green-wall of 1~7 storey height created inside the Eco Plaza has not only secured the interior green space but also highlighted its design side by using the colors those give the greatest visual effects. The color design concept of the Green-wall of the Eco Plaza, as the waves implying the harmony of environmental change and flow of history, it allowed to appreciate the harmonious and dynamically color planned Green-wall throughout the all 4 seasons by considering the White series of the inside of the building and the Green series of the basic color of plants harmoniously arranged while considering the brightness and contrast possessed by the plants and the seasons which flowers bloom

and fruits are borne (Figure 1, 2)

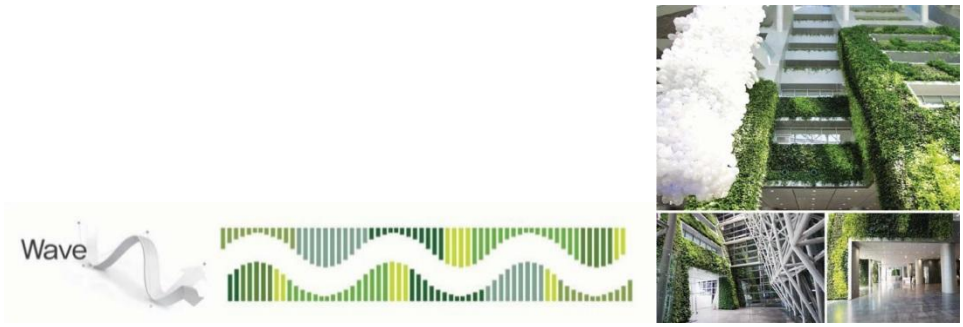

Figure 1. Construction color of White series and the color combination of the Green-Wall of Green series of the inside of Eco Plaza

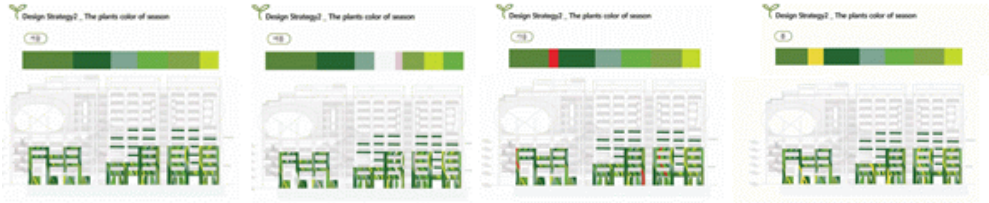

Figure 2. Eco Plaza Green-wall Color Plan by 4 Seasons

2.2 Investigation of the growth environment

In order to verify the temperature and humidity change between the Eco Plaza Green-wall planting surface and the inside of the building and analyze the growth condition change of the plants by this, the temperature and humidity data from 17th July, 2013 to 17th February, 2014 was collected and analyzed. The temperature and humidity meter of the planting surface of the Green-wall was installed on the 1st floor which was expected to have a big change of temperature and humidity due to a lot of floating population, and in the 5th floor terrace of the green space outside the office (Figure 3). BS1920 of Bientron with the automatic measurement and saving function was used for the temperature and humidity meter. The temperature and humidity data automatically measured at the central control room of Eco Plaza and the temperature and humidity data collected at the planting surface of the Green-wall was analyzed at the highest and lowest points of temperature and humidity of the day.

Figure 3. BS1920 installed on 1st and 5th floors.

3. Results And Discussion

By analyzing the temperature and humidity data measure at Eco Plaza, there was difference of temperature and humidity between the internal temperature and humidity measured at the central control room and that measured at the green wall surface. Especially, there was a big difference in humidity, and the humidity was measured to be 3~70(%) higher on the 1st floor compared to the central control room. Although the 5th floor showed lower value in overall than the 1st floor, some months showed more than 50(%) difference compared to the central control room (table 1)(Figure 4). Although, the temperature difference was mere compared to the central control room, the difference with the 1st floor was approximately 1~4(℃). Moreover, the difference was larger in the lowest point than in the highest point (Table 2, Figure 5).

Table 1. Monthly average humidity of the inside of Eco Plaza and the green wall surface

	Central control		1Floor		5Floor	
	High	Low	High	Low	High	Low
7	29.39	27.58	90.05	80.85	79.25	63.57
8	33.56	30.21	86.86	76.47	75.30	56.04
9	28.86	25.46	75.83	57.48	64.34	45.54
10	25.84	21.37	70.27	49.27	56.07	35.91
11	21.21	16.57	57.97	43.93	43.20	27.54
12	18.67	13.22	41.28	36.74	29.25	24.40
1	16.81	12.50	19.77	10.81	11.72	8.18
2	18.37	13.69	30.56	20.85	21.70	13.89

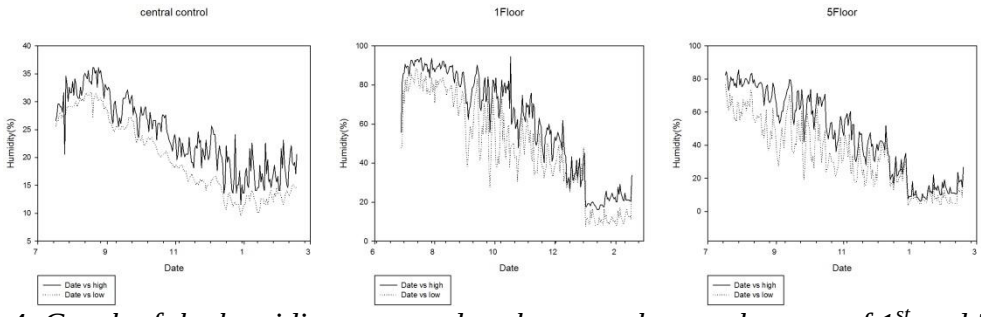

Figure 4. Graph of the humidity measured at the central control rooms of 1st and 5th floors of Eco Plaza

Table 2. Monthly average temperature of the inside of Eco Plaza and the green wall surface

	Central control		1Floor		5Floor	
	High	Low	High	Low	High	Low
7	29.76	27.08	25.72	24.67	28.69	26.64
8	33.57	30.09	26.80	25.30	31.25	27.72
9	28.83	25.50	24.99	21.32	28.20	23.60
10	25.84	21.37	21.27	17.57	26.44	20.12
11	21.21	16.57	18.06	15.26	24.637	17.80
12	18.67	13.22	15.16	10.63	18.47	12.64
1	16.81	12.50	13.81	9.50	16.72	11.50
2	18.23	13.63	17.10	13.33	19.93	14.75

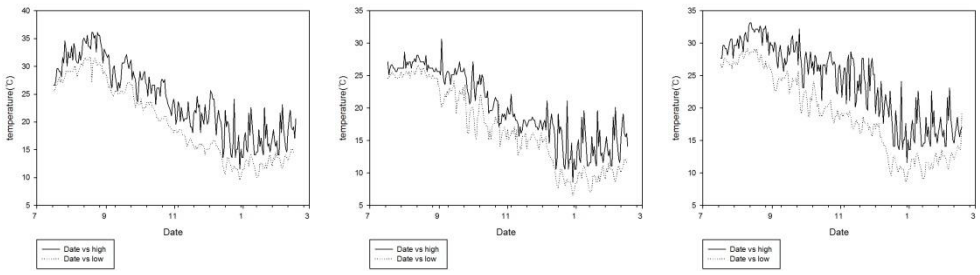

Figure 5. Graph of the temperature measured at the central control rooms of 1st and 5th floors of Eco Plaza

By comparing the temperature and humidity data measured at Eco Plaza with the growth condition changes of the plants, the conditions of *Spathiphyllum* and *Aglaonema* those had a big difference of temperature and humidity relative to the central control room between July and September became very poor. The reason being, the high temperature and humidity growth environment sustained in an interior space without good ventilation even for humidity-familiar plants, and the plants on the Green-wall exposed to the pests generated by this were greatly influenced by this such as turning brown or dying.

Figure 6. Poor growth condition of Aglaonema(A) and Spathiphyllum(B) at the front of 1st floor.

4. Conclusions

This study has proposed the management guidelines for sustainable maintenance of the color design of the green wall, based on the green wall data of Eco Plaza, Seoul. The data was collected by classifying the temperature and humidity measured at the inside according to the zones, rather than simply proposing the temperature and humidity required for the growth of the plants. Through this, it could be known that there was some difference of temperature and humidity in the space where the actual plants were implanted with the overall internal temperature and humidity of the building. The appropriate temperature and humidity is very important for the plants to maintain their intrinsic colors, thus, rather than simply checking the overall temperature and humidity of the building, a system to check the temperature and humidity by approaching from diverse angles is necessary, as the environments differ by zones of the buildings, and additionally, a divided green wall system is required to avoid the outbreaks of pests mostly influenced by temperature and humidity.

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ART

El Peyote como Esencia del Color en el Arte Wixárika

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Abstract

El origen del arte Wixárika radica en una tradición ancestral; el plasmar de manera física, las imágenes visualizadas por los chamanes, inducidas por la ingestión de peyote (hikuri), su cactus sagrado, permitiéndoles, franquear el umbral de lo desconocido y así relacionarse con lo divino. Estas obras son hechas con chaquira o con hilo de estambre, cada una lleva simbólicos motivos, historias de su cultura y leyendas de su cosmogonía, que nos ofrecen un panorama de su sociedad. El objetivo de este trabajo es dar a conocer la influencia del peyote en el colorido arte Wixárika y como influye este en su vida diaria a través de su vestimenta y sus ofrendas. Es debido a la importancia de su mundo sagrado y su intrínsica relación con su modo de vida, que en su arte se exprsan siempre cientos de historias que narran la mitología y cosmovisión de esta fascinante cultura. La artesanía no comercial, esta dedicada a narrar sus diversas vivencias religiosas en cada uno de sus autores, convirtiéndose en fantásticas piezas de hermosos colores y figuras inimaginables, que pueden ser concebidas sólo en la mente del artista Wixárika, el cual posee una personalidad independiente con relación a otras etnias del país, etnocéntrica y tradicionalista. En los días de fiesta en que se reúnen en el centro ceremonial común, lucen sus bellísimos atavíos, ricamente bordados, pintan sus rostros y comporten alimentos y bebidas.

El grupo étnico Wixárika, ubicado en la cadena montañosa llamada Sierra Madre Occidental o Sierra Huichola, es una etnia de gran tradición en México caracterizada por su marcado misticismo cultural y religioso. Se cree que el origen de los Wixáritaris viene de los aztecas (Náhuatls) por su semejanza en el idioma y ciertas costumbres. Los Wixáritaris emigraron del sitio que ocupaban cerca de la gran Tenochtitlán, hacia la región centro occidente del país, por la hostilidad de los aztecas, los olmecas y demás grupos guerreros que habitaban la zona, además de huir de los conquistadores españoles. Actualmente ocupan parte de los Estados de Jalisco, Nayarit, Zacatecas y Durango.

Para poder entender el arte wixárika, se tiene que tomar en cuenta la importancia de la vida familiar, su religión y cosmovisión. La organización social productiva de los Wixáritaris se da a través de la familia, agrupadas en familias nucleares y extensas, mismas que ocupan un determinado territorio. Esta agrupación tiene como características el ser tradicional, con una agricultura de sobrevivencia y prácticas ancestrales. El concepto de tradicional está cargado de una gran sabiduría, la cual sirve de medio intelectual al campesino indígena en la realización de sus prácticas productivas y manejo de la

naturaleza. La familia extensa tiene como funciones visibles más importantes las expresadas por el trabajo cooperativo y por el culto familiar. El trabajo cooperativo es el eje central de la vida económica de la familia extensa, y el culto es el que lo retroalimenta. La fiesta ritual no sólo es una fiesta que sirve para brindarle culto a los dioses y pedirle buenas cosechas, salud o lluvias abundantes, sino que sirve además, para reafirmar por una parte, "el costumbre" que es la forma ritualizada de vinculación entre los humanos, con la naturaleza y lo sagrado; en ella se dan relaciones de alianza y se cimientan las lealtades primordiales entre las familias patriarcales Torres, (1995). Las mujeres trabajan en el cuamil (parcela familiar) junto con su hombre; bordan y el hombre vende las prendas bordadas o las fajas y los morrales tejidos. El hombre administra las ganancias y por lo general se queda con ellas y las gasta rápidamente, ya que no es previsor. Para él no existe el mañana ni el futuro, sólo el presente.

En cuanto al aspecto religioso, existen como máximos representantes los mara'akames, quienes son sacerdotes y curanderos, estos se auxilian por los cantadores, los cuales son muy importantes para cubrir cualquier ritual. En los días de fiesta, en los que se reúnen en el centro ceremonial común, lucen sus bellísimos atavíos, ricamente bordados, pintan sus rostros y comparten en forma comunal alimentos y bebidas, mientras se llevan a cabo los diversos rituales de su religión o las ceremonias propias del cambio de su gobierno civil.

La cultura Wixárika ha ido sobreviviendo generación tras generación, ya que desde pequeños los niños wixáritaris son enseñados a hacer sus propias ofrendas para la diversidad de deidades existentes en su mundo y estas ofrendas tienen que ver con su arte.

Una de las ceremonias más importantes y reconocidas en el ámbito nacional e internacional es el viaje a un lugar sagrado llamado Wirikuta, (Real de Catorce) localizado en el estado Mexicano de San Luis Potosí. Cuando esta ceremonia se lleva a cabo, los Wixáritaris, emprenden una caminata desde sus comunidades, hasta Wirikuta, en busca del peyote sagrado. Mata, (1972).
Relato del encuentro con el espíritu del híkuri (peyote)

"Cuentan los ancianos, que hace mucho, mucho tiempo en la sierra huichola se reunieron los abuelos para platicar de la situación en la que se encontraban. Su gente estaba enferma, no había alimentos, ni agua, las lluvias no llegaban y las tierras estaban secas. Decidieron mandar de cacería a cuatro jóvenes de la comunidad, con la misión de encontrar alimento y traerlo a su comunidad para compartir fuera mucho o poco. Cada uno representaba un elemento, es decir el fuego, el agua, el aire y la tierra. A la mañana siguiente emprendieron el viaje los cuatro jóvenes, cada uno llevando su arco y su flecha. Caminaron días enteros hasta que una tarde de unos matorrales saltó un venado grande y gordo. Los jóvenes estaban cansados y hambrientos, pero cuando vieron el venado se les olvidó todo; comenzaron a correr detrás de él sin perderlo de vista. El venado veía a los jóvenes y se compadeció. Los dejó descansar una noche y al día siguiente los levantó para seguir con la persecución. Así transcurrieron semanas hasta que llegaron a Wirikuta (desierto de San Luis Potosí y camino sagrado de los huicholes). Estaban justo en la puerta al lado del cerro de las Narices, en donde habita un espíritu de la tierra y vieron al venado que brincó en esa dirección. Ellos juraban que se había ido por ahí, lo buscaron pero no lo hallaron. De pronto uno lanzó una flecha que fue a caer en una gran figura de venado

formada en la tierra de plantas de peyote. Todas juntas brillaban con el sol, como esmeraldas mirando a una dirección. Confundidos los jóvenes con lo sucedido, decidieron cortar las plantas que formaban la figura del venado (marratutuyari) y llevarlas a su pueblo. Después de días de camino llegaron a la sierra huichola donde los esperaba su gente. Se presentaron de inmediato con los abuelos y contaron su experiencia. Comenzaron a repartir el peyote (híkuri) a todas las personas que después de un rato los curó, alimentó y les quitó la sed".

Desde ese momento los huicholes veneran al peyote que al mismo tiempo es venado y maíz, su espíritu guía. Así cada año, hasta nuestros tiempos, siguen andando y peregrinando, manteniendo viva esta ruta de la sierra huichola hasta Wirikuta, para pedirle al Dios lluvias, sustento y salud para su pueblo. Méndez (2014).

El peyote es considerado la planta sagrada, es uno de los elementos de la creación (venado, maíz y peyote), la cual en su creencia es la fuente de vida del pueblo wixárika. La raíz del peyote representa la conexión con la tierra, es por ello que no les importa realizar una caminata de por lo menos 40 días entre ida y vuelta, con ayunos, mandas y tareas especiales.

Cuando los peregrinos huicholes encuentran plantas de peyote en el desierto, disparan flechas a la izquierda y a la derecha para alejar a los malos espíritus y proceden a recolectar la parte que sobresale del suelo arenoso. Tras la recolección, el grupo está listo para regresar a sus montañas, donde llevarán a cabo la ingestión ritual de la planta, previa desecación de sus gajos o "botones". De nuevo en casa, por la noche, los hombres y mujeres se sientan en círculo, en el suelo de una casa sagrada, o en el exterior, alrededor de una fogata resplandeciente. Después de una oración de apertura, cada participante recibe cuatro gajos secos, que tienen un sabor muy amargo, y que van masticando poco a poco hasta tragarlos. El cambio se siente tres horas después, cuando empiezan las visiones. Un estado de euforia es seguido por una profunda relajación que se alarga por varias horas.

Las descripciones de la experiencia mencionan la aparición de formas de colores cambiantes, sentimiento de actividad intelectual aumentada, sensación de flotación, y una curiosa pérdida de importancia de las relaciones del espacio y del tiempo. La experiencia con la planta es parte de la causa de la visión del mundo de los wixáritaris, impregnada de magia. Los artistas wixáritaris plasman en coloridas pinturas hechas en tablas con estambre o hilo sus visiones y su modo de ver todos los pasos del ritual del peyote.

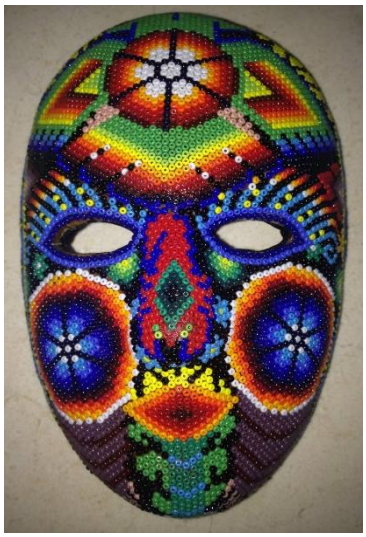
Arte Wixárika

Quienes conocen los destrezas de sus creaciones artesanales, entienden que el suyo es un arte ancestral: un arte que cuenta, canta, provoca; un arte que hace imaginar diálogos, bailes, enfrentamientos, misterios. Porque todas sus imágenes, todos sus diseños, por sencillos que parezcan, tienen una misma virtud: contar historias. Los wixáritaris gustan de hacer arreglos, ofrendas, escudos y flechas para narrar la historia de la creación del mundo y del universo, pero también usan estos mensajes para detener el viento, para llamar a la

lluvia o al sol o para ejecutar rituales de hechicería. El ritual más puro ocurre sólo en los llamados mitotes, ceremonias religiosas en las que se ejecutan danzas y movimientos mágicos para activar la energía vital, para agitar la vida, o sea el kipuri, estimulados por el peyote**.**

El arte wixárika es una prolongación conceptual de la existencia, es la memoria colectiva de un pueblo atrapado en coloridos estambres, la naturaleza capturada en chaquiras, la energía vital de la región habitando en el diseño abstracto de las grecas.

La joyería hecha con cuentas de chaquira (también llamada mostacilla) es un elemento importante en su indumentaria, la usan tanto mujeres como hombres, sobre todo ciertos collares y pulseras, aunque también elaboran medallones, aretes, brazaletes y anillos. la artesanía es su forma de adquirir dinero, en esta labor trabaja toda la familia y los niños se inician aprendiendo el arte de la joyería alrededor de los cinco años, comienzan sólo engarzando las cuentas en los diseños más sencillos de los collares, después continúan con las pulseras y ya en la adolescencia, una vez que dominan el oficio pueden comenzar haciendo collares mucho más complejos, con flores o con alguna otra figura, también hay quienes se especializan en hacer sólo ciertas piezas, pero la culminación del arte, cuando ya domina a la perfección la técnica y puede reproducir distintos diseños o hacer sus propias creaciones, es quien hace las máscaras, Figura 1 y 2; en donde sobresale el homenaje al peyote, representándolo en la mayoría de las ocasiones con una flor. Bojórquez (2001)



Figuras 1 y 2. Máscaras de madera decoradas con chaquira

Generalmente las obras que ellos mismos tallan en madera, además de las máscaras, representan figuras de deidades y animales sagrados, pues conservan también una viva tradición religiosa que manifiestan a través del arte de la escultura, figuras 3, 4 y 5. A la pieza de madera se le coloca una capa de cera y pacientemente se adornan con chaquira (mostacilla), hasta culminar el diseño propio de la inspiración de cada artesano y de acuerdo a su experiencia con el peyote.

Figuras 3, 4 y 5. Figuras de madera decoradas con chaquira (jaguar, venado y toro)

Según algunos historiadores, el primer contacto de los wixáritaris con las cuentas de chaquira, de origen europeo, fue entre 1591 y 1600. Estos suministros le dieron un carácter al atuendo huichol que lo marcó para siempre, aunque su vestimenta fue evolucionando a través de los años, de acuerdo a sus costumbres, la chaquira representa actualmente su principal característica, tanto en sus adornos personales como en su artesanía.

Otros trabajos artesanales que realizan son: El tejido de lana Figuras 6, 7 y 8. Las tejedoras producen el arte decorativo que ha dado fama a los wixáritaris, cuando éste se hace sobre el telar de cintura, lo realiza la mujer. Las niñas a los 12 años ya saben usar el telar. Cuando la lana se utiliza para decorar cuadros, se convierte en una actividad mixta. Los tejidos exhibe diseños convencionales o estilizados en cinturones o morrales, así como en cobijas (frazadas).

Figuras 6. Tejido en cinturón.

Figura 7. Morral tejido

Figura 8. Lana en cuadro

La artesanía en chaquira actualmente es una de las ocupaciones que más aporta ingresos a la familia, aunque esta actividad se lleva acabo de una manera desorganizada por la misma combinación de sus ritos con el trabajo productivo, además existe un mercado a base de intermediarios para la compra-venta de sus artesanías. En ocasiones les quieren pagar a tan bajos precios que ellos prefieren acudir a los poblados más cercanos y tratar de vender directamente el producto.

La artesanía se convirtió en una actividad económica importante a partir del movimiento contracultural de los años sesenta, que despertó el interés masivo en el arte wixárika y su estética inspirada en experiencias "psicodélicas". La visita a los diferentes centros urbanos y turísticos donde se vende la artesanía, suele combinarse con recorridos por diversos lugares sagrados.

Asimismo, la producción artesanal, sale al mercado en las metrópolis, a través de las giras que se hacen para llevar ofrendas a los dioses. Los hombres van en la mayoría de las ocasiones acompañados por sus mujeres, quienes llevan las cargas más chicas, con el peso adicional de un niño colgado a la espalda y con sus demás hijos detrás, siguiéndolos.

La actividad productiva de la mujer en esta localidad es muy importante, su trabajo está directamente relacionado con el bienestar de la familia en los económico y lo social. Ellas son el pilar fundamental de la supervivencia del grupo huichol, como hijas, esposas y madres, se dedican a trabajar todo el tiempo.

Sus prendas de vestir son muy elaboradas y de vistosos colores, llevan imágenes bordadas relacionadas con su mitología y con la naturaleza, son unas verdaderas obras de arte, Figura 9; sobre todo la ropa del hombre, pues las mujeres se esmeran en hacer el mejor trabajo, ya que es la manera de que el grupo social la reconozca como buena esposa. Antes confeccionaban su traje con tela de algodón crudo llamado manta, ahora es de algodón más industrializado. Las largas y voluminosas faldas así como el paño que usan en la cabeza las mujeres son cocidas a mano, igual que el traje del hombre. Las niñas desde los ocho años comienzan a bordar. Bojórquez (2001)

Figura 9. Traje bordado de hombre

En la sierra un wixárika con su traje bordado, es como un pájaro que luce su plumaje nuevo. El wixárika sufre y se alegra con la naturaleza, vive y muere con ella. La naturaleza enseña que hay fuerzas buenas y malas, benéficas y perjudiciales.

Aunque por lo regular la mujer se encuentra en los lugares en donde ellos comercian, ella no negocia con los clientes, esta actividad les corresponde a los hombres. Por esto la mujer rara vez sabe cuánto dinero ingresa por este concepto y también le es difícil

concebirse como aportadora al ingreso familiar, ya que el que vende es el que gana el dinero y por lo tanto en algunas familias se le otorgan todos los créditos, aunque se estén comercializando los productos hechos por la mujer. Bojórquez (2001)

Cosmogonía y cosmovisión wixárika

La religión es producto de la fusión de elementos prehispánicos y católicos de la época colonial que dio origen a un sincretismo, en el cual han incorporado santos católicos a sus más de cien deidades. La vida religiosa del wixárika es sumamente importante. La base fundamental de su existencia está dada por preceptos místicos, ellos consideran que el medio ambiente que les rodea y en el cual habitan, lo crearon los ancestros, llamados nuestra Madre Tierra, nuestro Padre Sol, nuestro Hermano Venado Azul, etc. Los huicholes sé autonombran wixárika que significa Hijos del Sol. Bojórquez (2001)

En la comunidad la estructura religiosa está compuesta por los mara'akame (sacerdotes o curanderos) que también hacen de cahuiteros (hacen la recitación del Cahuito, texto ritual sagrado) y los peyoteros que son los que representan a la comunidad en el viaje a Real de Catorce para traer el peyote que se utilizará durante todo el año en las ceremonias religiosas de la comunidad.

En los lugares sagrados se encuentran los centro ceremoniales llamados caligüey. Figura 10. Dentro se colocan las ofrendas e hincados se dicen las oraciones, que son recitadas en wixaritari, dirigidas por el ma'arakame. La relevancia del mara'akame en estas comunidades es altísima. Para ser mara'akame, es necesario cumplir con ciertos requisitos. En ocasiones en cuanto un niño nace se le vaticina que llegará a serlo.

Figura 10. Centro ceremonial, llamado "caligüey".

Los wixáritaris viven haciendo fiesta, para darnos un ejemplo, tenemos la Fiesta de la Lluvia, que regularmente es realizada en el mes de agosto, incluyendo los preparativos dura un mes, pero luego las ofrendas se siguen haciendo por varios meses y cada familia es responsable de seguir venerando a los dioses hasta el mes de mayo, que se hace la última fiesta colectiva, lo cual se lleva cerca de un año para cerrar el ciclo. Bojórquez (2001)

El sistema de cargos tradicional, es presidido por el Consejo de Ancianos (los

kawiterutsixi). Estos cargos vitalicios son reservados a las personas más destacadas entre los adultos mayores, generalmente se trata de mara'akames "los que saben soñar", quienes han ocupado varios de los cargos importantes, conocedores de la historia mitológica, ellos consultan a los antepasados y ancestros deificados durante sus experiencias oníricas.

Los mitos cosmogónicos wixárikas se dividen en tres grandes ciclos:

- El primero versa sobre la salida de los antepasados del mar y su búsqueda del lugar del Amanecer. Entre los episodios más importantes figuran la creación del Sol y la primera cacería de venado. Ambos mitos enfatizan el auto sacrificio: un niño se arroja en la hoguera y se transforma en el astro diurno; el venado se entrega voluntariamente a los cazadores y se convierte en el peyote.

- El segundo ciclo mitológico trata del diluvio, de la creación del maíz y del origen de los seres humanos. Estos textos describen cómo Watakame, el primer cultivador, busca a la diosa del maíz, la manera en que es salvado del diluvio, y cómo su perrita se transforma en la primera mujer.

- El tercer ciclo mítico trata de la vida de Cristo, de la creación de los animales domésticos, del dinero y de otros objetos asociados con los mestizos.

En Tatei Neixa, "la danza de Nuestra Madre", se celebra la presentación ritual de los primeros frutos (elotes y calabazas tiernas) y de los niños menores de cinco años. Durante un largo canto, el chamán los guía por un viaje imaginario al desierto de Wirikuta. En cierto momento, los niños se identifican con los primeros frutos y son presentados como tales a los dioses, después se establece una separación simbólica entre los seres humanos y sus alimentos. Para participar en la fiesta, los niños el primer día se mantienen en ayuno. Los niños sólo pueden comer peyote, lo hacen cuando lo indica el ma'arakame. A los bebés las mamás se los dan masticado. Al día siguiente ya comen de todo rompen el ayuno con la carne de venado (que simboliza también el peyote, pero a nivel terrenal), siendo éste el más sagrado de los alimentos que reciben en el día. La carne es entregada por el mara'akame en pequeños trozos, se consume el tejuino que puede ir acompañado también de peyote.

En las fiestas y ritos el huichol conoce las ceremonias, los cantos, las oraciones, la historia de los dioses, el origen y razón de las cosas. En los cantos y consejos del mara'akame, el wixárika aprende preceptos sobre la vida y sobre la muerte, pues ni aún en la otra vida deja de tener obligaciones, preceptos sobre el trabajo, sobre las relaciones con los demás miembros del grupo; las ofrendas que inicialmente se elaboraron para tal fin, ahora son su medio de subsistencia Figuras 11, 12. Bojórquez (2001)

Figura 11. Jícara decorada con chaquira

Figura 12. Ofrendas en un caligüey

La vida consuetudinaria está basada en el cumplimiento con los deberes hacia los dioses, su tiempo no es el nuestro, ahí la vida parece ir sin tanta prisa, cuando algún acontecimiento de su mundo religioso se lleva a cabo, lo demás parece no importar, todo se pospone, lo primero es cumplir con "el costumbre". Sus valores se establecen fuertemente en su vida familiar y comunitaria, el niño huichol se cría con un sentido religioso de la vida, que le revelan poco a poco el misterio de los significados de su mundo místico. La enseñanza familiar, se apoya en tres fuentes principales: el hogar, las fiestas y ritos y la naturaleza, fundidos en una sola cosa: "El costumbre". Bojórquez (2001)

"El costumbre" es como una constitución no escrita o ley consuetudinaria viva, vigente, dinámica. El costumbre es una sabia y antigua manera de hacer las cosas, de iluminar los actos, de dar consejos, de hacer justicia, de aplicar los castigos. La obligación más importante para un wixárika es conservar el costumbre. La naturaleza es normativa, es un ejemplo vivo. La rama frágil enseña a no cogerse de ella. El arroyo crecido enseña que no debe cruzarse. Hay pájaros que anuncian la proximidad de la muerte o la cercanía de la primavera. Los tiempos de abundancia enseñan que hay escasez. Con respeto miran a los venados, las águilas y las serpientes. Con respeto y admiración miran el maíz y el peyote. Sienten admiración por el sol, el viento, el fuego, la lluvia y las cuevas sagradas. Bojórquez (2001).

La obediencia a las autoridades tradicionales es sumamente importante, estos les inculcan los valores propios de los antepasados y les fortalecen la fuerza espiritual de su cultura. Tal vez la vida moderna invada el mundo wixárika y vaya borrando poco a poco las huellas de ese mundo mágico y misterioso, pero todavía unos pocos elegidos escogen el duro camino del chamanismo, guiados por los mara'akames, Figuras 13 y 14 y por el protector abrazo del Híkuri (peyote), la planta sagrada del desierto y por la forma correcta de vivir de los sacerdotes-curanderos perdidos en el tiempo.

Figura 13. Ma'arakame en ceremonia.

Figura 14. Peyote (híkuri).

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Colours in Old Amish Quilts

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Abstract

The Amish religious movement have its roots in the Protestant Reformation in the 16th century. The Amish people are anabaptists and have strict rules for their way of life. They were persecuted in Europe and Amish groups emigrated to Pennsylvania. Today the most traditional part of the movement – the Old Amish People – lives in Lancaster County west of Philadelphia, USA. This paper describs a study of the colours in Old Amish Quilts, traditional Amish patchwork quilts used as bed covers. The patches are single-coloured fabric pieces forming clear symmetrical patterns with deep and strong colours. The quilts are important in Amish culture; they are made for the bride's wedding chest. Nowadays traditional Amish quilts also are made for turists as wall decorations – "wallhangings".

The selection of quilts for my survey consists of five Old Amish Quilts from Lancaster Heritage Museum and The American Quilt Study Group, 15 quilts, at that time, belonging to The Esprit Collection and eight new quilts with traditional patterns (wallhangings). The colour analysis was carried out using Natural Colour System (NCS) with the aim of identifying general principles for selection of colours.

The analysis shows that most hues are located in the lower part of the colour circle – from red (R) to green (G), and most nuances - with relatively high degree of blackness or chromaticness - in the lower part of the colour triangle. Colour choice is often dependent on moral or religious preferences. For example, in quilts from Lancaster County, yellowish colours are - as representing "hochmut" (arrogance) - regarded as bad colour choice.

The strong colours in Old Amish Quilts have no counterpart in public life. In Lancaster county Amish people wear black, brown and dark blue clothes and their wagons are black; colourfulness is restricted to the bedrooms and the private sphere.

Background

This paper describes a study of the colours in *Old Amish Quilts*, traditional Amish patchwork quilts used as bed covers. The patches are single-coloured fabric pieces forming clear symmetrical patterns with deep and strong colours. The quilts are important in Amish culture; they are made for the bride's wedding chest and are used in the beds of all family members.

Amish are members of a Christian religious movement with roots in the radical Protestant Reformation in the 16th- century Europe. Their name derives it's origin from the strict teachings of Jacob Amman, a swiss anabaptist leader (Kraybill 2001:21ff; Nolt 1992). The

Amish people consist of religious groups that follow rules rooted in “Die Ordnung”. These rules keep them isolated from modern society and in contact with God and the earth made by Him. They are also called The Plain People, as they live a simple life in which unnecessary things are forbidden, refuse most modern technology and dress distinctly conservative (Kraybill 2001; Kraybill and Olshan 1994; Strai 1995).

To avoid persecution and compulsory military service in Europe the Amish people began emigrating to the British colony Pennsylvania in the 1720s (ibid). Today there are more than 465 Amish settlements in the United States and Canada (Caldwell 2012). Amish live near other Amish, which enables them to support each other's lifestyle and establish local congregations of people with similar beliefs and convictions. The most traditional part of the movement – the Old Amish People – lives in Lancaster County west of Philadelphia in a rural farm society.

The Amish learned to make quilts when they immigrated to America, but they did not follow the Victorian quilt tradition of blocks, built up by smaller pieces of coloured and patterned fabric, repeated all over the surface. The quilts traditionally made by Amish women are to be used in bedrooms and are composed as one huge block, as shown in figure 1 (Pellman et al. 1981; Granic 1989).

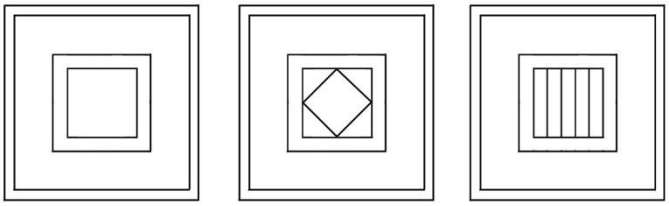

Figure 1. Traditional Patterns in Old Amish Quilts: Center Square, Center Diamond and Bars (from Pellman 1984).

Methods

My study is a survey and a phenomenological analysis of antique quilts made by Amish women in Lancaster County, Pennsylvania, USA, during the period 1860-1940. It includes empirical analyses of quilts. The aim is to identify characteristic traits of colour and form design. The analysis resulted in a hypothesis concerning the basic principles of colour and form design of old Amish quilts. The selection of quilts for the survey consists of five Old Amish Quilts from *Lancaster Heritage Museum* and *The American Quilt Study Group*, 15 quilts, at that time, belonging to *The Esprit Collection* and eight new quilts with traditional patterns (wallhangings). The colour analysis was carried out using Natural Colour System (NCS) with the aim of identifying general principles for selection of colours (Hård, Sivik and Tonnquist 1996). Literature studies and on-location interviews about Amish Society and Amish women’s work with quilts were conducted to gain an understanding of the social and cultural context of the Old Amish quilt. In Lancaster County, USA, three interviews were conducted with members of the Amish society, one with a salesman of Amish quilts and a telephone interview with an author of many books about Amish society and quilts. This author, Rachel Pellman, had been raised in Lancaster County, belonged to the Mennonite church (a branch of the same anabaptist movement as

the Amish) and made quilts herself. She was also the curator for *The People's Place Quilt Museum* in Intercourse, Lancaster County for many years.

Colour and form analysis

There is quite a lot of American literature on the Amish people and their quilts. Books intended for quilters often start with a historical view of the Amish and describe how they live today, and then gives information about how the quilts are composed and made. My introduction to Amish quilts was *Amish The Art Of The Quilt* (Hughes 1990). The book presents colour photographs of 82 Old Amish Quilts from *The Esprit Collection*. Douglas Tompkins, who together with his wife Susie launched the company *Esprit de Corp* in 1962, bought Old Amish quilts with the intention to decorate the company's new factory in San Francisco.[1] One of the interesting things about this book is that the three authors describe in three different ways why so many people find The Old Amish Quilt so fascinating. Douglas Tompkins chose the quilts for aesthetic reasons; he calls them "masterpieces of design" (Hughes 1990:7). The American art critic Robert Hughes regarded them as art. Julie Silber, the curator of the collection, looks at them as textile evidence of the Amish women who made the quilts and the culture in which they lived (Hughes 1990:7-8).

The sample of the quilts studied comprised five antique Amish quilts from *Lancaster Heritage Museum* and *The American Quilt Study Group* in San Francisco, fifteen antique quilts from *The Esprit Collection* and eight new quilts made with traditional patterns and colours. Unfortunately, I did not have access to *The Esprit Collection*'s original quilts, but had to analyse these quilts from photographs in the book *Amish The Art of The Quilt* (Hughes 1990). The book, however, provides high quality photographic registration and great efforts were made so that the photographs would correspond with the original quilts.

The quilts were analysed by mapping the colours in the NCS space – in the colour circle and colour triangle. Colour samples corresponding with the colours of each quilt were noted in the NCS space; the notations were combined to form a graphic structure in the NCS space that describes the basic colour codes of each quilt. A limitation was made to the three simplest kinds of quilt patterns *Center Square, Center Diamond* and *Bars* in Figure 1.

Result

The religious frameworks in which the quilts were made can partly explain the design and process of making them. The Amish consider artwork unnecessary, but all homes need many bed quilts, as Amish families usually have many children. However, in quilt making, the artistic woman had an opportunity to express herself and show her artistic ability (Rachel Pellman, February 1998). From the present visual study of antique Amish quilts, some principals of Amish quilt making were observed. The reasons for these principals were sought through literature studies and interviews and will be presented below.

[1] The *Lancaster Heritage Museum* got *The Esprit Collection* in 2002. From September 2006 a rotation of the 82 quilts was exhibited at the new *Lancaster Quilt & Textile Museum*. In 2013, lacking money to buy/take care of the collection, the museum lost *The Esprit Collection*.

Pattern design

In contrast to the Victorian quilt tradition, the antique Amish Quilt patterns in this study are not composed of repeating blocks. The quilts are big enough to cover a bed, normally 75x75" – 80x80", and most pieces of fabric are bigger than those used in Victorian quilts. In the middle of these patterns there is a plain square, a square with a diamond, or a grid /"bars" (figure 1). The centre is framed by a border that may have small squares in another colour in the corners (corner blocks). This first border is then framed by another, wider border that also may have corner blocks. A narrow binding finishes the quilt (Granic 1989; Pellman and Ranck 1981; Pellman and Pellman 1984).

Colour design

The results of the colour mapping showed that colours used in the Old Amish Quilts are mainly to be found in the marked area of the NCS colour circle and colour triangle in Figure 2.

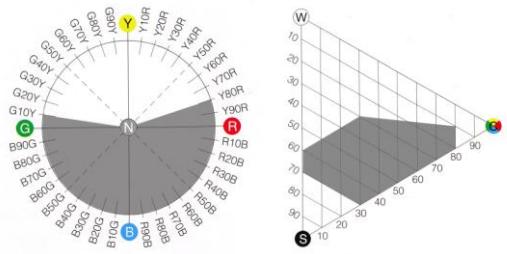

Figure 2. Characteristic colours of the Old Amish Quilts described in the NCS triangle and circle (dark areas).

The results of the colour analyses showed that the colours of Old Amish quilts are represented in an area in the NCS space that corresponds with colour descriptions used in the reference literature. Therefore, the quilts analysed can be regarded as representative of Old Amish quilts in general. Within the "Amish colour code", we find close nuances both in the colour circle and the colour triangle. At the same time there are strong contrasts of hues and nuances. Three principles of colour design seem to be typical:

- *Well-defined patterns of patches with distinct borderlines*, whether with or without apparent contrasts. A strict simplicity is characteristic to Amish pattern design.
- *Limited colour areas contribute to a coherent whole.*
- *Contrasts chromaticness/blackness give variation*. The use of colours with a high degree of blackness as well as colours with a high degree of chromaticness are characteristic; it is the combination of the greyish/blackish and more coloured patches that give the visual tension and the surprising effect that is so characteristic of The Old Amish Quilt.

The balance in pattern design, the unity of colour nuances and the special colour contrasts result in a harmonious expression of the patterns even when these principles are used in smaller products. This effect is strengthened by the size; it gives a contemplative, "sacred" impression. The reason why a colour combination holds together is not as easy to predict as the reason why a pattern gives a coherent impression. We know from tradition that harmonious colour combinations contain colours that have one or more colour qualities in common (e.g., redness, blackness, chromaticness, etc.), and that complementary colour contrasts give some kind of harmony. The colour combinations in Old Amish Quilts, however, often deviate from these principles – especially when it comes to complementary colour contrasts – but they give nevertheless an experience of coherence and "holiness".

Cultural influences on Old Amish Quilt

The reasons for this simple pattern design, which deviates from quilt making outside the Amish community, may be explained by the rationality of the culture. Use of larger pattern elements reduces the time spent on sewing the pieces of fabric together (Boynton 1985). This may also reduce the decorative effect, as fewer details are included in the quilts. It should be mentioned here that the Amish wish to avoid decorative effects and are therefore forbidden to use patterned fabric in their quilts; they use plain fabrics.

All colours have some degree of grey- or blackness, as in the colours of the Amish clothes used at home. Pure black is most often only found in smaller elements or the narrow binder that surrounds the quilts. In an interview with an old Amish woman named Nancy, she said that this is the way they use black in quilts even nowadays (Nancy, February 1998). Black is not used so much in the quilts made by Amish women in Lancaster, although it is common among Amish in the Midwest (McCauley and McCauley 1988). Reasons for why black is not used so much in quilts were not given, it simply seemed to be a custom. Granic (1989) says that the Amish in Lancaster County cannot remember any rules for the use of colour in quilts, but they all noticed that yellow and white were not good colour choices. Yellow is not used in quilts from Lancaster County. When I asked why yellow is not used in Amish quilts from Lancaster County, Nancy said firmly: "*Hochmut*"[2]. However, yellow is used in quilts and on the roof of the Amish horse wagons in Ohio, yet Nancy said "but that is not our way" (Amish woman Nancy, February 1998).

The Amish people are supposed to be plain and not expose themselves. For instance, Amish people were not to be photographed, as this would make them more visible. They are supposed to cultivate the land of God, not themselves. It seemed that bright yellow is still a colour considered too intensive to be used, while nowadays white is often used in Amish quilts in Lancaster County. I also noticed that pink and pastels were colours used in later quilts from Lancaster County. The literature says that pink was popular in dresses in the nineteen thirties and that the use of pastel colours became popular during the 1940s (McCauley and McCauley, 1988). Nancy did not understand the question when I claimed that pink was not common in quilts. She said that pink was used in dresses for young girls and perhaps dresses used when working at the field. My interpretation is that fashion introduced the pink and pastels from the 1930s and 1940s, and that Amish Society found no reasons to avoid these colours. A clear red colour found already in quilts from the eighteen

[2] *Hochmut* refers to a combination of pride, arrogance and haughtiness (Dimmitt 2013)

seventies was confusing, because this colour diverges from the softer colours used in clothes. According to one Amish woman, the reason for this is, that peddlers made packages of assorted fabrics that they sold at lower prices. They put fabric that was difficult to sell into these packages. The red colour was too bright to be used for Amish clothes, but if the women had just thrown it away, the package price would not have been especially low (Pellman and Pellman 1984:25). Because the colour could not be used for clothes, it ended up in the quilts. From the nineteen twenties, this red colour has been used in larger parts of the quilts (Pellman, February 1998).

The Amish colour code is connected to cultural rules. Some exceptions is allowed, probably because the strong colours in Old Amish Quilts have no counterpart in public life; the Amish people wear black and dark blue clothes and their wagons are black. The colourfulness is restricted to the bedrooms and the private sphere.

The Amish women have their own understanding of the *habitus* (Bourdieu 1984) in Amish society to cope with when choosing colours and putting them together. They had at hand fabrics in limited colours and were supposed to combine them in a special pattern. Moreover, they probably wanted to make a quilt that did not look like the ones they had previously made. They were conscious both of their own habitus for quilt design, of the habitus of other Amish groups (e.g., in Ohio) and of how quilts are made outside Amish societies, but could for the most part not explain the reasons for the existing limitations of colours and patterns.

Nowadays the Amish are strongly influenced by the rest of the American quilt tradition, and make nowadays rarely quilts similar to those in *The Esprit Collection*. Plain fabric must still be used, and some colour codes exist, but the quilt patterns are much more complex and made up of more and smaller pieces of fabric. White background colour is common (Amish Quilter Hannah, February 1998; Quilt salesman Kim Hondares, February 1998). The reasons for these changes are probably to be found in the influence from the American quilt tradition. The Amish culture has become more and more popular for tourists - starting in the 1940s when a hotel opened in Lancaster and encreasing[3] after the film "Witness" with Harrison Ford hiding an Amish woman and her son at an Amish farm. The growing Amish communities cannot isolate themselves as they did earlier (Kraybill and Olshan 1994; Strai 1995). Today the Amish quilters often find inspiration from the American quilt tradition and can also make repeated block quilts with patterned fabrics for sale. The Amish people are, however, not allowed to use these quilts themselves (Amish Woman Nancy, February 1998; Amish Quilter Hannah, February 1998). When the quilts become business it also influences the social fellowship; quilting is traditionally a collective work. When a number of quilters work together with the same quilt the stiches become individual and varying, the customers, however, ask for uniform stiches. The commercial influences on colour and form of the quilts may also influence on future Amish quilts; as the Amish woman Nancy said: "If you cannot get it sold – what shall you do with them?".

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Digital Color Design Of 'Chinese Red'- Methodology And Application

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Abstract

In this paper, a new approach that uses science and technology to design a color - 'Chinese Red' - for a prestigious civil engineering project is discussed. The Chinese government commissioned a bridge to be built and decorated in a classical Chinese red color. The approach to color selection involved color design, color science, color data visualization and imaging technology. More than a hundred color specimens representing 'Chinese Red' in terms of history, culture, and folk custom were collected and measured. The data was mapped in a CIELAB color space, and a normalized point of "Chinese Red" was calculated using measured data sets. A cubic model was built to calculate reference colors derived from the normalized point with evenly distributed color attributes in terms of Lightness, Chroma and Hue. Then reference colors were evaluated both visually and digitally in the color and imaging systems. Eight colors were appraised and chosen for physical sampling using digital communication and color formulation. Physical color samples were evaluated visually and digitally, under different illuminants and other outstanding criteria. Four colors were chosen and used for on-site painting experiment on a life-size model for half year experiment under extreme weather conditions. Finally, the color with less variation and good weather fastness was designated as 'Chinese Red' for the bridge. This approach takes the advantage of the color measurement, color quality control, color formulation, and real-time digital color communication technology to bridge the gap between art and science.

Introduction

As the national color of China, red is of far-reaching significance to Chinese people, such as auspiciousness, happiness, success, driving disaster and disease, turning ill luck into good. Chinese people have always valued traditions of the nation. C*hinese RED* is a growing sign of color vision with the development of traditional Chinese culture [1].

Why do Chinese people prefer red? The background of Chinese culture which exists five thousand years can well explain that. Different from Western culture originating from marine civilization, located in the east country China owing to its agriculture-oriented tradition, bundles Chinese people with the land for generations. China is the first nation of

the world to use the fire. Logging fires, slashing and burning life, deepened the understanding of ancestors of the fire and cultivated their sense of intimacy to the red. In addition, the tendency of aesthetic culture also gives a reasonable explanation of the reason for which Chinese people love *Chinese RED* so much. The ideological shackles formed during the long period of Chinese feudal society, leading to the phenomenon that convergence within Chinese people extremely desire the passionate red to stimulate. Just the complementarity between reality and aesthetic makes the color red which representatives assertive become an unconscious pursuit in the Chinese aesthetic level [2].

With the continuation in aesthetic psychology of the Chinese nation, the applications of *Chinese RED* in modern design can be seen everywhere, such as design of packaging, the indoor environment and architectures [1]. A famous color design project, supported by local government of China, was emphasized on the design and application of *Chinese RED* for Wusu Bridge [3], which is known as a prestigious "the Oriental First Bridge" in China and embraces the earliest sunrise in the country. As a landmark of eastern-north most borders of Chinese connecting Russian, the bridge is the first single-pylon cable-stayed structure in the history of the bridge and has profound significance in political, economic, transportation, and international trade [4][5].

Color science relates to the physiology of the human visual system sophistically, and color design is similarly inextricably embedded to human perception. From the history of color design, it can be seen that it more emphasize on the trend, aesthetic, physiological, and psychological aspects of color, while how to choose colors while how much degree the color designed could be fulfilled had seldom been considered. Although color science and technology have yet been widely utilized in industries over the years, it has not yet been extensively explored in color design [6]. In recent years, some studies began to address on the importance of interaction between scientists and designers [7]. In addition, different color systems had been used for color design, which were focused more on using digital technology to create color and color schemes by number [8][9][10]. However, there are no previous studies focused on combining the color design with the color application process, with which best color integrity could be accomplished.

To expand the use of color science and technology in color design, in this paper, the color perception of *Chinese RED* were quantified in the CIE L*a*b* color specification system in terms of normalized digital color coordinates. Color data were measured and visualized, and then analyzed with the help of the digital color & image systems so that it could be designed and further used for color communication, color duplication, and color quality evaluation [6][11].

CIE Color Specification System

The CIE Color system was used in this paper for specifying colors in digital format. CIEL*a*b* is a uniform color space which was recommended by the CIE in 1976 [12]. It describes all colors visible to the human eye and was created to serve as a device independent color specifying model. Three coordinates of in CIE L*a*b* color space are lightness of the color (L*), its position between red and green (a*), and its position between

yellow and blue (b*) respectively. Figure 1 and Equation 1 are description of CIEL*a*b* color space and calculation of the CIEL*a*b* Color difference:

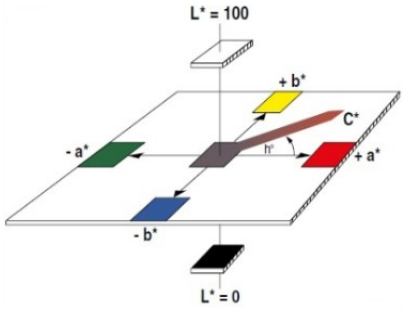


*Figure 1. CIEL*a*b* (1976) color space:*

$$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

*Equation 1. Calculation of CIEL*a*b* color difference*

Where:

ΔE^* *being the total color difference between two objects;*

Δ *L* being the lightness difference.*

Δ *a* being the red/green difference.*

Δ *b* being the yellow/blue difference.*

Equipmdents and Materials

Various digital color systems were employed for digitization of color in this study, all color systems were maintained and calibrated for each measurement. Table 1 shows a list of color instrument used for color measurement and evaluation.

Table 1. Digital Color systems used in this project

Digital Color System	Purpose
X-rite Capsure™	Measure color data from Symbolic *Chinese RED* items
Datacolor 650™ spectrophotometer / Datacolor Tools QC™	Measure color reflectance data of each specimen for color evaluation and color communication
Verivide DigiEye™	A color and image system, used for on-screen visual color presentation and on-screen color

	evaluation
X-rite Spetralight III™ light Booth	Visual evaluation of physical color samples
X-rite 530™ handheld spectrophotometer	On-site color evaluation

Three kinds of physical color samples were prepared in the experimental for digital and visual evaluation. The colors were painted on "PVDF Composite Panel", "Mini-sized concrete model"，as well as "Life-sized concrete model" respectively.

Criteria of Color Evaluation

A mixed methods research was used to permit both an objective and subjective presenting and evaluating the *Chinese Red*. The significant criteria for color evaluation will be addressed as below:

- Light Source: D65 (simulating sunny daylight, Color Temperature 6500K, UV Include), C (simulating cloudy daylight, Color Temperature 6700K, UV Exclude) and X-rite Horizon light (simulating dawn/dusk daylight, Color Temperature 2300K).
- Criteria such as color difference, colorfastness, and color consistency were measured by spectrophotometer and evaluated in the digital color software.
- Visual evaluation of physical color samples was conducted inside a standard light booth in a dark room, while evaluators were checked for color deficiency and showed a pass in Farnsworth Munsell 100 Hue Test.
- Color evaluation of virtual samples was conducted using color and image system, on a calibrated monitor in a dark room.
- Evaluation of *Chinese RED* candidate samples was conducted by five professors in the Tsinghua Art Academy. Some important considerations about color selection are aesthetic, harmony, meaning, durability, as well as local natural environment characteristics such as climate, plant covering, sunlight, ambient temperature etc.

Color Design Protocal

Phase 1. Chinese RED Specimens Collection and Digitalization

Symbolic *Chinese RED* items were collected and/or measured by using the Color Capsure™ colorimeter. The targets include Tiananmen Gate Tower, Chinese Flag, Chinese Lantern, Beijing 2008 Olympic Torch, Chinese Knot, Shanghai World Expo Main Building, Forbidden City, Chinese Silk, Chinese Drum, Chinese Ceramic etc. Furthermore, the CIE color coordinates of these measurements were input into the CIEL*a*b* color space which is shown in Figure 2:

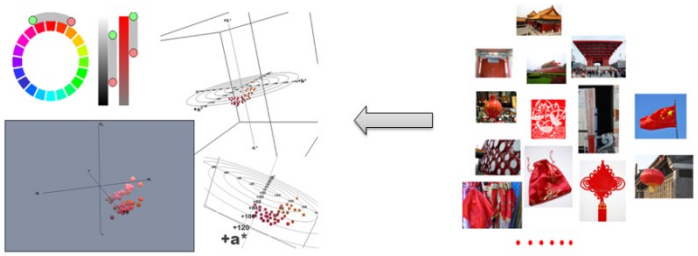


*Figure. 2 Collecting of Chinese RED data and presenting in CIEL*a*b* color space*

It can be found from the Figure 2 that the color data of the *Chinese RED* collected are falling within a localized area in CIE L*a*b* color space. However, these data are not identical, which means a variety of red colors were employed in delivering the meaning of *Chinese RED*, with more or less differences in lightness, chroma, and hue. There is not a definite *Chinese RED* which can be used straightly from the color data collected even though each color collected are being called *Chinese RED*. At the same time, all data collected have meaning, which suggest all data are valid as they were collected from symbolic Chinese items and should contribute to a "reference point" of *Chinese RED*.

Phase 2. Normalization of Chinese RED- the "Reference Point"

In this calculation, the assumption was that the CIE L*A*B* color space is a uniform color space, while equal distance of two points in color space reflect equal color differences visually, regardless of lightness, chroma, or hue. In addition, the color data were taken as solid color, while the influence of surface condition and substrate were not considered.

Then, The reference point of *Chinese RED*, which in the form of CIE color coordinates - L*, a*, and b*, were calculated based on the Equation 2.

$$L_r^* = \frac{\sum_{i=1}^{n} L_i^*}{n} \qquad a_r^* = \frac{\sum_{i=1}^{n} a_i^*}{n} \qquad b_r^* = \frac{\sum_{i=1}^{n} b_i^*}{n}$$

Equation 2. Calculation of reference point of Chinese RED Using data collected.

Where:

r being the Reference point

i being the number of sample size

n being the number of total sample size

The color coordinates of *Chinese RED reference points* were calculated, which are L_r^*=39.72, a_r^*=51.92, and b_r^*=31.51 respectively. The reference point then has been taken as the origin of coordinates in a relative CIE color space as is shown in Figure 3.

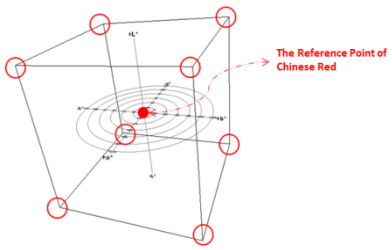


Figure 3. A relative color space based on the reference point of Chinese RED

Then, a cubicle has been put in the relative color space, and the origin of coordinate will be the center of the cubic as well. The cubic has eight vertexes and each vertex is the same distance to the center of the cubic (origin of coordinates). The distance of each vertex to the L*~a*plane is the same as to the L*~b* plane, as well as to a*~b* plane. Suppose the distance of the reference point (origin of coordinate) to each vertex is one unit of CIE L*a*b* Color difference (ΔE) then the coordinates of cubic's eight vertexes will be defined using below equation respectively:

$$\begin{pmatrix} L_i^* \\ a_i^* \\ b_i^* \end{pmatrix}_{Vi} = \begin{pmatrix} L_i^* = L_r^* \pm \Delta E\frac{\sqrt{3}}{3} \\ a_i^* = a_r^* \pm \Delta E\frac{\sqrt{3}}{3} \\ b_i^* = b_r^* \pm \Delta E\frac{\sqrt{3}}{3} \end{pmatrix}_{Vi}$$

Equation 3. Calculation of color coordinates of derived Chinese RED based on reference point

Where: i being 1 to 8 for 8 vertexes of the cubic

Furthermore, in order to expand the range of color candidates that can be chosen from, more colors had been mathematically created and included in the datum of *Chinese RED*. This has been achieved by setting the distance (or color differences) of the zero point to each vertex two, three, five, and ten times of a CIE L*a*b* unit.

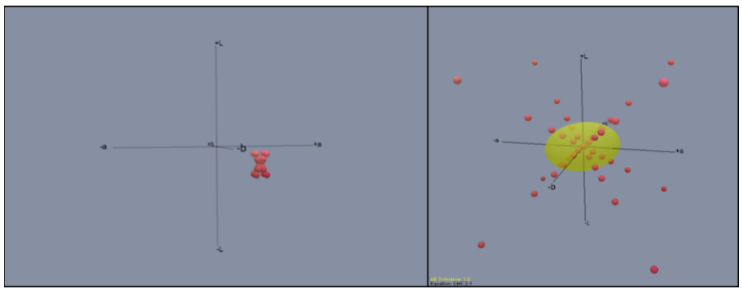


Figure 4. Derived candidate color of Chinese RED in CIE absolute color space (left) and CIE relative color space (right)

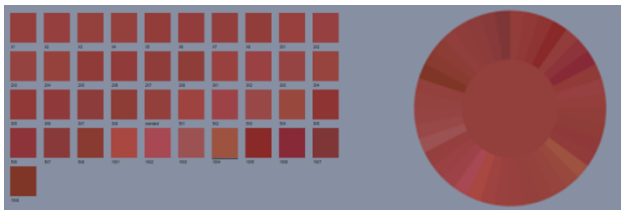


Figure 5. Presenting of derived color candidate in Color and Image system, Color Tiles (left), and Color Circle (right)

Then totally forty colors with derived color coordinates were calculated and demonstrated in Figure 4. It should be noted that the adjacent colors on the direction of each vertex have same distance, or same mathematical difference, in other words, for CIE L*, CIE a*, and CIE b* respectively (also means same differences regarding Lightness, Chroma and Hue). Figure 4 and Figure 5 also show the distribution of the forty derived color coordinates of *Chinese RED* in both CIE L*a*b* absolute color space and relative color space (take the reference point as original of coordinates).

Phase 3. Define Candidate Standards

Based on color coordinates of forty derived color candidates of *Chinese RED*, a subjective evaluation has been conducted in a color laboratory in Color & Image institute at Tsinghua University. All the candidate colors displayed in light booth and on a calibrated monitor in DigiEye™ color and image system, respectively, while the comparison and evaluation was conducted among all the derived colors based on the evaluation criteria described previously. As a result, eight candidate colors have been selected to prepare the physical painting samples.

Application of the digital *Chinese RED*

Figure 6. Visual evaluation of Color sample panel (left) and mini-Model in the color laboratory (right).

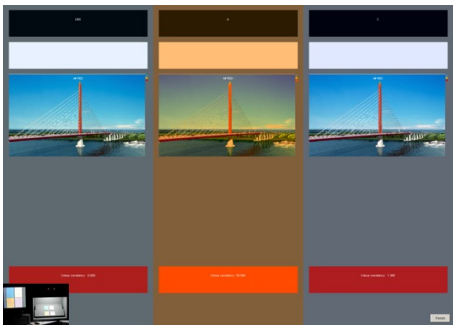


Figure 7. Color presentation in color & image system for on-screen visual assessment of color under simulated light sources (Left: C; Middle: Horizon; Right: D65)

The reflectance data of eight candidate colors were sent to a JUTON Paint laboratory in Zhangjiagang, P.R. China. Then the data have been imported to the Computer Color Matching System to calculate the formula (colorant combination) for each candidate color respectively. Furtherly, each formula was painted on matte color card and corrected until the color difference less than one unit of CIEL*a*b*. Then the physical sample was prepared in both paint-coating color card and mini-model for further evaluation. Again, those physical samples have been sent to a color laboratory in Color and Image Institute and visually evaluated under light booth, as well as on screen in color and image system, based on the evaluation criteria described previously. The evaluation procedures were shown in Figure 6 and Figure 7. The color coordinates of preferred *Chinese RED* candidates are [L*=37. 01; a*=48. 15; b*=32. 70], measured by Datacolor 650 benchtop spectrophotometer, as is shown in Figure 8.

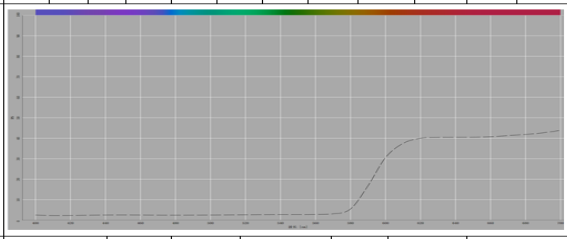
Sample Name	Primary Color Standard – No.1(Datacolor 650, d/8, Benchtop Spectrophotometer)											
Color Coordinates	X	Y	Z	L*	a*	b*	C*	h*	x	y	Dominant Wavelength	Purity
	16.06	9.54	2.71	37.01	48.15	32.70	58.21	34.18	0.5672	0.3370	609.84	73.03
Reflectance Curve												
Reflectance Data(10 nm)	400-450nm	2.56	2.36	2.39	2.48	2.56	2.59					
	460-510nm	2.56	2.51	2.49	2.52	2.55	2.60					
	520-570nm	2.66	2.71	2.74	2.74	2.80	3.13					
	580-630nm	5.50	16.84	30.60	37.51	39.97	40.45					
	640-690nm	40.51	40.54	40.76	41.30	41.90	42.66					
	700n	43.95										

Figure 8. Normalized Color data and reflectance curve of Preferred Chinese RED standard

The final step of this project was to verify the color integrity of the preferred *Chinese RED* candidate on a life-size concrete model, which had been painted on site.

The concrete model was built at the same geographic location as the bridge, which is shown in Figure 9.

Figure 9. Life-size concrete model painted with the candidate Chinese RED on site.

The color data on the painted model will be measured, compared, and evaluated for environmental and weather impact after half year, so that any color change or shift under extreme weather conditions in that geographic area could be identified and evaluated. A portable spectrophotometer was used to measure color on life-size concrete model. The short term color shift had been evaluated based on the data in Table 2. It can be read from Table 2 that the color had very limited changes while the color difference are 0.77 CIEL*a*b* units within 24 hours after painting. Furtherly, the long term color integrity has been recorded and evaluated in Table 3. After half year's on-site weathering experiment, undergoing extreme temperature (as low as -40℃), heavy wind, sunlight, snow, frozen, rain, as well as many other environmental factors, the color change is about 1.49 CIE L*a*b* color difference unit and grade 4.49 (out of 5), which demonstrated good color integrity.

Table 2. The color integrity of the preferred Chinese RED on concrete model- short term

Sample Name：	Preferred *Chinese RED* (x-rite 530, 45/0, Portable Spectrophotometer)												CIEL*a*b* ΔE
Color Coordinates	X	Y	Z	L*	a*	b*	C*	h	x	y	D.W.	Purity	
	15.65	8.83	1.59	35.66	51.63	39.94	65.28	37.73	0.6003	0.3387	609.5	82.82	STD
Sample Name：	Preferred *Chinese RED* on concrete model - 10 minutes after painting												
Color Coordinates	X	Y	Z	L*	a*	b*	C*	h	x	y	D.W.	Purity	
	15.35	8.65	1.48	35.31	51.32	40.50	65.38	38.28	0.6023	0.3397	609.1	83.62	0.73
Sample Name：	Preferred *Chinese RED* on concrete model – 2 hours after painting												
Color Coordinates	X	Y	Z	L*	a*	b*	C*	h	x	y	D.W.	Purity	
	15.62	8.89	1.60	35.77	50.97	40.06	64.83	38.17	0.5984	0.3405	608.8	82.75	0.68
Sample Name：	Preferred *Chinese RED* on concrete model – 24 hours after painting												
Color Coordinates	X	Y	Z	L*	a*	b*	C*	h	x	y	D.W.	Purity	
	15.78	8.97	1.58	35.93	51.17	40.49	65.25	38.35	0.5991	0.3408	608.6	83.05	0.77

color changes

Table 3. The color integrity of the preferred Chinese RED on painted model- long term color changes

Sample Name :	Preferred *Chinese RED* on concrete model (24 hour)					Total Weathering Fastness†	CIEL*a*b* ΔE
Color Coordinates	L*	a*	b*	C*	H		
	35.93	51.17	40.49	65.25	38.35		
Sample Name :	Preferred *Chinese RED* on concrete model (194 Days)						
Color Coordinates	L*	a*	b*	C*	h		
	35.28	50.48	39.34	64.01	37.93	Grade 4-5 (Excellent)	1.48

†: (AATCC Gray Scale for Color Change)

The results from color changes are shown the color is close to the preferred *Chinese Red* designed. It is also means that the colors designed are communicated and duplicated successfully with digital approach. In addition, the design purpose was accomplished not only in terms of aesthetic and appearance, but also in terms of application methods related to color integrity and techniques such as paints selection and painting. While at the same time, the paint chosen has good weathering colorfastness in the long term.

The bridge was completed and opened to public traffic in January 2013.

Figure 10. The photos of Wusu Bridge and Chinese RED,
Panoramic View at noon (top); Night View (bottom-left); Sunset View (bottom-right)

Conclusion

This is the first instance color design and application for a bridge motif using digital methods from beginning to end. The "*Chinese RED* was described artistically and defined scientifically, The color coordinates based on CIE L*a*b* color space and reflectance data of *Chinese RED* were used for color design process and will be kept for future references. Meanwhile, the color data of *Chinese RED* were related with proofed formulation and paint coloration process. This approach took the advantage of the digitized color measurement, color quality control, color formulation, and real-time color communication technology to extending the color application between art and science.

However, it should be addressed that the subjective evaluation by the designer should never be underestimated which is the source of creative ideas and inspirations. This paper provides an insight using digital color technology for color design, duplication, evaluation, and communication. With the development of more advanced and précised color and image system, it can be foreseen the digital technology will be more widely used in color design and application.

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Preconditions of Research on a Esthetic Experience of Colour

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Abstract

This is an attempt, from an epistemological point of view, to describe preconditions of research on aesthetic experience of colour.
In ancient and medieval philosophy the world has an intrinsic structure that appears as 'harmony' (gr. harmonia); 'harmony' reflects the outer cosmos or/and a divine ideal order of the world.
Since the Age of Enlightenment 'harmony' lies in "the eye of the beholder"; it is looked upon as an aspect of the aesthetic experience. Aesthetics is an epistemology and aesthetic experience an overall coherent understanding of the world.
The task of human perception is to make the surrounding world complete, stable and apprehensible. Aesthetic experience fulfils the same purpose. It reflects the perceptual order of the human ecological niche, the way human beings adapt to the world as a whole.
Perceptual adaptation is not only automatic but also dependent on understanding, visual experiences and culturally based aspects. Thus, the experience of harmony is multiple; if, for example, colour harmony means that we feel that colours "fit together" or "hold together", we could expect experiences of colour harmony at several levels of experience simultaneously: when colour combinations follow basic perceptual rules (for example our natural ability of recognizing colour distinctions and colour similarities), when colours correspond with colours of an environment that we are familiar with, or/and, when a colour combination reflects a culturally based meaningfulness (colours of a national flag, heritage colour schemes, etc.).
The complex nature of aesthetic experiences has implications for the possibility of using traditional scientific research methods. Aesthetic experiences are made up of perceptual qualities. They cannot be reduced or separated from their spatial and cultural context and require a holistic approach and a qualitative research methodology. This necessitates Inter-disciplinary studies and calls for common basic perspectives on aims and purpose of colour perception.

The world of colours is dynamic and colours have many perceptual qualities, but nevertheless the experience of colour has a nature of coherence. Just like all sense experiences, colour is perceived and understood on different levels, from the basics that are common to all humans to the most rapidly changing cultural trends.

The visual aesthetic experience is an aspect of the human coherent experience of the world around. To a large extent it is to be taken in intuitively. Perceived colour and form is a logical structure recognized intuitively. At the same time, experiencing always

means to find ways of choosing what in a given context has to be attended, to develop an *attention structure*. Finding new approaches and new ways of thinking demands abilities to make this kind of "perceptual judgments". Seeing something *as* something or seeing something *in* something is fundamental to art and science, to human life. The visual experience is complex and difficult to grasp.

In this paper I try to describe, from an epistemological point of view, preconditions of research on visual aesthetic experience and argue for the necessity of an interdisciplinary approach based on ecological perspectives, phenomenology and aesthetic philosophy. This text is primarily about colour and colour experiences. In real life colour and light are very closely related, almost inseparable and "two sides of the same coin". Therefor they are often mentioned together below.

Background

In ancient and medieval philosophy the world is seen as having an intrinsic structure that appears as 'harmony' (gr. *harmonia*); harmony reflects the outer cosmos or/and a divine ideal order of the world. Ancient and medieval art reflects cosmos; it does not copy nature, but synthesizes it. It reconciles the eternal outer structures with the human modes of experience. Thus classical art – and harmony – could be described as 'objective' and 'mathematical'. (Jørgensen 2001:50-54) The Age of Enlightenment puts human beings at the centre of the universe. Since the Age of Enlightenment there is a reliance on explanations that emanates from the individual; 'harmony' lies in "the eye of the beholder" and is looked upon as an aspect of the aesthetic experience. Gottlieb Baumgarten, originator of aesthetics as a specific academic discipline, describes knowledge that implies coherent intuitive understanding and is given directly by sense experiences (Baumgarten 1739 [1983:80]). He defines aesthetics as the 'science of perception' or 'science of sensitive knowing'. (Brady 2003:8). In this sense Baumgarten's aesthetic experiences are what we today would call *coherent human sense experiences*. Aesthetics is, according to Baumgarten, not concerned exclusively with art. The aesthetic experience is an overall coherent perceptual understanding. In aesthetic experiences theintellect and the senses are given equal weight and the human subject is seen as the source of any knowledge we may have of the world. (Labio 2004:4-6).

Human experience and esthetics

The perceptual systems have developed for millions of years interplaying with the surrounding world. There is a tight perceptual attunement between human beings and their environment. The perceptual relationship between the outer world and the human inner world is natural and without hindrance (Gibson 1979).
Human perception works with the aim of making the surrounding world complete,stable and apprehensible. Aesthetic experiences fulfil the same purpose. They reflect the perceptual order of the human ecological niche, the way human beings adapt to the world as a whole. Human experiences are by nature subjective, but their perceptual and mental basis is functionally the same for all human beings. In aesthetic experience

we consciously attend to our spontaneous perceptual process of understanding; attending to aesthetic qualities in art and design – or in the world around – means that we open up for reflection on experiences as such. What we attend to is the perceptual qualities – for example colour and light qualities - not the physical thing.

Human experience of colour and light in space is both perceptual and cognitive. What we call adaptation is not limited to basic physiological reactions (Noë 2004:1–3); it is interplay between the individual and the world on many levels. These include the basic level of innate reactions, the level of perceptive skills based on direct experience of the world and the level of cultural context.

What we could call harmony is, from this perspective, dependant on perceptual preconditions, direct intuitive experiences of the world around and culturally based aspects. If, for example, colour harmony means that we feel that colours "fit together" or "hold together", we could expect experiences of colour harmony at several levels of experience simultaneously. Colour harmony would appear when colour combinations follow basic perceptual rules (for example our natural ability of recognizing colour distinctions and colour similarities), when colours correspond with colours of an environment that we are familiar with, or/and, when a colour combination reflects a culturally based meaningfulness (colours of a national flag, heritage colour schemes, etc.). (Klarén 2012:27-28).

Interdisciplinarity and common perspectives

The complex nature of human experiences has implications for the possibility of using traditional scientific research methods to describe and analyse experiences of colour and light. This does not, however, mean that systematic research on the coherent colour and light experiences would be impossible, but that it has certain important limitations.

Physical and physiological studies on colour and light have merely an indirect relation to human experience. Their contribution to description of colour and light is limited to causal relations. Phenomenological studies, on the other hand, are direct and holistic, but they seek essentially to describe rather than explain.

Direct experiences are coherent, dynamic and dependant on the surrounding world. They are made up of perceptual qualities and cannot be reduced or separated from their spatial and cultural context. They understanding of the interaction between colour and light demands a holistic approach, a qualitative or descriptive research methodology and an interdisciplinary approach including such fields as psychology, neurology and lighting technology. It also requires a deep understanding on colour and light applications in architectural spaces. Although relevant research has long been carried out within all these fields, knowledge is, however, still fragmented and lacks coordination.

In the fields of colour and light important steps have been taken in direction of interdisciplinarity by the Nordic research project *SYN-TES: Human colour and light synthesis. Toward a coherent field of knowledge* (2010-2011). It involved researchers and practitioners specialised on colour and light from different

academic disciplines and industries working with light sources, paint, colour standards and window glass. SYN-TES has carried out studies on colour and light together from a number of different disciplinary and practical perspectives. Seen in an international contemporary perspective the interdisciplinarity that characterized SYN-TES was unique. (Fridell Anter et al 2012a, 2012b).

Interdisciplinarity includes not only comparative studies of parallel fields of research, but also integration of ideas and knowledge. This calls for common basic perspectives on aims and purpose of colour and light perception. Without common perspectives the research results run the risk of being as limitless as the studied reality.

Colour and light research is in one way or another always related to the human coherent spatial experience of the world around. A possible common perspective to all fields of research on colour and light could be phenomenological and ecological; there are in the phenomenological tradition attempts such as David Katz' definitions of spatial modes of appearance of various colour and light phenomena (Katz 1911[1935]) and James J. Gibson's ecological approach to visual perception (Gibson 1979). The correspondence between Katz' phenomenology and Gibson's ecological perception indicates a possible way to a coherent ecologically based phenomenology describing colour and light as parts of a coherent human experience of the world.

Another possible common perspective – or common platform for research - could be found in aesthetic philosophy. The American philosopher Susanne Langer's aesthetic philosophy is a part of the epistemological tradition from Baumgarten. Connecting to Wittgenstein she asks, how do we give symbolic form to the tacit dimension of our direct experience? She claims that the emotional content we can experience in a piece of art or a designed object is symbolic in a special way (Langer 1957:60); perceptual patterns of colour, light and form, abstracted from their normal context in life, can be used as symbols for "felt life" in pieces of art and in designed objects. Langer calls them logical expressive – or articulated – symbols (Langer 1953:31). The logical expressive symbols are, however, not only valid for expressions in artefacts, i.e. pieces of art or designed objects. We continuously scan the world searching for significant form and meaningful perceptual patterns. Expressive symbols give form to human experiences also of the natural world around. Their sources are both physical, perceptual, cognitive and cultural. Thus the logical expressive symbols can be described and studied on many scientific and philosophical levels and from many aspects.

There is no contradiction between the ecological/phenomenological and the aesthetic philosophical perspectives. Ecology and phenomenology form a context to the "aesthetic" expressive symbols.

Art and research

When it comes to knowledge about aesthetic experience of colour and light, creative and artistic processes are often referred to. It is true that artists, designers and architects, in some respects, are experts in colour and light phenomena. They construct expressive symbols for appearances of colour and light in space. They study the perceptual

coherence of order and significance; intuitively they use it and present it in their works. Art, design and architecture represent a special kind of reflective experience. The American philosopher Susanne Langer remarks, however, that it is not enough to learn the language of the practitioners. To be useful for analyses their working vocabulary and the creative processes behind their works have to be defined and systematized. (Langer 1953:ix–xii). The aim of artistic work is an intuitive understanding, not systematic analyses or scientific or philosophical explanations. In this respect artists can contribute to scientific research and to philosophical studies on human experience.

Describing human experience

The manifoldness of human colour and light experiences cannot be quantified or mapped in detail. No specialised scientific area of research on visual perception or visual understanding is capable of giving a full description of the coherent visual experience. Genuinely interdisciplinary studies, with explicit ambitions to search common concepts and formulations, would, however, gradually contribute to more well-founded and coherent descriptions of visual experience. It would also elucidate the relationship of each specialised area of research to the living visual experience of colour and light as a whole and thus open for new research questions in connection to this broader perspective.

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Mechanisms of Contamination Between Pictorial and Architectural Space in Contemporary Artistic Practices: The Role of Colour

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Abstract

This study is part of a research conducted by the University of São Paulo and implemented in several Brazilian cities about urban chromatic identity. The objective of this paper is to present, through the work conducted in one of the cities chosen to be the subject of this study which here is Belém, Pará, the methodology used to carry out studies and chromatic readings of large and medium-sized cities. The aim is to develop a chromatic palette that is representative of these urban centers.
Belém is located in the northern part of Brazil and is the capital of the State of Pará. The city, which is over 400 years old, has about 1.5 million inhabitants and had its heyday in the early twentieth century with the extraction and commercialization of rubber in the Amazon, the "rubber boom". One of its characteristics is to present an intense chromatic diversity in buildings that blend various historical periods.
Its historical center preserves some important architectural icons as a fisherman's market, several churches and a shopping center with old buildings, many of them coated with ceramics and with a chromatic composition characterized by high saturation colors and sharp contrasts of light.
The methodology used in this study is based on photographic records and the development of chromatic palettes through appropriate softwares, and, whenever possible, in loco readings through the NCS colour scanner, aiming at comparing outcomes. As results, photos, charts and tables in Lab, NCS, Munsell, and HSB systems are presented.

1. Introduction

This paper belongs to a developing practice-based research on the use of colour as groundwork in the creative process of contemporary painting, analysing specifically its transformative potential and significance in the artistic practice that somehow connects pictorial and architectonic languages, mainly in the field of expanded painting. The study is a consequence of my work and experience as a painter; a work where colour, a visual and expressive element that is volatile, ambiguous and continuously deceives, is protagonist in the creative process of pictorial objects that perform an appropriation of architectonic elements or that assume a more evident architectural dimension and quality. In this process,

colour is able to transform significantly space and the way we perceive and experiment it, both the space represented in painting and the space created by painting through its distension to real space, its expansion and three-dimensional derivation. In this case, chromatic relations can provide a more physical and interactive experimentation, being connected with the architectonic space. I want to explore distinct mechanisms of contamination between pictorial and architectonic space, incorporating architecture's formal and structural specificities in artistic objects that are always and primarily painting. In the dichotomy between geometric space and open space designed by the language of landscape there is an interdisciplinary exercise: painting quotes architecture, needing also to leave its own field, which might start in the definition of the support and the way it connects with the exhibition room, diluting boundaries. Throughout this process, architecture can be translated into an artwork of small-scale or in the orientation of the artwork to an architectonic, monumental scale, occupying space and inviting the spectator to physically experiment the artwork. In any event, the intention is to relate space, scale, limits, matter, construction and habitability in a pictorial object, manipulating these concepts through the expressive and defining potential of colour: its ability to be and behave in different ways in distinct spaces and contexts, evidencing a vulnerability that is intrinsic to the changing nature of its expression, organization, identification and orientation. Due to this changing volatile and unstable nature, the discourse on colour is, in fact, often divergent and inconclusive, which is transversal to distinct knowledge areas. Mainly when it is constructed in an artistic context, the colour subject is fundamentally approached and though in the act of doing things and through practice (Batchelor [2008: 15]). As David Batchelor states, at least over the last century and a half, the discourse on colour has been, for the most part, a discourse of reflexions, observations, asides and remarks, being fragmentary, contradictory, difficult to generalize. The one thing that we can be consensual about is that it is a discourse made in and through practice. That is why the author argues that colour is not largely an academic discipline; rather it is generated in the course of making things (Batchelor [2008: 15]). In studio art investigations the concepts of investigation and creation tend to merge and be contaminated, so it is based on this assumption that this research wants to approach colour subject through a continuous artistic experimentation in the field of painting, connecting practice and reflexion in a coherent unit. In this process, it is fundamental not only to import the results of the developed artistic practice to the final results of the investigation, but also to understand how artists currently approach the concepts and processes coincident with this investigation. In fact, it is fundamental to frame my artistic practice in the context of several and distinct approaches to the privileged use of colour in contemporary practices: do artists, today, use colour in a preferential, specific assumed way and work with it as an autonomous element that defines the composition and interferes in the perception of space? Or is *chromophobia*, as defined by David Batchelor (2000), still interfering in contemporary artistic practices? When artists or architects assume the significance of colour in their work, which strategies do they use, in their creative process, to perform it? How is colour relevant in their work, how do they

relate to it, how do they apply it, do they assume it, how can colour be central in the construction of artistic objects? And what role colour plays in contemporary art? When Batchelor talks about *chromophobia*, he argues that colour has been an object of extreme prejudice in Western culture (Batchelor [2000: 22]). Since antiquity, colour was systematically marginalized, diminished and target of a fear of something that seems unknowable. This *chromophobia* that denies colour complexity manifests itself, according to the author, in two essential ways: colour seen as some "foreign" body linked to concepts as the feminine, the oriental, the primitive or the infantile; or colour perceived as a secondary quality of experience, something superficial, supplementary and inessential. So, colour would be dangerous, trivial or both. Even advancing to the present day, the belief that seriousness in art is an issue in black and white still persists (Batchelor: [2000: 23]).

However, some significant changes occurred: we can use the example of the exhibition curated by Ann Temkin at the Museum of Modern Art, New York, in 2008: *Color Chart: Reinventing Color, 1950 to Today.* The exhibition gathered the work of forty-four artists that, at some point of their careers, used colour in a privileged way. The exhibition took as its starting point the commercial colour charts, addressing the impact of standardized, mass-produced colour on the art of the past sixty years (Temkin [2008: 16]). This acknowledgement of colour as a matter-of-fact element, common and accessible, rather than a vehicle of spiritual or emotional content, represented a major artistic shift that took place during the middle of the twentieth century. This change of perspective on the topic of colour, whose subjective and emotional dimension lost power throughout the twentieth century, was coincident with a new attitude from the artists themselves: they started rejecting the artistic traditional pedagogy about the right colour relationships and, instead, adopted aesthetical approaches that relied in ready-made sources and arbitrary systems, using colour bought off the shelf or assigned by chance, loosing the idea of the traditional colour harmonies. Thus, artists work with colour as an autonomous element that is appropriated and used directly as it is, using chance, intuition and randomness. Batchelor argues that there are three different but connected levels of autonomy that are assigned to colour in this context of use: the autonomy of colour from every other colour; the autonomy of colour from colour theory; and the autonomy of colour from the register of representation (Batchelor [2000: 105]). So, there are no hierarchies, each colour is independent from the other, colour is assumed as a theme, a concept, a source and raw material, simultaneously. Colour is colour and doesn't have to be associated to an object, a landscape or an excerpt of architecture. Artists like Donald Judd and Gerhard Richter sought an approach to colour through the intellect and not through an emotional or sentimental level. With his colour charts, Richter concentrated on accident, indifference, and the pleasure in looking. He broke with all forms of expressive and symbolic statement associated to colour [5]. Other artists like Jasper Johns, Ellsworth Kelly, Kenneth Noland, Al Held, Sol Le Witt and Frank Stella worked with colour charts, dissociating colour from any traditional mean or strategy and redefining the parameters of colour.

Nowadays, it is worth questioning the place, role and significance of colour in contemporary artistic practices and what conscience do artists have about that role. It is also worth trying to answer Ann Temkin's question: What defines colour after colour theory? (Temkin [2008: 8]).

This paper aims to propose a contemporary approach to colour subject, focusing some examples and confronting them with my own artistic practice, a practice where colour is, in an assumed way, essential. It is important to frame the act of composing and creating through colour in artistic contemporary practices, emphasizing the specific cases of artworks that represent an abolishment of the frontiers between painting and architecture. I intend to cross my creative process with the ones of three selected artists or architects that gather, in their body of work, issues, processes, themes, concepts or techniques coincident with this investigation and, thereby, that intersect my own artistic work at some point. The main purpose is to think about colour from the perspective of experience.

2. Colour In The Creative Process: Intuition, Trial And Error.

Colour is a theme of assumed and unquestionable ambiguity and prone to divergent results. The fact that it is hard to systematize and that the identity of each colour only arises through a relational process leads to an unavoidable reflexion about the role of intuition in the creative process that focuses on colour and chromatic relations, tensions and interdependence. How much of reason and intuition are part of the artist's decisions? Josef Albers argued that the development of sensitivity for colour arises through experience (Albers [1976:4]). The author proposes that, through experience and a process of trial and error, we can develop the ability to see colour, its action, relations and connectivity. This strategy comes from the fact that colour is an element of enormous subjectivity and that deceives continuously, evoking several interpretations. So, it is important to question if an artist that works in an assumed and privileged way with colour is able to develop, through experience, an intuition that leads him to perform precise and balanced choices in his creative process. For Albers, what matters is to see what happens between colours (Albers [1976: 1], but can the intentions inherent to a creative process based on colour interaction be effectively controlled? If colour identity arises exclusively by relation and we can´t isolate it from a context containing a number of variables, how can we identify and establish an order and balance, or a disorder and chaos, in an artwork where colours are determinant? How can we control the results, reactions and perceptions of an established order, if we can´t control the variables?
I believe that this control and establishment of an order arises through experience. We need to manipulate colour to understand its transformative potential and the way it changes an entire composition based on one decision or one choice.

In my creative process, I start composing exclusively through colour. I can use a blue stain crossed by two red lines as the beginning of the work. Everything that comes next has to dialogue with the previous choices, even that it is to erase it, to abolish their significance. This is a process of trial an error and continuous experimentation, a process of adding, nullifying, emphasize, of effective and affective utilization of the error, the problem and the uncertainty. Intuition is, in fact, used in a compatibility platform with a cycle of thinking/action and information/transformation. Colour, here, is used as a subject and an experience, a physical experience from the act of doing things. It is nothing else than itself and, for that reason, governs the creative process, composes the image, guides its construction and management, transforms significantly space, landscape and architecture's grammar, using a relational process to influence the perceptive and interpretation results. Therefore, there is an appreciation of the sensorial experience of the artwork, which has the ability to seduce, using chromatic relations to achieve it. In these creative mechanisms that assume a grade of randomness and variability, after several wrong solutions there is always one that assigns significance and indispensability to the previous ones. That is why there isn't a plan, only strategies to complete a balanced and necessary composition, strategies that are based on a previous continuous experimentation.

In my painting work [Figures 1-10], the appropriation of architectonic language to pictorial space, even turning it into something dysfunctional and fictional, connects to chromatic relations to design and structure landscape. The search for an idea of three-dimensionality in a two-dimensional base arises in the use of colour to create an image of depth, of several reading plans and also in the fact that these are representations of places and landscapes that appeal to our desire to inhabit them. There is an interest in the formal and aesthetical dimension of the architectonic language and the represented constructions, being wrong and impossible, intend to question what makes us feel at home, protected and sheltered. The house arises, here, as a paradigmatic example of the approach to place, to the intimate, personal and emotional experience of inhabiting, occupying and using.

Colour becomes fundamental in the process of creation of these landscapes, where architecture seems to be transformable, flexible, virtual, ephemeral and malleable, devoid of its functionality and pragmatism.

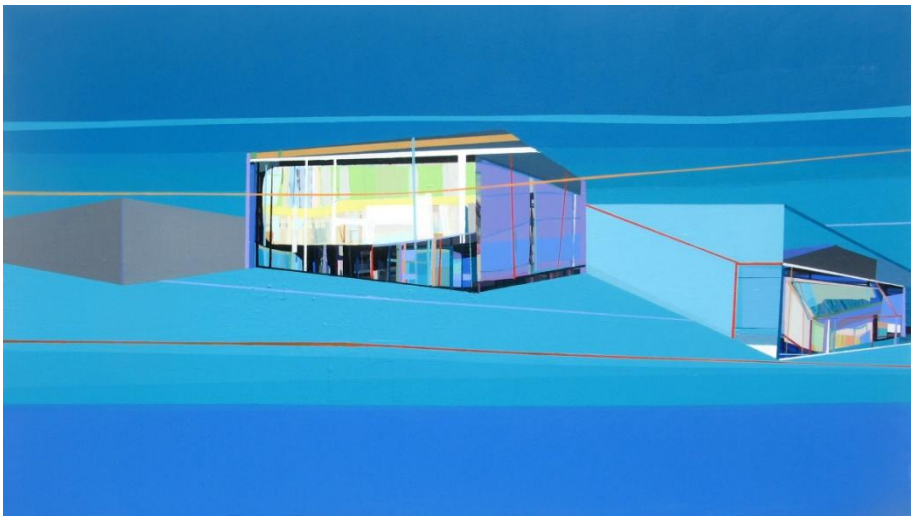

Figure 1. Ana Pais Oliveira. New strange place to live #16. Acrylic on canvas. 130x230cm. 2011.

Figure 2. Ana Pais Oliveira. Impressive constructed memory #6. Acrylic on canvas. 100x150cm. 2012.

The creation of a more direct relation between painting and architecture, especially between pictorial objects and architectonic space, became a natural and necessary consequence of my studio art investigation. In fact, painting would probably not evolve as it did if it wasn´t inserted in a platform where theoretical research is important to revive and transform the artistic object. One of the first projects that had the purpose of leaving painting without leaving it was the series entitled *Houses, several corners of the world*, developed in 2012 [figures 3 and 4] The project is composed by seventy drawings with collage on different coloured cardboards. It is a work that wants, precisely, to create a more direct relation between the support of painting or drawing and the architectonic space. Each piece has its own autonomy, but the project contemplates its view in a frieze that designs a colourful line (of about 24 meters) in the architectonic space or exhibition room. The interaction of the

chromatic results achieved through the different funds appears only when the drawings are exhibited together. It is intended to create a game of contrasts and harmonies, approximations and deviations, a dynamic and pulsed reading of the whole piece, that models space and our perception of it through colour.

Fig. 3 - Ana Pais Oliveira. From the Series Houses, several corners of the world. #62 and #15 from 70 drawings 15x30cm. Drawing and collage on coloured cardboard. 2012.

Fig. 4 - Ana Pais Oliveira. Excerpt from the Series Houses, several corners of the world. 70 drawings 15x30cm. Exhibition view, Espaço Habitado, Espinho, Portugal. 2012.

At this point of the investigation it became crucial to explore new three-dimensional options. The project *Neighbourhood* [Figures 5 and 6] comprises a series of elements that come together in an exhibition context, resulting of the articulation of wooden panels with the dimension 13x18cm. Several supports were used to compose two three-dimensional pieces through chromatic relations. The pieces are intended to be three-dimensional paintings: they are exhibited in the wall, but they materialize a need to bring out some constructions present in the paintings. With this exercise, using their values, hues and luminosity can enrich chromatic relations. In *Neighbourhood #2* [Figure 6] colour is, in fact, used as a concept and an autonomous element that creates an architectonic construction through different saturations of the same or similar colours.

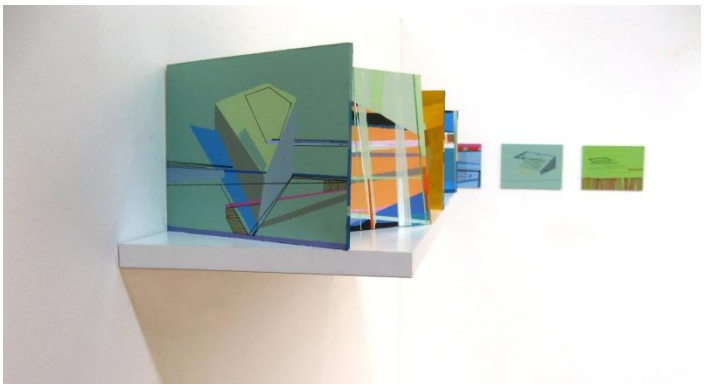

Figure 5. Ana Pais Oliveira. Series Neighborhood (Exhibition view). Acrylic on canvas, wooden shelf. 2012.

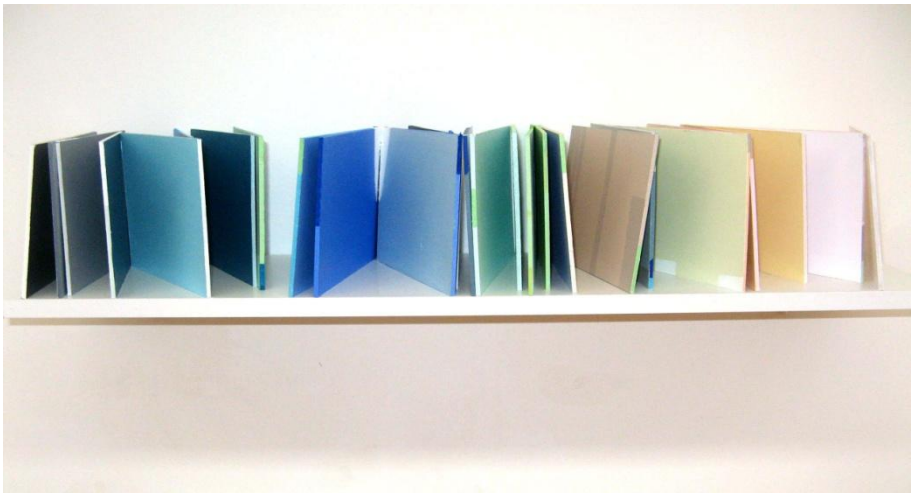

Figure 6. Ana Pais Oliveira. Neighborhood #2. Acrylic on panels with canvas, wooden shelf. 80x20x15cm. 2012.

In more recent work, the support of painting is used to provide a three-dimensional perception of the piece, giving the idea that painting wants to leave its own field, intercepting the spectator's perception with volumes with different widths and thicknesses [Figures 7-9]. The different canvases are like architectural blocks, neighbourhoods and shelters that are always connected to the architectonic representations in pictorial space. The spectator can wish to contour and physically explore houses, shelters, volumes and containing forms.

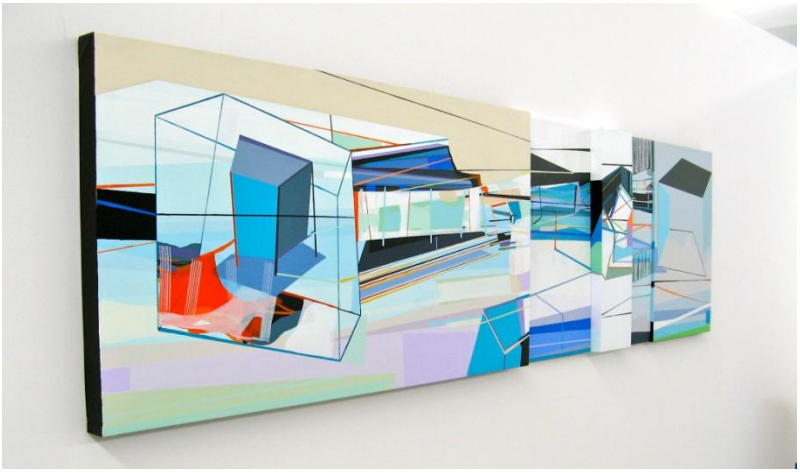

Figure 7. Ana Pais Oliveira. Neighborhood #4. Acrylic on canvas. 70x 260cm (5 canvases with different widths and thicknesses). 2013.

Figure 8. Ana Pais Oliveira. Entrada privada. Acrylic on canvas. 80x 290cm (6 canvases with different widths and thicknesses). 2014.

Figure 9. Ana Pais Oliveira. É favor entrar. Acrylic on canvas. 130x135x10cm. 2014.

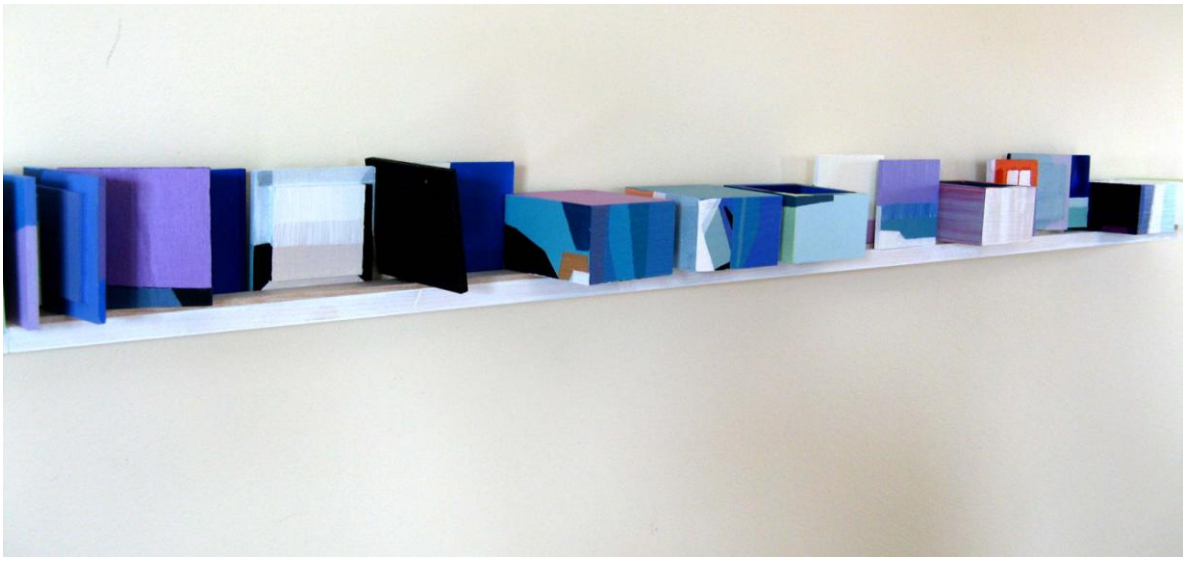

Figure 10. Ana Pais Oliveira. Onde vamos morar? Acrylic on canvas. 120x6x6cm. 2014.

3. Colour in the work of selected artists and architects

3.1. José Bechara

The selection of some artists or architects to deepen in this investigation was based on the intention to find, in the work of each one of them, a specificity more expressive and significant that could justify the choice and inform the artistic reflexion of this research. But the first criterion used to perform these choices was based in a subjective, almost emotional perspective: there is a great sense of identification and proximity between my work and theirs.

José Bechara, born in 1957, is a Brazilian artist that started his career as a painter, but soon had the need to explore different methods and materials to create constructions that allow distinct experiences in the pictorial field. In any event, the use of colour in a boldly way and the remnants of his experience as a painter are present in the sculptural work and transversal to his entire production. José Bechara embodies a paradigmatic example of the

progressive expansion of the traditional field of painting, using pictorial language in different supports and materials. He soon abandoned the traditional support of painting and started using, instead of paint and canvases, truck traps, cattle leather, oxidation and copper emulsions. Then he had the need to perform a sculptural experience. His work approaches an intermediary and indefinite field where painting, sculpture, drawing, installation and architecture intersect and become contaminated. In fact, we could try to frame his *Graphic Sculptures* or *Spatial Drawings* in a tight field, but that would be unsuccessful because they represent the perfect example of how painting, architecture, sculpture and drawing can meet in the same object. The questioning of the specificities of each language starts in the title itself: they are sculptures, but also a three-dimensional derivation of drawing. The artist draws the full and empty volumes in the architectonic space, occupying it with colour. Maybe we could call this series of works *Graphic Paintings*, as colour is so important in the way occupies space and provides a true pictorial experience. In *Ultramar com 9 cabeças*, ultramarine blue pervades our senses, and that is why I need to look at this piece as a three-dimensional painting that imports architecture specificities in the way it presents a geometric plot distended to real space.

Figure 11. José Bechara. Ultramar com 9 cabeças (from the series Esculturas Gráficas). Vinyl emulsion and ultramar pigment on wood and balsa wood, 2010. Extracted from www.josebechara.com File captured on 22 January 2014.

In Bechara's work, the theme of the house is frequent and enhances the communication interface of the artwork with architecture. The house is treated in a symbolic and plastic way. Thereby, in the work of Bechara architecture can be a small house impossible to inhabit, painting can be the result of the oxidation of an appropriated material, and space can be manipulated by a three-dimensional deviation and extension of drawing. Colour is always important. In the series Open House, for instance, colour can become fundamental to confer a pictorial dimension to an object that can be seen as sculpture or even architecture.

In fact, Bechara said he never stopped painting. He started an adventure in sculptural field without leaving painting. He says that in certain works, the residues of a sculptural thinking are present in painting work, and also the opposite. He could be investigating the presence of colour in a sculptural operation even that he was exclusively a sculptor. But he argues

that he needs to do that as consequence of his experience as a painter. Thinking about how colour can contribute to the intention that he has with a sculptural work, the idea is to confront it with part of the previous painting production, in a process of mutual contamination. And despite of the experiences with drawing, sculpture and installation, Bechara believes that painting ties it all (Bechara [2013]).

Another relevant specificity of the work of this artist, in relation with the purposes of this investigation, is the fact that there isn't, in his creative process, a plan. Bechara says that rarely a new work comes from a plan. In fact, every plan goes wrong, doesn't work. He does not specifically cause the accident, but he pays attention to it. The intention exists, but in fact it is not needed, it is not straight and it is attracted by the accident (Bechara [2013]).

Figure 12. José Bechara. Casa Maior (from the series Open House). Formica, MDF and PVC. Variable dimensions around 50x80x100cm. 2006. Extracted from http://www.josebechara.com File captured on 23 September 2011.

3.2. Pedro Calapez

Pedro Calapez, born in 1953, is a Portuguese artist that works between painting and drawing, figurative expression and abstraction, using multiple-part image compositions on geometric surfaces that are interfered with expressive gestures and striking colours. He uses strong primary colours to define the pictorial space of aluminium boards. The artist is interested in the pictorial and architectonic treatment of space. Architecture is, in fact, one of the organizing references of his work, but it is translated in contradictory lines and perspectives, becoming a fictional architecture. As he states, what typifies his work is the reference to representations of the landscape, of the architecture, of the space, whether inside or outside, spaces surrounding the observer. In the act of drawing through architectural representations, the artist performs an interrelation between lines and colour fields, a contamination process that can fluctuate: the space of colour and the space of line sometimes compete; sometimes come together. For Calapez, the choice of colours in his work is very intuitive and visual, fact that embodies the main specificity of his work that

connects with this investigation and my own artistic practice. Colour is an expressive visual element in Calapez's work and the fact that his choices are made based on intuition and in a visual action approaches the idea of constructing a discourse on colour based on experience. Pedro Calapez is interested in colour-field painting, because of the involvement of the spectator in that chromatic field. Then, he surely performs an expansion of paintings' field, turning the concept into something distensible and volatile. Since the mid-1970s Calapez has built a language within the scope of the "expanded field", as defined by Rosalind Krauss at the end of de seventies, regarding sculpture extension and "its extraordinary demonstration of elasticity" (Krauss [1979]) The truth is that chromatic relations can become more rich and impactful when they relate to the dialogue between pictorial and architectonic space, transforming the perception of artistic objects that dilute the boundaries between painting, sculpture and architecture.

Figure 13. Pedro Calapez. Mod #2. Set of 59 acrylic painted aluminium panels. 210x900x24,5cm. 2007. Extracted from http://artnews.org/artist.php?i=4663 File captured on 23 September 2011.

Figure 14. Pedro Calapez. Group one. Acrylic painted aluminium panels. 73x79x13cm. 2009. Extracted from http://www.seippel-gallery.com/cologne/exhibitions-past.php *File captured on 23 September 2011.*

3.3. Herzog & de Meuron

Herzog & de Meuron are two Suisse architects, Jacques Herzog & Pierre de Meuron, both born in 1950. Their architecture projects are frequently inserted in the discussion of if they are art or architecture, mainly because of the way they privilege collaboration relations with artists. They started collaborating with artists since the late 70s and frequently privileged this enriching collaboration from the beginning of the projects, which is different from decorating architecture after it is finished. These transdisciplinary relationships became a brand of their work and this is the specificity that made me choose them: the way architecture and art can connect in real space, in a building that wants to interact with the spectator and user as an artwork. Architecture, in fact, even started to be shown and discussed in the context of the art world. Since the 80s, Herzog & de Meuron has shown how the outer skin of the building can function as a set of images regardless of the receiving structure. An example is their collaboration with Thomas Ruff for the facade covered with images from the Eberswalde Technical School Library in Germany, a project from 1999. The architects wanted to combine a building with images and Thomas Ruff was invited to choose the images for the facade. Herzog & de Meuron decided the size, materiality and organization of the motifs. The result arises as an architectonic work of art where the idea of tattooed skin emphasizes the density and identity of the building. The skin appears like a two-dimensional surface that involves the volume of the building. Translucency and mutability take the place of the permanent and settled feature so common in architecture.

But another project where colour is protagonist in this collaboration relation between artists and architects is the Laban Dance Centre in Deptford, London, where Michael-Craig Martin was invited to integrate this project from 1997. This artist is known for his wall drawings of vibrant colours. He uses colour in a bold way and Herzog & de Meuron knew they wanted to use colour as a defining feature of the building, something that would benefit from the dialogue with an artist. Craig-Martin tried to develop a way of integrating the solid surfaces from the interior of the building with the translucent effects of the exterior surfaces and, to achieve that, he used a colour scheme in the three main corridors of the building. Colour turns out to define the rhythm and orientation both inside and outside the building, giving a particular identity to each part of the dance centre. Craig-Martin used lime, turquoise and magenta semi-translucent polycarbonate panels, turning the interior more penetrating and vibrant and the exterior more light and translucent. This is a perfect example of how colour can become an essential visual element to connect art and architecture.

Figure 15. Herzog & de Meuron. Laban Dance Centre, Deptford, London. Project with collaboration with Michael Craig-Martin. 1997. Extracted from http://www.panoramio.com/photo/37605821 . File captured on 10 June 2014.

4. Final Considerations

Each of the selected artists or architects to work in this investigation have a specificity connected to the relation between colour, painting and architecture, informing the artistic research that it is being made. It is fundamental to understand how they work with colour nowadays and to frame the discourse on colour in contemporary practices. A final and primordial purpose of this investigation is to create an exhibition project where it will be included the developed work that better represents the results of this research and better reflects the primordial use of colour as a way to intersect and hybridise painting and architecture in the same object. What can be said at the moment is that the discourse on colour is present in contemporary artistic practice, even that it is in a non assumed way. Pedro Calapez, José Bechara and Herzog & de Meuron are three examples of artist and architects that value the transformative capacity of colour, specially connected to space issues, but many others experiment colour in their contemporary artistic practice. Roland Barthes described colour as *a kind of bliss*, something that is new each time. Fascination and mystery are a constant of chromatic relations and their possibilities. Even that we can certainly still find some *cromophobia* in contemporary art galleries or in contemporary artistic discourse, the fact is that many contemporary artists find necessary to value the pleasure of looking, the beauty and seduction of the artwork, something that it is easily achieved through a profuse and striking use of colour. Nowadays we certainly hear much talk about processes, concepts, devices, technology and even if the artwork is new… but much less about beauty and the ability to seduce that the artwork can provide. That role of provoking emotion, seducing and assuming the experimental and formalist pleasure of the

artwork is very legitimate nowadays. Painting, as an object with the ability to speak and explicit the act of thinking, has also that ability to seduce, often through colour.

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Dos Grandes Pilares del Arte Argentino:
Xul Solar y Antonio Berni -Y sus valiosas influencias-

María del Carmen Puccio

Abstract

From the works of two Argentinean artists who have very different conceptions of the use of colors and shapes, an analysis was performed, whose goal is to understand the use of color and shape. Both vary not only according to the criteria and ideals of their lives but in line with the country and the historical moment in which they live.

Antonio Berni (1905-1981), enriched the field of Visual Arts with new techniques, the use of color in his pictures varies according to the trends he experienced. His palettes are subject to emotions, as we will see in this work. This artist is dedicated to closely observe the extreme poverty of the 1930s Argentina and performed his works, as testimony to this reality, denouncing the economic and political situation of the country. Committed artist, controversial politician, he is considered one of the most important artists of the twentieth century in Argentina. The year after his death The Konex Foundation awarded him with the most relevant honor dedicated to the visual arts affirming: 'For Antonio Berni painting is a form of love to pass the years in art'.

Alejandro Xul Solar (1887-1963). His production is characterized by originality. He shared his artistic interests with Jorge Luis Borges and Emilio Petorutti, was an eccentric artist of great culture and simple manners. He generally used colors based on his studies of the European avant-garde from the 30s and 40s. He created strange landscapes and original designs, full of fantasy, which enlightened his studies: Theosophy, mysticism and astrology. He designed imaginary future cities, used geometric shapes and symbols, saturated colors with a freshness that makes his work easily recognized by the peculiar language that characterizes it.

The end result will compare both painters by the use of color in their works.

Xul Solar (1887-1963)

Oscar Agustín Alejandro Schulz Solari (1887-1963), nació en la Argentina. Su padre era alemán y su madre italiana. Transforma con ambos apellidos "Xul" de Schulz (paterno) y "Solar" de Solari (materno), su nombre artístico.

Xul Solar , además de pintor, fue un autodidacta, estudioso, habló ocho lenguas y creó otras. Apasionado por la Literatura, la Historia del Arte, Religión, Astrología, Música, Teatro, Filosofía de Oriente y Occidente, entre otras disciplinas. Realizo estudios para una lengua a la que llamo Neocriollo, en su afán por tener una mejor comunicación entre la gente.

Al ingresar a la Casa-Museo de Xul Solar, ubicada en la calle Laprida 1212 de la Ciudad de Buenos Aires, Argentina, la percepción de los espacios arquitectónicos, marcados con desniveles y con varias escaleras que ascienden, traen a la memoria las palabras de Osvaldo Svanascini: "Las escaleras indican la preeminencia del destino. Xul es un artista que conoce las claves astrológicas". El edificio del Museo recibió varios premios, debido a la arquitectura del mismo, que fue la vivienda de la familia, luego remodelada como Xul Solar había concebido el Pan Club en 1930. Este proyecto fue llevado a cabo en1986, después de su muerte, por su esposa Micaela (Lita) Cardenas y por Natalio Porvaché, el marchand del artista. Se inaugura el 13 de abril de 1993, con las obras seleccionadas por el autor, las que componen la muestra permanente del Museo, dedicado a preservar y difundir la producción de una manera extraordinaria, junto a sus pinturas, con objetos tales como el piano, cuyo diseño fue modificado para que el aprendizaje fuera más sencillo, como resultado de los conocimientos musicales que poseía. Tomando como base el ajedrez, crea el Pan-ajedrez donde combina el juego con otras disciplinas. El museo también posee esculturas y documentos que pertenecen a su archivo personal. En la parte superior del solar se encuentra la biblioteca, que posee 3.500 volúmenes. Jorge Luis Borges recuerda "haber pasado tardes en esa espléndida biblioteca, quizá una de las mejores bibliotecas que he visto en mi vida, con libros en todos los idiomas; tres mil quinientos aproximadamente".

Al inaugurarse la muestra de Xul Solar en el Museo Nacional de Bellas Artes, Jorge Luis Borges da una conferencia que luego figura en el prólogo del libro que publica el Museo, afirmando que "los estoicos tuvieron la extraordinaria idea de que un hombre no tenía que ser únicamente ciudadano de su ciudad, Polis, sino ciudadano del cosmos, cosmopolita. Ciudadano del universo. Pues bien, yo he conocido a pocos hombres dignos de ese título, dignos de ser ciudadanos del universo y de sentirse como tales y quizá el único cosmopolita, ciudadano del universo, que he conocido fue Xul Solar". Añadiendo: "Nunca conocí a un hombre de tan rica heterogénea, imprevisible e incesante imaginación"[1] . Por otro lado, en la conferencia que diera J.L. Borges en La Fundación San Telmo, expresa que: "Xul era el más capaz de amistad que he conocido. Creo que le debo las mejores horas de mi vida, leyendo y discutiendo sobre todo, dejándome enseñar por él" [3].

La directora del Museo, Elena Montero Lacasa de Porvaché manifiesta que desea continuar con el pensamiento de Xul Solar: [9] "Querer que este mundo sea mejor para constituir una sociedad en armonía".

En 1912 deja su trabajo como empleado y se embarca rumbo a Europa en un barco de carga inglés, en segunda clase. El primer destino fue Londres, donde conoce el British Musseum. Luego recorre Francia, Alemania e Italia. Permanece hasta 1924 en Europa.

Este fue un período de importantes contactos, conoce a personalidades que marcaran el rumbo en su producción artística, visita museos, galerías, librerías, bibliotecas. donde se enriquece con experiencias, y conoce a los artistas posteriormente más destacados. Estudia e investiga, asiste a reuniones sobre religión, filosofía, astrología. En una carta dirigida a su padre, le relata su acercamiento al arte contemporáneo y sus avances en la técnica de la tempera.

En 1914-1915 se encuentra en Francia, cuando Alemania declara la guerra. Deja París y retorna a Italia. De esta época son sus primeras obras influenciadas por el Expresionismo. Realizadas en óleo y témpera. Al finalizar la guerra regresa a París con Alfredo Guttero y el músico Vicente Forte. Lo recuerdan al lado de Picasso y Modigliani. Alterna en París con otros artistas. [3]"Pinta en acuarela variantes sobre el tema Anjos y hace diversas interpretaciones de Ofrenda quori. Relacionadas con el simbolismo, las obras contienen un hondo sentido místico".

En Turín tiene su primer contacto con las vanguardias europeas a través del nuevo catalogo y almanaque del grupo expresionista "Der Blaue Reiter", donde se incluyó un texto de Kandinsky: [4]"El mundo canta. Es un cosmos de seres de influencia espiritual. La materia muerta es de este modo, viviente". Xul como Kandinsky piensan que el arte realizara un "Giro espiritual ". Para "Der Blue Reiter": [9]"El objetivo común de los artistas, antes que un estilo, era explotar el rol del color, la liberación del principio de imitación, la simplificación de las líneas y el retorno a lo primitivo". Estas ideas son las que llevaran a cabo en sus obras Kandinsky, Xul Solar , Paul Klee y Franz Marc. En su libro "De lo espiritual en el arte", dice Kandinsky: [6]"El artista cuyo objetivo no es la imitación de la naturaleza aunque sea artística que pretende expresar su mundo interior, a veces se encuentra un único hombre"(…) "Su contemplación gozosa es semejante a su inconmensurable tristeza interior". Los que se hallan más cerca de él no lo entienden e indignados le llaman farsante o loco. Así vivió Beethoven, insultado y solo en la cumbre". Muchos años pasaron para que fuera valorado, creo como también pasó con Van Gogh, como con Xul Solar.

Nuestro artista viaja a Florencia, donde conoce a Emilio Pettorutti (1892-1971), ambos recorren Europa y participan en exposiciones, reuniones y diversas actividades con destacados artistas. A partir de 1916 Xul Solar "Crea un lenguaje combinando signos y símbolos, verbal y visual, que coincide con sus intereses espirituales". Se interesa por la Teosofía. Asiste a las conferencias de Rudolf Steiner, se interesa en los temas relacionados con la educación, el arte, la vida, la moral y el lenguaje.

Para Jorge Glusberg [4] "Xul Solar no solo es la máxima figura estética de la primera mitad del siglo en la Argentina" (…) "lo que sería confirmado por la exitosa retrospectiva en el Museo de Arte Moderno de Paris en Octubre-Noviembre 1977". La falta de interés y el desprecio por su obra no lo afectaron. Después de su muerte, como el había pronosticado, sus trabajos fueron reconocidos. "Sabio Renacentista" con lo cual coincido, muy pocas personas pueden abarcar el caudal de conocimientos que poseía este increíble artista.

Su obra posee una esplendida gama de colores, en su mayoría cromáticos. Al ingresar a un museo donde se pueden ver obras de diferentes autores se destacan sus pinturas por encima de las demás. Amarillos, anaranjados, rojos, carmines, verdes, en general en estado puro y generando transparencias por superposición, que tienen una notable frescura, atraen la mirada del espectador. Uno dice, ese cuadro es de Xul, como equivocarse, sus obras son reconocibles por sus diseños, colores y las técnicas. Cuanto más el espectador se detiene ante ellas, mayor es el interés que despiertan.

Beatriz Sarlo haciendo referencia a Xul Solar y a la joven vanguardia que formaba parte de la revista Martin Fierro de 1924, dice: [4]"lo que Xul mezcla en sus cuadros también se mezcla en la cultura de los intelectuales: modernidad europea y diferencia rioplatense, aceleración y angustia, tradicionalismo y espíritu renovador; criollismo y vanguardia. Buenos Aires: el gran escenario latinoamericano de una cultura de mezcla".

Osvaldo Svanascini, fue un importante especialista e investigador de arte, que pudo interpretar, mejor que nadie, las escrituras, signos y símbolos de Oriente, a los que se remite en esencia la obra de este autor, destacó que [8]"no hubo en nuestro medio creador tan imaginativo como Xul Solar (...) éste artista transita por diferentes periodos, entre 1923-1924, realiza una serie de acuarelas de estupenda factura." La calidad plástica es mas evolucionada. Surge así su condición de colorista, que utiliza una extensa variación de tonos, neutralizando a menudo la progresión demasiado contrastante de los mismos mediante el empleo de medios tonos. Las composiciones de sus cuadros se encuentran en perfecto equilibrio. A veces sugiere profundidad, pero en general las composiciones se desarrollan en un primer plano. Sobresalen en esta serie los carmines, rojos, marrones rojizos y amarillos contrastados a verdes cadmio, azules y violetas. La técnico de la acuarela le permite realizar transparencias y veladuras que denotan un tanto fantásticamente las cosas. Se observa en algunas obras el empleo de números, letras y palabras. Destaca planos empleando algunas luces y sombras, algunas figuras se hallan contorneadas con tonos blancos, levemente esfumados y confundidos con los tonos dominantes, confiriéndoles la impresión de un halo mágico. De esta serie, la obra más conocida es "**Homme das serpents**", "Jefa", "Ion cintas", entre otras, "Tlalcoc" y "Chaco", estás ultimas inspiradas en motivos americanos, todas fueron realizadas en 1923.En general emplea formas geométricas, ojos ovalados y aunque este de perfil lo coloca de frente. Estas obras cuanto más se observan, resultan más interesantes y atractivas.

Según Rudolf Arnheim: [1]"El esquema de color característico de un artista podría también relacionarse con el tema de sus obras, como también con lo que se conoce de su personalidad."

Figura 1 "Homme das serpents", 1923, tinta china y acuarela, 25,6 x 31 cm.

[8]"Para Xul Solar el deseo de comunicación entre los seres fue clave inestimable". Vio que a través de la astrología y los sistemas de "pintura –escritura" que constantemente variaba y enriquecía, esperaba llegar a convertirlos, en una aplicación práctica. Los pintores chinos y japoneses llegaron a realizar un ideograma con un alto contenido estético, creando "ritmos y armonías internos". Para ellos la pincelada deberá hacer "visible lo invisible", a través del concepto caligráfico. Esta representación de la naturaleza se estudia en el "Chieh Tzu van Rua Chuan, manual chino del siglo XVII." Sesshu, Sesson como Tohaku llegaron a plasmar un paisaje o una figura sin dejar de lado el sentido caligráfico. En occidente, artistas como Pollock, Schneider y Tobey emplearon los rasgos caligráficos. Tobey en Kyoto asistió a un monasterio, donde practico pintura, meditación, caligrafía y poesía .Hubo otros artistas, que se interesaron por la caligrafía de oriente como Mathieu y Kleine, entre otros .Es indudable que a Xul Solar le atrajeron todos los antecedentes, antiguos y contemporáneos. Estudio todos los tipos de escrituras, que son muchas y me extendería demasiado. Con el fin de obtener un lenguaje pictórico regido por palabras, llamo a sus pinturas de su último periodo "modos de escritura" y separo los diferentes estilos en escrituras cursivas, geométricas, silábicas. Una obra, por ejemplo, repite las palabras "Paz, trabajo, amor", en otra utiliza la frase de San Pablo "Examinar todo retiene lo bueno". Este interés por creaciones originales pone también de manifiesto su idealismo. Esperaba que las pinturas fueran leídas, como una oración, como un mantra o un mandala.

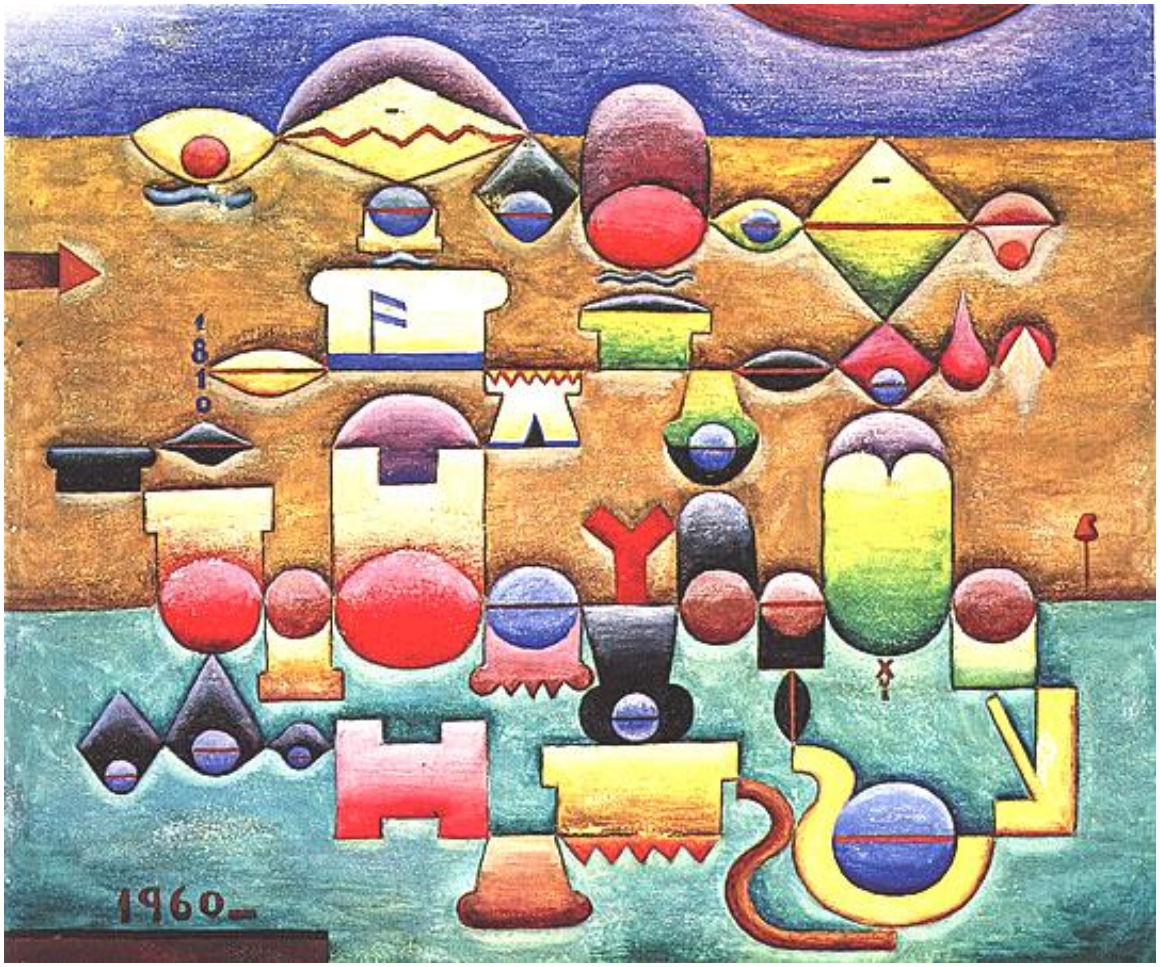

Fig. 2 Texto Cívico, 1960, 48 x 56 cm, témpera, colección Museo Xul Solar.

Según Osvaldo Svanascini, [8] "para Xul Solar todo era factible de ser experimentado y perfeccionado. Una actitud estimulada por el descubrimiento".

En 1949, Jorge Luis Borges escribió sobre Xul "hombre versado en todas las disciplinas, curioso de todos los arcanos, padre de escrituras, de lenguajes, de utopías, mitología, y de Infautor, panajedrecista y astrólogo perfecto en la indulgente ironía y de la generosa amistad".

Xul es uno de los acontecimientos más singulares de nuestra época. La invención caudalosa no excluye el honesto rigor y su mundo metafísico. La apasionada arquitectura, los colores felices, los muchos pormenores y laberintos.

Antonio Berni (1905-1981)

Como Xul Solar, sin duda, Antonio Berni también es una figura emblemática del Arte Argentino del Siglo XX.

En relación a este artista, dice Rafael Squirru [7] "Concientizar al máximo la tarea de vivir es el principal desafío de una existencia espiritual ". Fue capaz de emplear 100 materiales diferentes para llevar a interpretar gráficamente el caudal de imágenes que acuñaba en su interior de manera personal, obteniendo la expresividad y el clima necesarios para lograr la crítica social que dedica a los sectores más necesitados. A. Berni considera que se cumplen los grandes destinos: "Cuando se hace lo que se tiene que hacer. Todos llevamos la grandeza adentro, ya que cada destino por modesto que parezca es sagrado, pero no todos alcanzan la voluntad y el coraje para cumplirlo".

Antonio Berni comienza a trabajar siendo muy joven en un taller de vitrales, donde esmeriló y fileteó vidrios e hizo moldes. Allí se produce el contacto con diversos materiales. Realiza dibujos, conoce a Juan Carlos Castagnino y se interesa por las obras del periodo impresionista de Fernando Fader. Este interés por los colores cromáticos se verá plasmado en su obra "El Galpón" de 1921, con sombras violetas y celestes, luces amarillas y anaranjadas. Obtiene una beca para estudiar en Europa, donde se vincula con las vanguardias: dadaísmo, surrealismo y futurismo, entre otras. Establece amistad con Aragón, quien le marca el camino hacia el surrealismo, que está en auge en Europa. El paso del artista es breve, desde 1930 a 1932, pero no por eso es menos significativo, su obra es personal e inconfundible, por ejemplo "La siesta y su sueño", oleo sobre tela de 50 X 69 cm, "La muerte acecha en cada esquina", oleo sobre tela de 53 X 72 cm., entre otras, tienen superficies de colores saturados, como el amarillo, rojo, y azul, aunque no son de gran tamaño, poseen cierta monumentalidad. "El tratamiento de la materia se antecede al art brut, que empleara 20 años más tarde Dubufet. Sus obras difieren de las de Dali y De Chirico, a partir de allí, sus obras se identificaran con un realismo social.

Expone desde 1920 hasta 1980, aproximadamente, en galerías, museos nacionales y provinciales, argentinos y extranjeros. En 1929 realiza una exposición junto a Xul Solar en Amigos del Arte.

Antonio Berni, según Squirru [7] "reconoce, que pensar en una lectura política de su obra es fundamental, y que no se puede dejar de lado". Pero no es una propaganda de un partido político, sino el cuestionamiento ante las desigualdades sociales y la falta de oportunidades, de algunos sectores de la sociedad, formulado desde lo social y lo humanitario. Desde un modesto trabajo, observa la profunda crisis social en nuestro país y en el mundo. Las ollas populares , manifestaciones y la desocupación, sobre estos temas trabaja el artista, en obras de grandes dimensiones: "Manifestación" (1934) pintada al temple, sobre arpillera, 180cm x 250cm; "Desocupados", temple sobre arpillera, 218cm x 300cm, del mismo año, rechazado por el jurado del XXV Salón Nacional ; otra obra "Chacareros" de 1935, oleo sobre arpillera 200cm x 300cm, con esta obra obtiene el segundo premio del Salón Nacional. En esta obra se presenta un cambio en las relaciones de las distintas clases sociales, que se integran generando una rebelión y la formación de la organización gremial a partir de 1935.

Figura 3. Chacareros, 1935, 200 x 300 cm, ó oleo sobre arpillera, Museo Sívori.

Estas pinturas forman parte del imaginario colectivo de su país, como un testimonio de la realidad. En ellos, los grupos que forman las personas, tienen individualidad propia cada una de las mismas, posee una característica, el grupo es la resultante de una aguda observación, los colores están colocados acorde con las expresiones, como así también la composición que el autor elabora facilita lograr el clima de gravedad que trasunta el momento. Lo antedicho tiene su fundamento [5] "el artista tomaba fotos de las manifestaciones y protestas callejeras". Como lo destaca Rafael Sendra, "de la experiencia con Siqueiros adopta el formato y una temática latinoamericana " [5] .

Antonio Berni se destacó porque dejo de lado las tendencias y vanguardismos, tomó de todos aquello que se adecuaba a lo que deseaba expresar, sometiéndolo a su visión personal: surrealismo, informalismo, expresionismo, nueva figuración. Afirmaba [5] "Ser artista es una de las mayores formas de ser libre" y también decía "si no hay amor que transmitir, no hay pintura, no hay arte ,no hay nada". Tanto el amor como la libertad son los valores que hacen a la dignidad humana.

En el año 1933 llega al país David A. Siqueiros, el renombrado muralista mexicano, quien con L.E. Spilimbergo, J. C. Castagnino, A. Berni y Lázaro, realizan un mural en la quinta de N. Botana. "Este equipo de artistas decide dejar de lado los métodos arcaicos, no realizan boceto y emplean herramientas y técnicas modernas; cámara fotográfica en vez de lápiz, reglas flexibles, brocha mecánica, etc. Coordinan sus capacidades individuales enriqueciendo su capacidad creativa, según A. Berni, para atacar el muro de 200 metros cuadrados, directamente. A esta experiencia la denominaron "Ejercicio Plástico". Este fue un antecedente previo para la realización de los murales en la Galería Pacifico. El artista recorre el norte argentino, convive en Santiago del Estero con los leñadores a quienes recreara en sus pinturas. Viaja a Bolivia para contemplar Tihuanaco, continua hacia Perú, recorre los museos y lugares donde asimila las culturas. Se identifica con la tierra, los hombres y su arte.

Según Fermín Fevre [5] "La guerra mundial traerá paradójicamente un alivio al panorama que afecta al arte de Berni. Un frente común al avance del nazismo hace más aceptable el arte de este autor, por sus implicancias sociales y americanistas ". En 1940 recibirá el Primer Premio del Salón Nacional y en 1943 obtiene el Premio Adquisición del Salón Nacional por su obra "Lily ". En 1962 le otorgan el Gran Premio de Grabado en la XXXI Bienal de Venecia, siendo el primer artista latinoamericano en ganarlo, por la Saga de Juanito Laguna y Ramona Montiel, donde recurre a la crítica social. Emplea todos los recursos plásticos de las diversas escuelas pictóricas e introduce nuevas técnicas para realizar los collages, en algunos trabajos utiliza enormes tacos de madera (xilografías), tomadas de las villas miseria, donde se supone que habitan los personajes de su serie, materiales reales extraídos del lugar, por ejemplo: latas de basura, restos de aparatos electrónicos, trozos de telas y cualquier material que considere oportuno para recrear las secuencias: "Juanito remontando un barrilete", "Juanito jugando con su trompo ", "**Juanito dormido**", "Juanito tocando la flauta ", "Juanito en la laguna", etc. Describe en estas escenas la vida de un niño inmerso en las villas de las grandes ciudades latinoamericanas, como símbolo de una niñez que carece de todos los recursos necesarios para desarrollarse en un medio hostil que lo degrada, reflejando una dura realidad.

Dice Rudolf Arnheim [5] "El hecho de que el color es portador de intensa expresión es indiscutible"(...) "Existe, por cierto, la extendida opinión de que la expresión del color se basa sobre las asociaciones que evoca". Como lo hacen también las texturas, las formas y los demás elementos que forman parte del cuadro.

Figura 4. Juanito dormido, 1973, 160 x 105cm, oleo, madera, metal y materiales varios sobre madera.

Expresa Rafael Squirru "Juanito Laguna, sus familiares y amigos seguirán viviendo más allá del tiempo efímero"..."La intensidad del sentimiento que volcó el artista para plasmar sus imágenes lo ha colocado en un presente eterno en el que se dirime la condición de arte".

Señala F. Fevre "todo lo basó en una racionalidad penetrante e insistente, extremadamente autoconsciente. He ahí su condición de artista moderno, de hombre de su época.".

Al año siguiente de su muerte, la Fundación Konex le otorga en su primera edición dedicada al arte, "El Konex de Honor al Artista fallecido más relevante de la Historia Argentina".

No se puede dejar de señalar los aportes económicos que realizo a la Fundación Favaloro, que está dedicada a la atención de los enfermos cardiológicos. Obtenida de la subasta benéfica que se realizo en la casa de Antonio Berni, inaugurada en 1981, fue la sala más importante con la presencia del propio artista.

Muy importante fue como maestro, que además de instruir, tenía un espacio dedicado a los artistas jóvenes para que pudieran exponer sus obras.

Por todo lo manifestado y mucho más, que sería interminable expresar en este espacio, reitero la grandeza de Xul Solar y Antonio Berni como dos pilares fundamentales del arte Argentino del siglo XX, permanentes inspiradores de tantos artistas de mi país, entre los

que me incluyo, que los admiramos profundamente y hemos recibido sus muy valiosos aportes para el enriquecimiento de nuestras obras.

María del Carmen Puccio

Como muchos artistas las obras de estos autores me han movilizado profundamente. Ambos dejan de lado las tendencias y vanguardias para expresar su interioridad. Para ellos el arte y la vida están fuertemente ligados. No esperan la aprobación ni el reconociendo de los demás. Son fieles a sus ideales de amor, vida, justicia y libertad.
A pesar de que las imágenes volcadas en sus obras difieren, el sentimiento es similar, de allí la fuerza que se desprende de sus obras ¡únicas, originales e inéditas! No temen quemar etapas para crecer.

En Antonio Berni las figuras humanas que tienen un papel preponderante en su esplendida producción; con todo respeto y sin compararme, a mi me resulta inevitable en mi obras la presencia de la representación del hombre.

En Xul Solar el misterio de la vida y los orígenes del universo, junto a los colores que emplea, me retrotrae a los comentarios, que realizo en una crítica referida
a mi obra; Fermín Fevre. Con motivo de una exposición en el Catalogo dice "Los desnudos de Ma. del C P adquieren identidad a partir del entorno en que están situados(...) Esto contribuye a darles un clima sensual que el tratamiento del color y las figuras acentúa(...) En esta situación particular las figuras emergen a veces entrelazando sus cuerpos creando formas curiosas e insospechadas que ahondan en el misterio y la ambigüedad del enigma. Lo obvio es ajeno al arte y la artista lo sabe"

Como dice el joven uruguayo Álvaro Daniel Farías Díaz, en referencia al hombre fragmentado: “El individuo postmoderno, sometido a una avalancha de informaciones y estímulos difíciles de estructurar, hace de la necesidad virtud y opta por un vagabundeo incierto de unas ideas a otras. El postmoderno no se aferra a nada, no tiene certezas absolutas, nada le sorprende, y sus opiniones son susceptibles de modificaciones rápidas. Pasa de una cosa a la otra con la misma facilidad con que cambia de detergente”. Mi serie pictórica “Hombre fragmentado” se vincula, en cierto modo, con estas expresiones, a las que añado la desintegración de las personas presionadas por las múltiples actividades que está obligada a realizar cotidianamente para adecuarse a las diversas situaciones que le toca vivir.

Autora: María del Carmen Puccio Serie: "El hombre fragmentado" Técnica Mixta.

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El Color en el Arte Abstracto en México: Un Acercamiento a través de una Exposición de Artistas Mujeres y la Tecnología

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Abstract

En este trabajo plantearé un acercamiento al color en el arte abstracto en México analizando una exposición recientemente presentada en el Museo de Arte Moderno de la ciudad de México titulada Silencio, rumor y grito. Considero que la obra allí presentada es representativa porque expone obra del acervo del museo desde su inauguración en 1964 a la fecha.

La exposición suscita varias lecturas, la primera, por supuesto es la que hace la curaduría del propio museo al decidir sacar de su bodega una selección de obras abstractas realizadas por artistas mujeres. Respecto al criterio de género, el curador Octavio Avendaño apunta en el texto de sala que la colección del museo cuenta con 2 694 obras, de las cuales 315 únicamente son de mujeres, equivalentes al 11 por ciento del total, señalando que, aun así, el MAM posee la mayor representación de mujeres en acervos públicos en México. La exposición intenta entonces rescatar la presencia de artistas mujeres en general poco representadas en los acervos de museos y por otra parte destacar la importancia de los lenguajes abstractos en este grupo de artistas mexicanas y extranjeras residentes o con un breve paso por nuestro país.

Alrededor de la muestra habría muchos aspectos interesantes por abordar, como por ejemplo la manera en que se ha conformado la colección del museo, en gran parte constituida por donaciones de los propios artistas, la abundante representación de artistas extranjeras o las razones por las cuales pocas veces se exhiben estas obras. Con éstos márgenes, nuestro interés central será realizar una aproximación a las obras de esta selección desde la perspectiva del color: ¿qué nos dice? ¿cuál es su sentido y peso en el lenguaje de las artistas?

En el diálogo que establecimos con las obras y tratando de encontrar contrastes, encontramos una primera diferencia entre las artistas que eligen mantener el color natural del medio que eligen, así como el uso de medios y técnicas tradicionales, y las que optan por medios y colores más industriales usando "tecnología". Concuerdo con Renato González (2003:244) cuando afirma, al hablar del trabajo y técnica de José Clemente Orozco, que

> El problema, para la historia del arte, no puede ser solo el color: éste no es ajeno a las técnicas para obtenerlo. Los colores son todos concretos aunque

sirvan para construir, como en este caso, una imagen barroca, un concepto abstruso, una composición de lo sublime, si vale la paradoja.

La obra de las pintoras Lilia Carrillo, Irma Palacios, Beatriz Zamora y Lucinda Urrusti se caracteriza por la utilización de pigmentos naturales y gamas de color restringidas de tierras, ocres, blancos, grises y sienas mezclados con arenas o polvo de mármol para dar un sentido real y radical de "materia" a las obras. Estas pintoras actúan como *médiums* para que el material mismo y sus cualidades cromáticas, lumínicas y texturales se exprese por sí mismo sobre las superficies. Las emparenta el carácter informal de sus obras que evita cualquier referencia a algo como –figura y fondo-, existe en ellas solamente superficie, materia y trazos que van de la grafía al esgrafiado que deja ver los sedimentos y capas sucesivas de color.

El ejemplo más radical de esta apuesta expresiva es la obra de Beatriz Zamora y sus cuadros negros. Es significativo recordar aquí el incidente: en 1978 Zamora recibió el Premio Nacional de Pintura. El día de la ceremonia oficial en el Palacio de Bellas Artes el pintor jalisciense Enrique Guzmán descolgó la obra ganadora e intentó destruirla. Desde entonces y hasta la fecha, la artista realiza sus obras con maderas carbonizadas o minerales adheridos a los soportes: cuarzo, arena, grafito, pirita, obsidiana, negro de humo, entre otros elementos. Todos sus cuadros son de densa materia negra, y sin embargo, ninguno es igual; ella tiene plena consciencia de que cada material posee exquisitos matices, y paradójicamente, la materia "negra" revela un universo de luz y color.

Difícil de asimilar por nuestra costumbre cultural de pensar en pintura como igual a colores, la radicalidad de Zamora al hacer del negro y los materiales naturales su medio y su vida a la larga ha logrado su objetivo: transmitir una idea filosófica de lo que considera esencial: la tierra, lo femenino y la oscuridad como generatrices, en oposición a las concepciones occidentales en el arte que privilegian los conceptos: hombre, blanco, luz y color.

> El negro es el principio y base del universo, es el 80 por ciento de todas las cosas, está en cada uno de nosotros, vivimos en el negro, está dentro de nosotros, pero no lo sabemos, no lo entendemos, no lo queremos y por eso es considerado una aberración en el arte. Por 40 años, yo he tratado de quitar esa idea de relación con el mal.

Estas fueron las palabras de Zamora en una presentación a los medios de su exposición *El negro, basamento del universo.*

Podemos afirmar entonces, que el color-materia tiene para esta artista una función argumentativa y retórica en el sentido planteado por Georges Roque (2003:277).

Este –dejar que la materia misma se exprese- mediante la mano del artista subyace en la obra de otras artistas como Lilia Carrillo, Irma Palacios y Lucinda Urrusti. Entre ellas hay resonancias líricas y expresivas. Encontramos mayor sensualidad en la pintura de Carrillo manifestada en grafismos y manchas de color que insinúan planos interconectados. Sus atmósferas terrosas transpiran colores

modulados: violetas, naranjas y blancos. En contraste, en la obra de Palacios predominan los ocres, tierras, grises y negros. En los grandes trazos y empastes hay una voluntad expresiva que parece evitar cualquier forma o composición predeterminada. Por otra parte, la obra de Lucinda Urrusti siendo esencialmente matérica por el uso de cargas (arena, polvo de mármol) mezcladas con el óleo, se diferencia de Carrilo y Palacios, así como de los pintores informalistas ibéricos (Millares, Saura Tápies) por su color apastelado, luminoso y agradable.

En las obras de Ilse Gradwol, Alice Rahon, Beatriz Ezban, Maka Strauss y Magali Lara se advierte un proceso en el cual la materia pictórica y el gesto expresivo mantienen una tensión y un diálogo. En las pinturas de Gradwol, Rahon y Strauss las manchas de color modulado y los trazos y esgrafiados conforman figuras protagónicas sobre fondos claros. En la obra de Magali Lara el gesto gráfico y la mancha de color alcanza mayor contraste y potencia cromática, al mismo tiempo que el fondo blanco se mantiene neutro como la superficie de una hoja de papel, mientras que en la obra de Ezban el fondo trabajado con colores terrosos y obscuros es cubierto por empastes blancos conformando grandes trazos.

Cordelia Urueta, Martha Palau, Agueda Lozano, Fitzia Mendialdúa, Nadine Prado son artistas que comparten una mayor preocupación por el trabajo compositivo, el orden espacial y el cromatismo del cuadro. El color esta "buscado" o elegido entre las gamas de colores al óleo o acrílicos disponibles comercialmente y están utilizados con mucho control de los contrastes y tonos en gamas cromáticas reducidas. Hay planos y una composición equilibrada buscada con antelación. En Cordelia Urueta la gama de rojos, magentas y ocres armoniza la composición de una figura circular que parece flotar entre planos de color, sin estridencia, el color es contundente, parecería que no le falta ni le sobra nada.

Agueda Lozano, Fitzia Mendialdúa, Nadine Prado y Martha Palau trabajan los distintos planos compositivos bajo un orden racional bajo el cual el color funciona como acento que enfatiza un plano o un gesto. Las formas doradas simétricas sobre planos grises y amarillos de Martha Palau, en su síntesis sugieren una forma escultórica de tótem que es contradicha por el marco dorado que se integra a la obra.

En las obras de Mayra Landau y Teresa Velázquez, el orden racional y el lirismo juegan armoniosamente de manera que materia, color y forma estructuran espacios que atrapan la mirada como una red. Desde 1965 Landau titula sus cuadros como "Ritmo" buscando incesantemente la belleza y la armonía. El lino crudo y los rectángulos coloreados se integran para formar el laberinto, tejido o pentagrama escritural de Landau. El ritmo cromático es parte tanto del soporte como de los pequeños rectángulos coloreados con un balance cuidadoso y delicado. Por otra parte, la pintura de Velázquez se plantea como un misterio para quien decida adentrarse en el espacio que ofrece el cuadro. En un primer acercamiento parece negro. Es necesario moverse frente él y buscar el ángulo y distancia adecuadas para ver las franjas, las líneas y las superficies trabajadas con delgadas capas de color que se superponen. El color parece emerger y a la vez sumergirse. En la obra de Velázquez el color alcanza una plena *función argumentativa*. Al explorar la filosofía

del color, Velázquez realizó una serie de pinturas basada en la teoría del color de Goethe, abordando en una serie posterior el *Fausto* del mismo autor.

La obra de María Martorell se inscribe en el arte óptico y cinético. La riqueza y la fuerza del color en bandas ondulantes caracterizan el trabajo de la artista argentina, cuya inventiva y exploración geométrica, óptica y cromática difícilmente se puede apreciar en una sola obra. Ocurre algo semejante con la obra de Fanny Sanín y Mercedes Pardo, es necesario ver un conjunto de sus obras para apreciar la riqueza de su trabajo. Sanín establece una rigurosa trama geométrica saturada de matices y tonos modulados simétricamente, mientras que Pardo trabaja con planos mayores de color saturado.

En cuanto a la obra tridimensional podríamos hacer la misma gran distinción entre las artistas que prefieren manipular los materiales "naturales" como piedra, arcilla, metal, cristal y las que utilizan materiales que requieren de un proceso más "industrial", o trabajan con materiales y medios híbridos. El color propio de los materiales prevalece en la obras de Emy Winter (madera, encáustica y grafito), Jaroslava Brychtová (cristal) y Gerda Gruber (porcelana, barro, madera). Helen Escobedo pinta con esmaltes su pieza de madera (negro, blanco, naranjas y amarillos) e Ivonne Charlin y Cecilia Martínez, tiñen parcialmente (azules, violetas, verdes amarillo y naranjas) su tapiz de fibra natural de yute.

En el segundo grupo estarían Lorraine Pinto y Sara Minter. La obra óptico cinética de Pinto requirió el uso de materiales industriales como acrílico transparente de colores, luz neón y equipo de sonido en su obra "Quinta dimensión" (por cierto, no funcionaba ni el neón ni el sonido el día que visité la exposición, pero se puede ver en http://www.youtube.com/watch?v=GzTBPsq-OX8). El video de Sara Minter proyecta imágenes óptico cinéticas.

Una de las conclusiones a las que me lleva esta muestra coincide con lo que las teóricas feministas (Cordero Reiman y Sáenz, comp., 2007) han encontrado al recuperar y analizar la obra de artistas mujeres en sus contextos sociales y culturales, y es que no existe nada específicamente "femenino" que las distinga del resto de la producción cultural, y que el estilo, uso de medios y materiales, incluyendo el color, están más cerca de sus colegas hombres que de lo que pudiéramos identificar como la "producción femenina" contemporánea a cada una de ellas. Faltaría por tanto analizar el color en la obra de artistas hombres que fungieron como maestros, parejas o influyeron en la obra de estas artistas. Para mencionar unos pocos: la checa Jaroslava Brychtová realizó la mayor parte de su trabajo en colaboración con su marido Stanislav Libenský, Lorraine Pinto fue alumna de Germán Cueto, Lilia Carrillo estuvo casada con Manuel Felguérez y Lucinda Urrusti, refugiada española en nuestro país, mantuvo una gran influencia de los informalistas ibéricos.

Otra conclusión es que puede aún ser de utilidad la diferenciación entre positivismo y romanticismo: Goethe *versus* Newton. La mayor parte de las artistas que aquí analizo utilizaría el color, y por supuesto la materia y la técnica de una manera que podemos llamar romántica, mientras que solo dos artistas serían positivistas por el uso que hacen del color-luz y de elementos tecnológicos: Lorraine Pinto y Sara Minter.

Las nociones de *función retórica y argumentativa del color* propuestas por George Roque me resultaron de utilidad para interrogar a las obras aquí analizadas.

El Museo de Arte Moderno se funda en 1964, época en la que comienza a darse mayor apoyo a las expresiones de arte abstracto como política oficial en detrimento de la llamada Escuela Mexicana, recordemos que es el periodo de la Guerra Fría.[4] Sería necesario analizar el color en los artistas y las artistas figurativas de la Escuela Mexicana que también son parte del acervo del Museo de Arte Moderno, así como en otros acervos de museos públicos, tarea que seguramente revelarían otras relaciones posibles.

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Analysis of Orange Colors of *Nishiki-e* Printings

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Abstract

Nishiki-e (Japanese traditional polychrome woodblock print) is one of the leading products of color culture in Japan. In our previous work, new vivid red colorants that are used on *Nishiki-e* printings in 1860s explosively can be detected by colorimetric analysis and by spectral analysis (Suzuki 2013). In this work, we tried to capture a change of printing method of orange color. The aim is to examine whether orange used in *Nishiki-e* printings changed in response to the change of red or not. In many *Nishiki-e* printings, orange color was represented by a overprinting of red and yellow. 301 *Nishiki-e* printings made from 1789 to 1905 were analyzed. Orange colors ($40° \leq h \leq 75°$, $C^* \geq 20$) were extracted from every printings, and frequency of use of chroma was visualized as a histogram. It is clearly observed that the use of strong chroma ($C^* \geq 60$) around 1900. This is a unknown orange colorant, not a overprinting of red and yellow.

1. Introduction

Nishiki-e is Japanese polychrome woodblock print of the *Ukiyo-e* school that was made from 1760s to 1910s. *Nishiki-e* is one of the leading products of color culture in Japan. Several kinds of colorants are used in *Nishiki-e*. Our interest is to identify these colorants and to reveal an area and a period that each colorant was used.

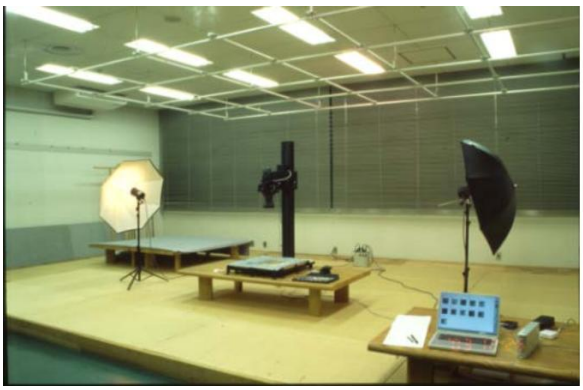
In our previous work, new vivid red colorants that are used on *Nishiki-e* printings in1860s explosively can be detected by colorimetric analysis and by spectral analysis (Suzuki 2013).

In this work, we tried to capture a change of printing method of orange color. The aim is to examine whether orange used in *Nishiki-e* printings changed in response to the change of red or not. In many *Nishiki-e* printings, orange color was represented by a overprinting of red and yellow. (See figure 1.)

Figure 1. Orange Color in a Nishiki-e printing

2.Color Correction of *Nishiki-e* Image

Since 2003, *Nishiki-e* printings owned by the National Museum of Japanese History (NMJH) have been taken using a digital imaging system (Suzuki 2004, figure 2). Each printing was illuminated uniformly by a flash xenon lamp and was taken with the GretagMacbeth ColorChecker. We developed an automatic extraction software program of a color chart and a *Nishiki-e* image (Minezaki 2014, figure 3). The RGB-CIEXYZ conversion matrix (Hong 2000) of each image for color correction was calculated from the extracted color chart image. Color-corrected images had CIEXYZ color values. For color analysis under a uniform color space, images which have CIELAB color values were made from them.



Digital still camera unit	
Body	Mamiya RZ67 ProII
Lense	Mamiya SEKOR Z 50mm F4.5W
CCD sensor	Kodak DCS Proback Plus
Pixels	4072×4072
Color depth	32bits (RGB 12bits)
Flash Xenon Lamp unit	
Lamp	COMET CLX-25 mini
Power supply	COMET CB-2400
White point	(x,y)=(0.3312,0.3446)
Color temp.	5555K

Figure 2. Overview of Nishiki-e digital imaging system and its specification.

Figure 3. Original Nishiki-e image (upper-left), detection of color chart (upper-middle), color-corrected image (upper-right), detection of Nishiki-e picture (lower-left), and extracted Nishiki-e picture (lower-right).

3.Analysis of Orange Color

301 *Nishiki-e* printings made from 1789 to 1905 were analyzed. From a *Nishiki-e* printing (figure 4(a)), orange colors ($40° \leq h \leq 75°$, $C^* \geq 20$, figure 4(b)) were extracted (figure 4(c)), and frequency of use of orange hues and chroma was visualized as a hue histogram (figure 4(d)) and a chroma histogram (figure 4(e)). Figure 5 is a graph of vertically serialized hue histograms (a) and chroma histograms (b). Every horizontal monochrome line in the graphs expresses one hue/chroma histogram. Maximum frequency value of every histogram is normalized to 1, and frequency value (0-1) is expressed by grayscale (black as 0, white as 1). Histograms are vertically serialized in order of the creation year.

Unlike red colorants, there was no characteristics in hue histograms (figure 5(a)). On the other hand, the use of strong chroma ($C^* \geq 60$) around 1900 was clearly observed from chroma histograms (figure 5(b)).

Figure 6 is a comparison of old orange and new orange. Spectral reflectances of each orange are different respectively. Photomicrographs of new orange (figure 7(b)) shows that this is a unknown orange colorant, not a overprinting of red and yellow.

From this result, the effect of the explosion of usage of new vivid red colorants on the new orange was not observed.

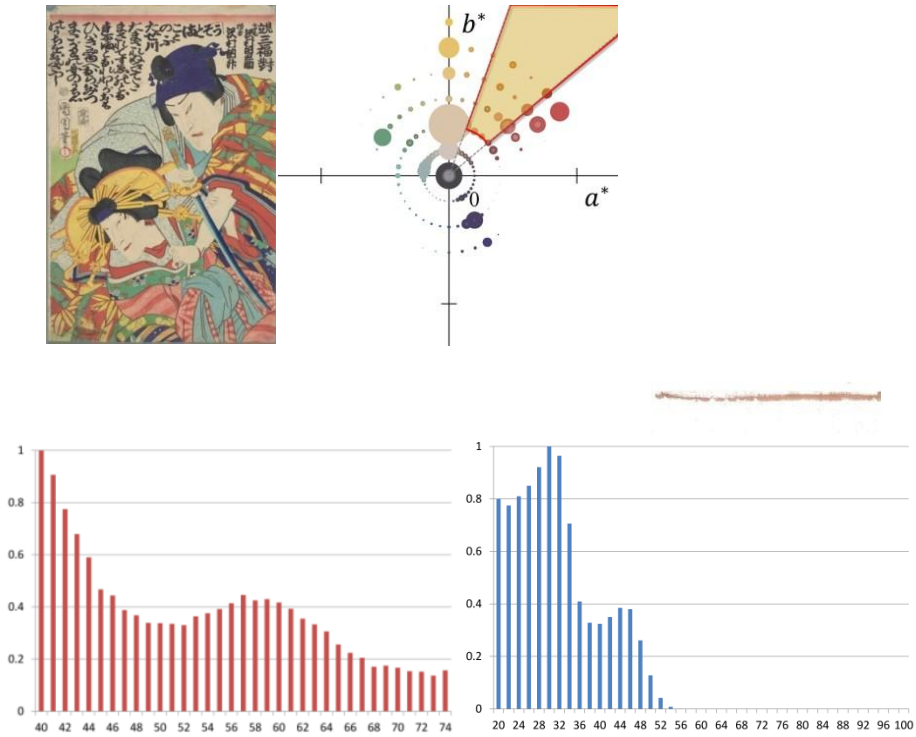


Figure 4. (a) Nishiki-e image (upper left), (b) color distribution (upper middle), (c) extracted orange (upper right), (d) hue histogram of orange(lower left),and (e) chroma histogram of orange(lower right).

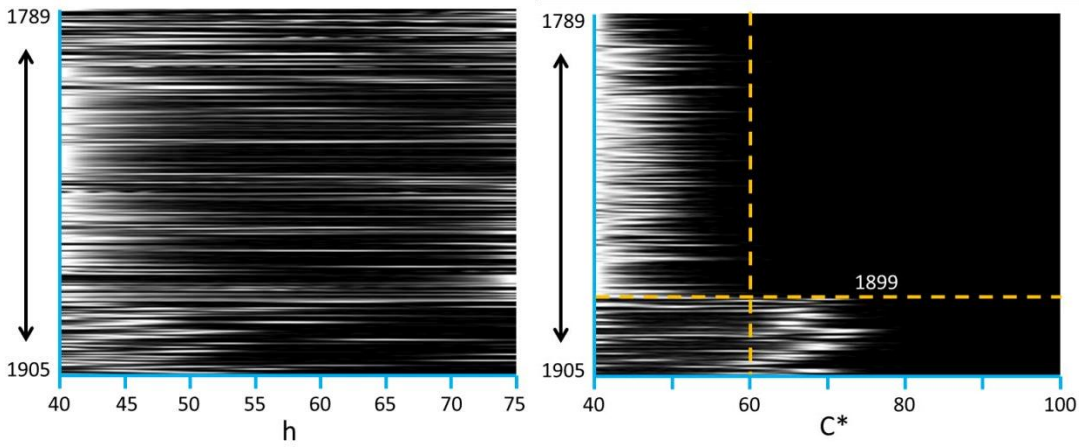


Figure 5. (a) Vertically serialized hue histograms (left), and (b) chroma histograms (right).

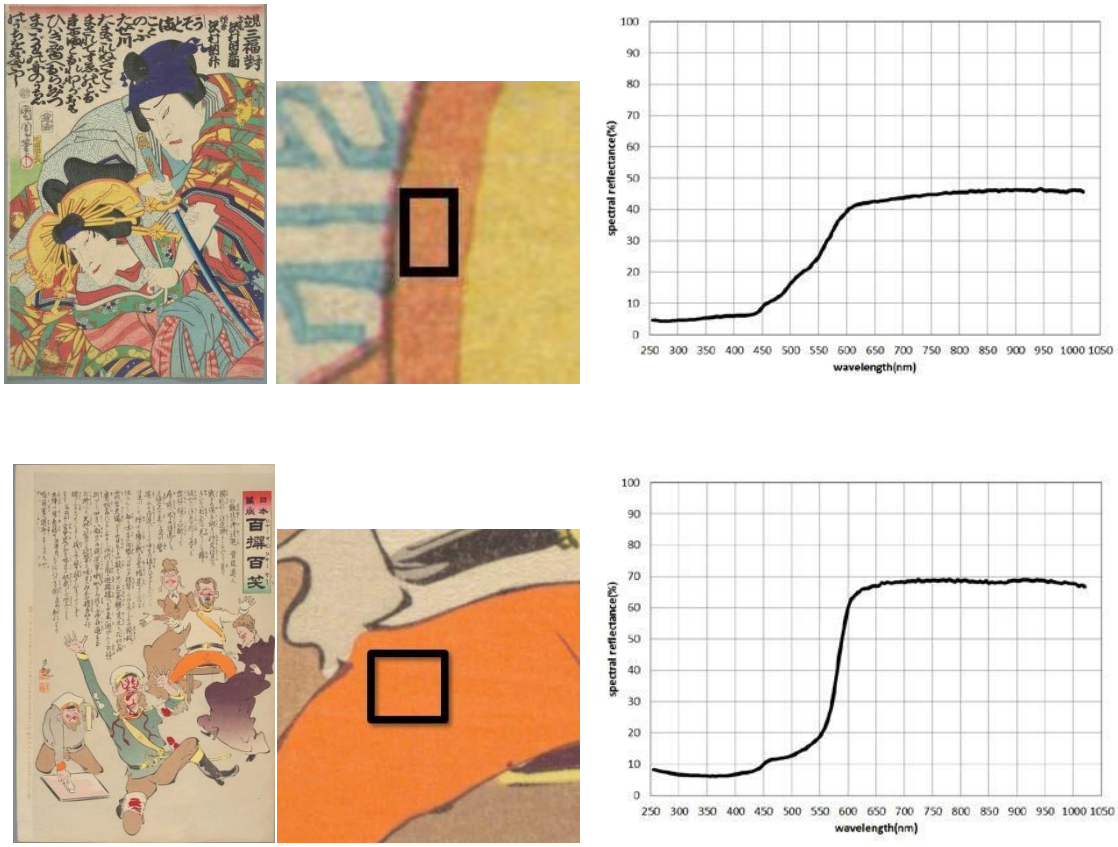


Figure 6. Comparison of (a) old orange (upper) and (b) new orange (lower)

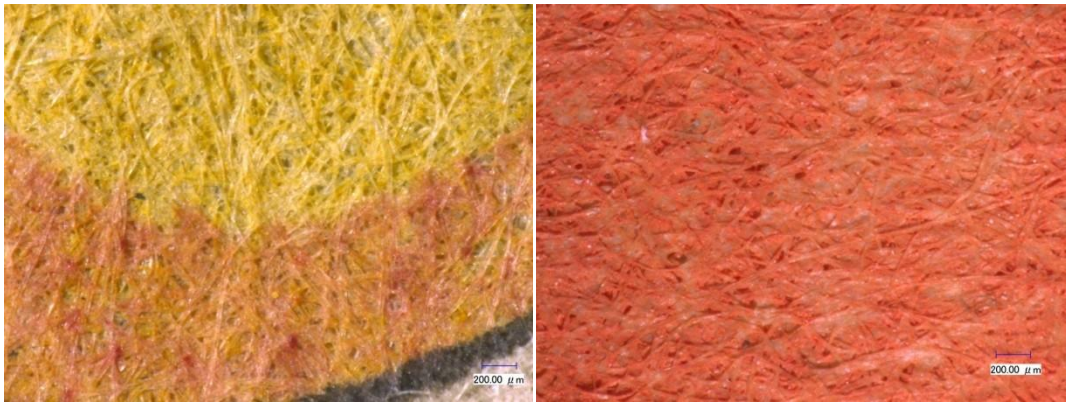


Figure 7 photomicrographs of (a) old orange (left) and (b) new orange (right).

4.Conclusion

An analysis of orange color to investigate whether orange used in *Nishiki-e* printings had changed in response to the change of red or not was done. We found a new orange color, but it was no relation to the explosion of usage of new vivid red colorants. The transition of the usage of colorants on *Nishiki-e* in Japan at 19th century is an interesting research task. Analysis of other color (e.g. Green, Purple, Violet, Yellow) is also our future work.

Acknowledgement

Prof. Dr. Jun'ichi Ōkubo in NMJH supports our research as an expert researcher of *Nishiki-e*. Assist. Prof. Yoshiko Shimadzu in NMJH took photomicrographs of *Nishiki-e* and gave knowledge about several kinds of colorants.

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DESIGN AND EDUCATION

A Comparison on Effects of Art Education during Childhood on Interior Color Preference across Cultures

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Abstract

In this research, we clearly identify the effect of creative education on bedroom color preference. This was done between 124 Japanese students and 136 foreign students in Japan. The respondents in each category were further divided into 2 groups (Japanese I and Japanese II, Foreigner I and Foreigner II) randomly. The experiment was consisted of (1)bedroom drawing (2)respondents were shown 56 bedroom samples (colorful samples to Japanese I and Foreigner I, black and white samples to Japanese II, and Foreigner II) (3)same bedroom drawing, and (4)a questionnaire. It was observed that foreigners used more number of color varieties compared to Japanese subjects ($P<0.05$). However, the respondents (both Japanese and foreigners) whom saw colorful samples tended to use more colors in their second drawing ($P<0.05$). Additionally, the strong correlation between environment and number of color varieties was observed ($P<0.05$). Creative activities ($P<0.05$), group works ($P<0.01$), being able to draw/imagine freely ($P<0.05$), seeing samples during childhood ($P<0.05$), visiting museums ($P<0.05$) and going to art schools ($P<0.05$) all had a positive correlation with number of color varieties. Overall, the influence of the samples, and the strong correlation between creative arts education and number of color varieties was observed.

1. Introduction

In a previous research (Baniani et al. [2012]), a cross-cultural study was conducted and it was concluded that art education has a strong positive correlation with color preference in comparison with regional, residential and personal backgrounds. Moreover, art education has a long standing love affair with the notion of creativity. Creativity is the essence of true learning, is valid of all subjects, and is fundamental to making viewing and understanding art (Jim Wright [1990]). However, the direct relationship between education and the development of artistic talent and creativity remains ripe for exploration (Rostan [2005]). Furthermore, Lowenfeld and Brittain (1970) suggest that it is much more important to develop creativity in children, because creativity cannot easily be learned at older ages, and one can teach youngsters of elementary schools very much of artistic skills. Therefore, in this research, we clearly identify and investigate the correlation between arts creative education – during elementary and junior high school – and color preference.

2. Methodology

2-1. Subjects

This was done in University of Tsukuba, Japan, between 124 Japanese students and 136 foreign students.

The reason the subjects were divided into 2 groups of foreigners and Japanese was because a cross cultural study (Baniani et al. [2009]) regarding interior color preference was conducted and it was concluded that there is not much color variety when Japanese people are choosing colors for their bedroom walls. Only, in Japan, more than half of the respondents chose white as their desired color, and this wasn't seen in any other country (including Asian countries). Therefore, for this research, we have divided the subjects into 2 groups of Japanese and Foreigners. However, we didn't see the need to divide the foreigners into more categories (based on their country). Although, for our purpose, we tried to have subjects from different regions and they were from: South America, North America, Europe, Asia and a few subjects from Central Africa.

2-2. Procedure

In order to see the influence of color education, the subjects in each category were furthermore randomly divided into 2 groups (Table 1).

Table 1. Number of the respondents

Foreigners		**Japanese**	
Group I	Group II	Group I	Group II
74	62	67	57

The experiment was done between November 2013 and January 2014. It was consisted of (1)bedroom drawing (Figure 1) – 24 color pencils were provided (2)subjects were shown 56 bedroom samples (colorful bedroom samples (Figure 2) to Japanese I and Foreigners I, and black and white bedroom samples (Figure 3) to Japanese II and Foreigners II) (3)same bedroom drawing (Figure 1) and (4)a questionnaire consisted of 15 questions regarding the environment they have lived in and the education they have received in elementary and junior high school.

Figure 1. Sample of the drawing

Figure 2. Sample of colorful bedrooms shown to the subjects

Figure 3. Sample of black and white bedrooms shown to the subjects

The data was analyzed by comparing before and after drawings done in steps (1) and (3) in the experiment, and comparing the questionnaire with the number of color varieties used in the first drawing.

3. Results

3-1. The Influence of Samples on Number of Color Varieties

Colorful bedroom samples were shown to Group I (Japanese I and foreigners I), while black and white bedroom samples were shown to Group II (Japanese II and foreigners II). It was concluded that subjects who saw colorful samples used more color varieties in their second drawing (Figure 4). On the contrary, subjects who saw black and white samples used less number of color varieties in their second drawing (Figure 5). *

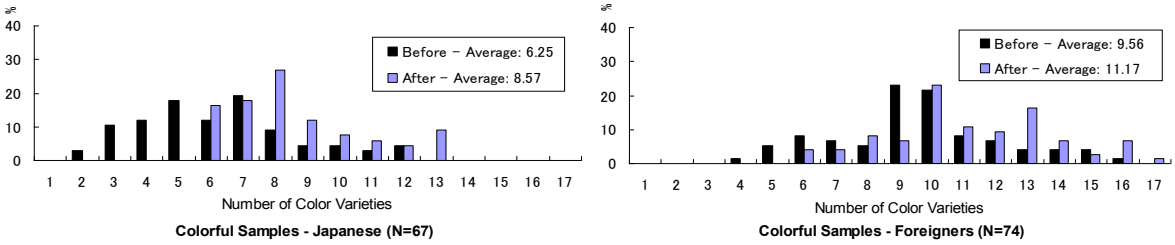


Figure 4. The influence of colorful samples

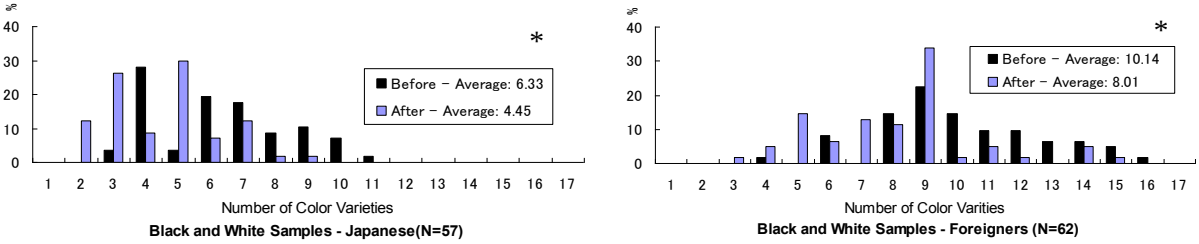


Figure 5. The influence of black and white samples

*Note: *P<0.05 **P<0.01*

3-2. Using Colors Freely during Childhood

The subjects were asked if they were able to use colors and their imagination freely during childhood and elementary and junior high school. It was concluded that subjects who were able to use their imagination and colors freely used more number of color varieties in their drawing compared to those who didn't (Figure 6).

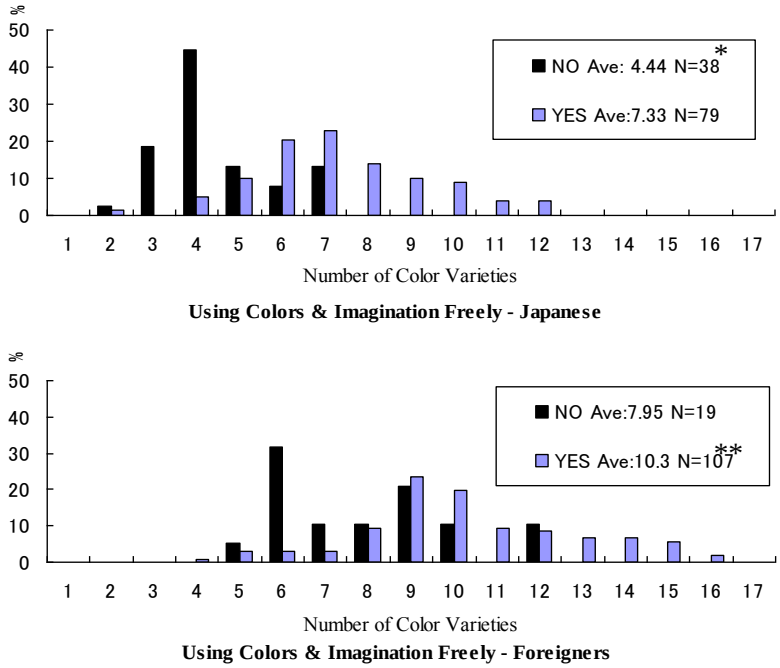
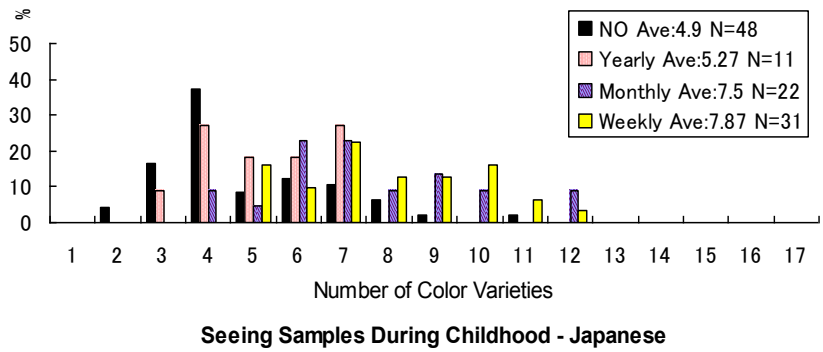


Figure 6. Using colors and imagination freely and number of color varieties

3-3. Seeing Samples during Childhood

The respondents were asked if they had seen any art samples like fashion, products, photography, calligraphy, architecture and interior, arts and crafts or others during childhood and elementary and junior high school. It was observed that respondents who had seen art samples weekly or monthly had used more number of color varieties rather than those who did not see any samples or saw them only yearly during childhood (Figure 7).



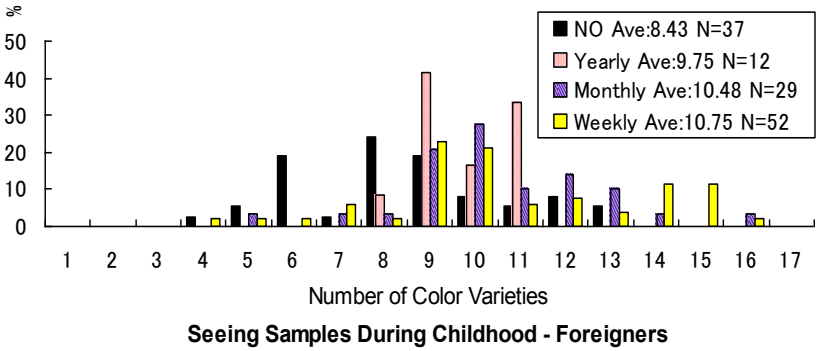
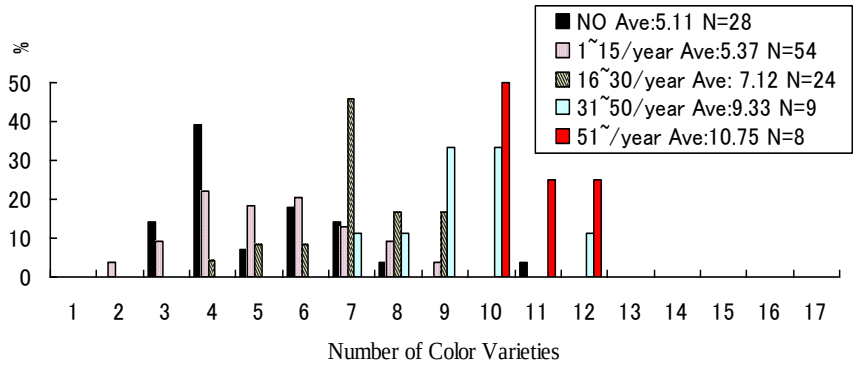


Figure 7. Seeing samples during childhood and number of color varieties

3-4. Creative Activities during Elementary and Junior High School

Another question was if the respondents had any creative activities (e.g. making posters/stamps/holiday cards/puppets/masks/art books and videos, looking at paintings and discussing them, drawing on disposable paper cups/plates or others) at school. It was observed that with more creative activities, more color varieties were used in the drawing (Figure 8).



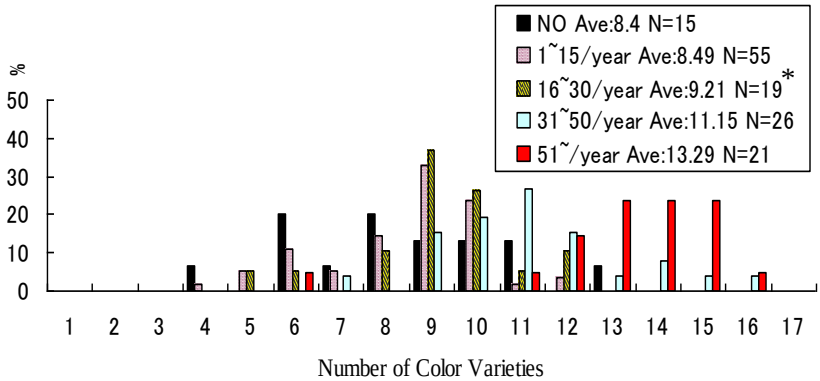


Figure 8. Creative activities and number of color varieties

3-5. Group Works at Elementary and Junior High School

Another question was if the subjects did any group works during their elementary or junior high school. The results indicated that respondents who had group works at school used more number of color varieties in comparison with those who didn't. The results for Japanese subjects can be seen in Figure 9, while the results for foreigners are shown in Figure 10.

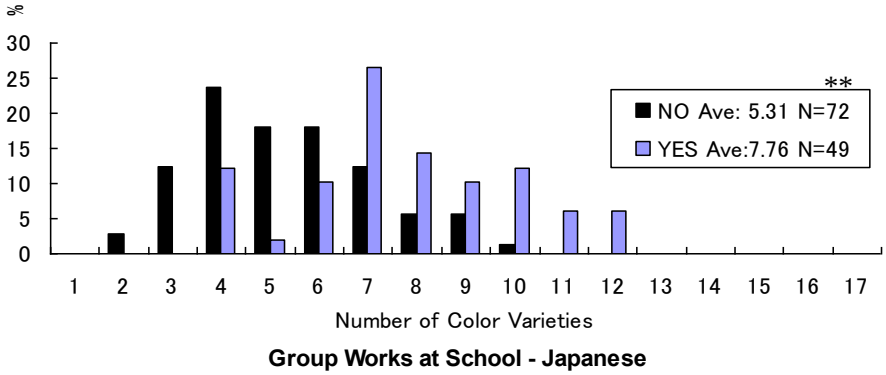


Figure 9. Group works and number of color varieties – Japanese subjects

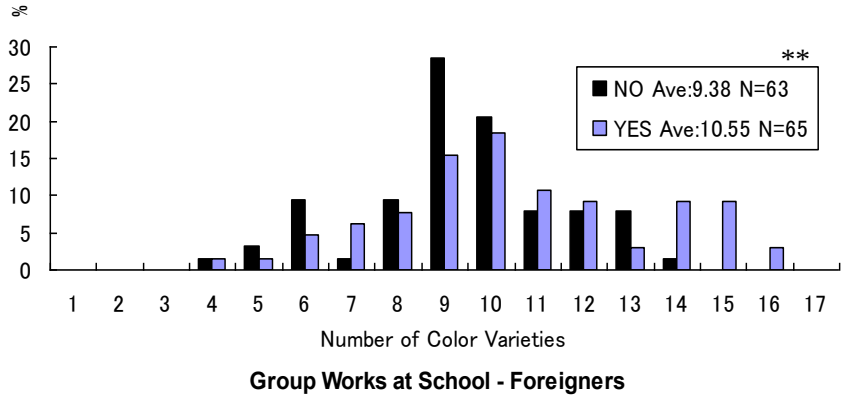


Figure 10. Group works and number of color varieties – Foreign subjects

3-6. Art Schools and Number of Color Varieties

The subjects were asked if they have been to any art schools (aside from their own school) – e.g. drawing, painting, photography, calligraphy or others. It was observed that the respondents who went to art schools used more number of color varieties compared to those who didn't (Figure 11).

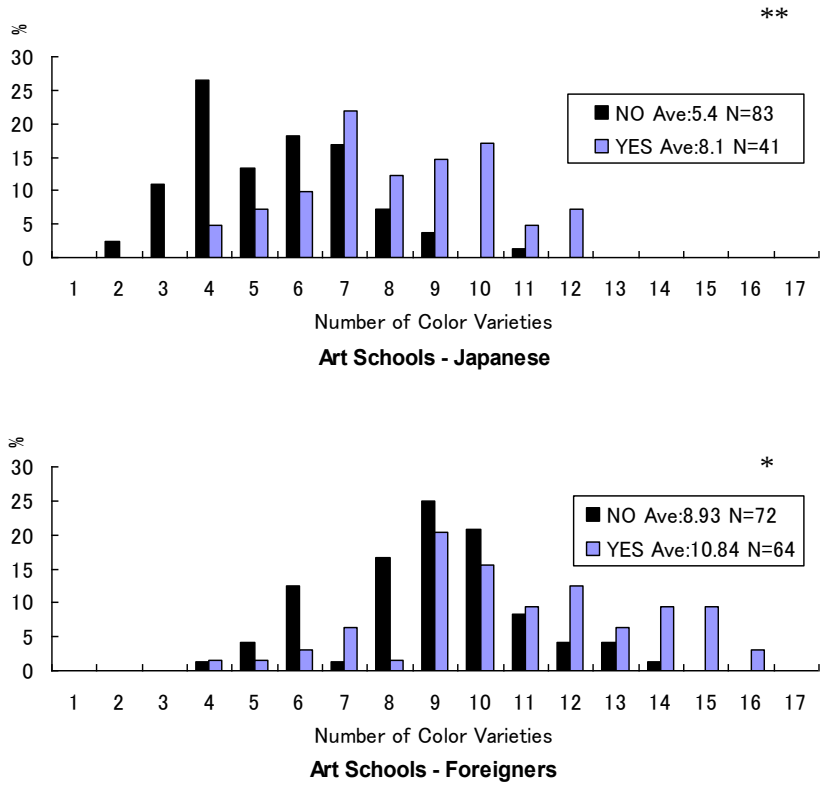
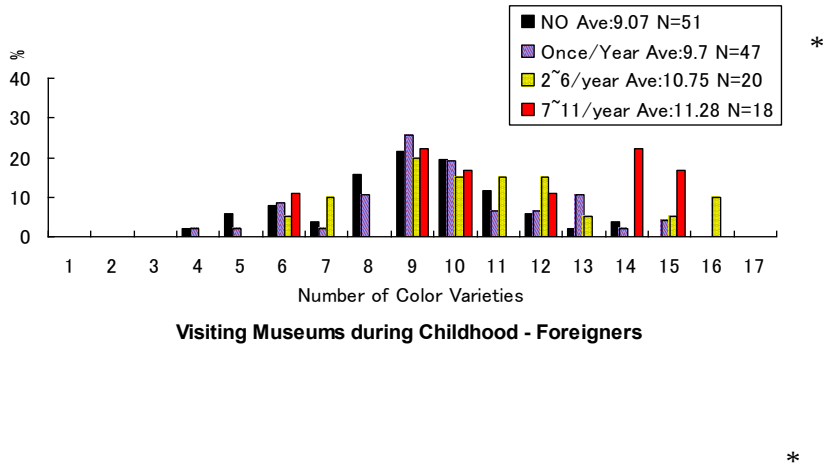


Figure 11. Art schools and number of color varieties

3-7. Visiting Museums during Childhood and Number of Color Varieties

Another question in the questionnaire was if the respondents visited any museums during their childhood and how many times a year. It was observed that the subjects who visited museums more than twice a year used more number of color varieties compared to those who only visited once or none at all (Figure 12).



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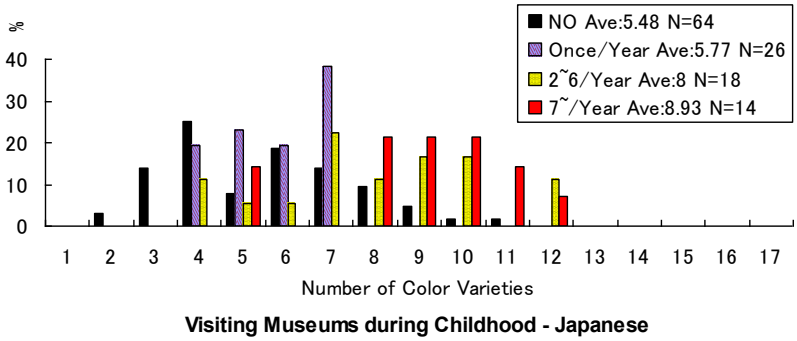

Figure 12. Visiting museums and number of color varieties

3-8. Colorful Environment and Number of Color Varieties

Another question was if the respondents lived in a colorful environment; whether colorful interiors, colorful exteriors, both or none. It was observed that the respondents living in colorful areas had used more numbers of color varieties in their drawing rather than those who didn't (Figure 13 and Figure 14).

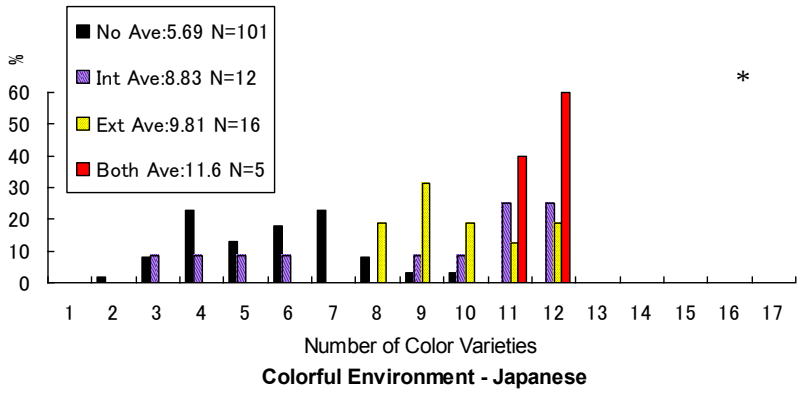

Figure 13. Living environment and number of color varieties – Japanese subjects

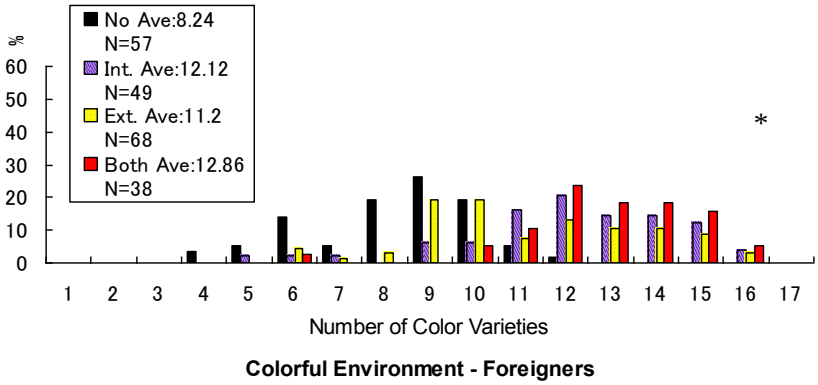

Figure 14. Living environment and number of color varieties – Foreign subjects

3-9. Colorful Schools and Number of Color Varieties

Another question the subjects were asked was if they went to colorful schools during elementary, junior or senior high school; whether they didn't go to any colorful schools,

just 1, or 2 or all three. It was concluded that the subjects who went to colorful schools had used more number of color varieties compared to those who didn't (Figure 15).

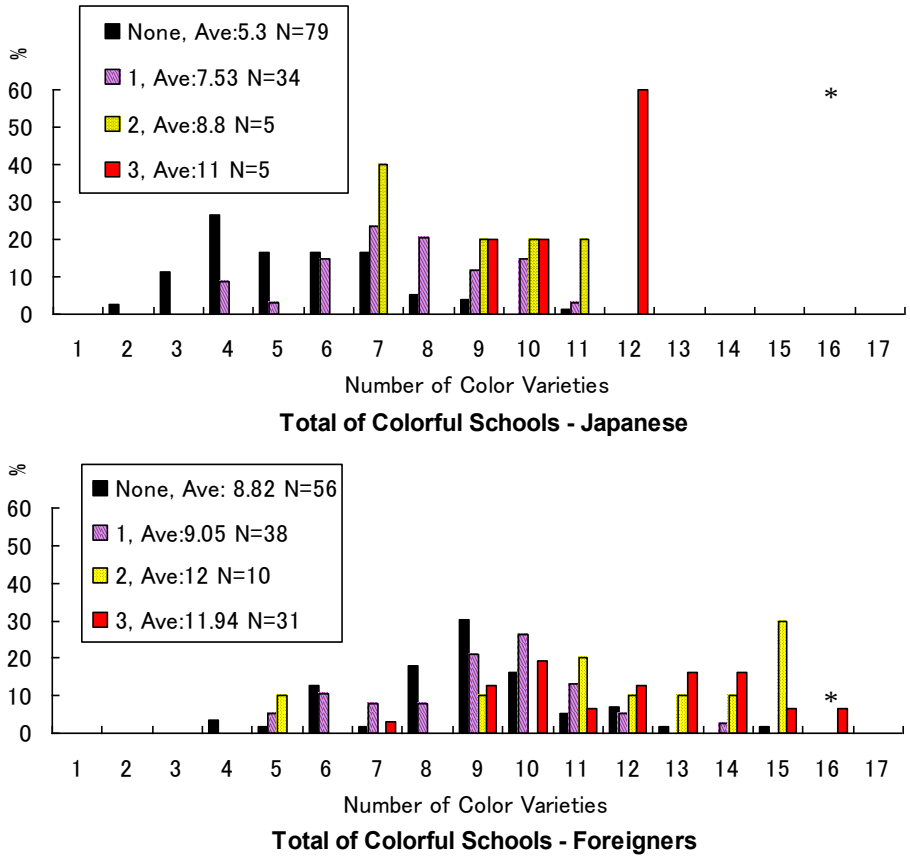

Figure 15. Colorful schools and number of color varieties

4. Discussions And Conclusions

In this paper, we clearly identified the influence of color education by using bedroom samples. It was observed that the subjects (both Japanese and foreigners) who saw colorful samples tended to use more colors in the second drawing ($P<0.05$). On the contrary, the respondents who saw black and white samples used less number of color varieties in their second drawing ($P<0.05$). It can be discussed that these findings demonstrate that color preferences can be influenced by experience.

Furthermore, the correlation between arts creative education and color preference was observed using a bedroom drawing and a questionnaire, which we will further discuss and verify in this section by referring to other preceding studies and works.

It was observed that respondents who were able to use colors and their imagination more freely during elementary and junior high school used more number of color varieties in the drawing compared to those who weren't able to. Runco (2004) state that allowing pupils to use their imagination and make mistakes provide substantial steps in the process of creativity.

Furthermore, it was concluded that subjects who were exposed to seeing more samples like architecture and interior, fashion, arts and crafts, photography, calligraphy and others used more number of color varieties compared to those who were not.

It was further concluded that respondents who had done more group works during school used more color varieties in their drawing. Lilly et al. (2004) argue that when there are group works, not only students collaborate with other students, but are also exposed to the concept of diverse learning and creativity as they are learning how to implement with each other.

Moreover, it was concluded that the respondents who went to art schools or visited museums frequently or subjects who had more creative activities at school used more number of color varieties. Shapiro (1993) suggests that the proper selection of classroom activities can create a positive classroom and enhance creativity.

Additionally, it was concluded that the subjects who have lived in more colorful areas or subjects who went to colorful schools used more color varieties in their drawing. Furthermore, in total, foreigners used more number of color varieties rather than the Japanese subjects.

Ultimately, from this study, it was concluded that both environment and arts creative education – during elementary and junior high school – have a positive significant correlation with bedroom color preference. Moreover, the influence of color education on color preference was observed, which proves the reliability of the rest of the data and results as well.

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Drawings and colors. What blind children can/ should learn about this?

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Abstract

Blind children can produce and read drawings when they are made with raised-lines. The learning of drawing since childhood facilitates blind people's access to visual images appearances. However, what type of drawing should we teach to blind children? What type of drawing/design can make visual communication accessible to blind people? How and why to teach colors to blind children? These are the questions that will be presented and discussed in the article that is being proposed. To this end, some conceptions will be formulated by means of a pathway that involves: 1) theoretical principles of cognitive psychology related to cognitive categories and the fundamental formal properties of objects; 2) theoretical principles originating in neuroscience about multimodal processes and the importance of the formal configuration of objects for the construction of cognitive categories and semantic conceptions; 3) theoretical principles deriving from theories about children's drawings and their genesis; 4) results obtained in field investigations with blind people and the the relationship between object, shape, color and culture.The main discussion will be based on the conception of "cognitive levels", proposed by Eleanor Rosch (1973, 1978; on the "formal properties of objects", conceived from the arguments of Jean-François Richard (2004); and on the universal character of some graphic schemes made by children at the beginning of their drawing experiences. I intend to show that general schemes (prototypes) are capable of successfully representing an entire cognitive category. These generalizing schemes – drawing with clean lines and simple colors - could be adopted in information design, and when made with raised lines, they might be apprehended by blind people; thus, they, too, would be able to use this kind of communication.

Can blind people produce and read drawings when they are made with raised-lines? Can the learning of drawing since childhood facilitate blind people's access to visual images appearances? What type of drawing should we teach to blind children? What type of drawing/design can make visual communication accessible to blind people? How and why to teach colors to blind children?

Few researchers devote their work especially to investigate blind people's drawing and/or reading of images. Besides my own investigations, I know the work of Susanna Millar, in England, John M. Kennedy, in Canada, Lola Bardisa, in Spain, Morton Heller, in United State of America, and Francisco Lima in Brazil. Until today large schools and institutions dedicated to teaching blind children have considered drawing and reading of visual images an insuperable obstacle, inherent to the condition of non-visuality. However, through direct contacts with blind adults and in situations of interview, I could witness the great interest that the possibility of reading tactile-visual images brings out (which is even bigger than the interest in drawing objects). That interest seems to be obvious if we consider that blind adults work with computers and on the screen of computers there are countless offers and information conveyed through visual signs and photographic images.

John Kennedy (1993) and Susanna Millar (1991) have investigated blind people's capacity to draw and to read images, but they are not devoted to teaching drawing or to studying learning procedures of drawings produced by blind children. Lola Bardisa (1992), on the other hand, has created a methodology to teach drawing, which was developed on the basis of classroom practices and research carried out at ONCE[1], in Madrid. Following Kennedy's indications and his conception of "raised-lines", she teaches blind children to outline the objects by registering the line that delimits and configures their forms. In her work, the objects are divided, planned out, and outlined. The result resembles a Chinese shadow in which the figure is distinguished exclusively by the continuous line that separates it from its background.

In my investigation, I also consider Kennedy's conception of *raised line*. However, I emphasize subjects that are usually drawn by children. I use drawings of each object that are similar to the ones produced by standard children and try to follow the same sequence of procedures used to produce them.

In one of his systematic investigations, Millar observed that it is easier for blind children to draw than to read relief images. In research done by Marcia Cardeal (2009) and supervised by me (for your Master's Degree), we have also noted that blind children who make drawings have more facility to read images.

In this article, grounded on a methodology to teach drawing to blind children, I will seek to present and discuss the principles of construction of informational visual images that, when produced in tactile relief, create a reading possibility for non-visual people. If some types of lines and shapes are perceptible in the tactile modality, colors are only oral information for the totally blind. Therefore, this verbal information can be extremely important.

Theory of cognitive levels – Generalization and knowledge

Until the seventies, linguists defended the idea that the cognitive categories used by human beings to classify objects were intrinsically connected to language in a cause-effect relationship. In other words, it was believed that categories or classification of objects would only exist together with, and in reason of, language. It was also believed that, like language, categories should be an arbitrary human construction. By investigating the organizational orientation of tasks proposed with non-named objects to the Dani population, in New Guinea, Indonesia, Eleanor Rosch (1973)[5] invalidated that belief.
The Dani community did not have words to express colors; they just had a word for darkness, "mili ", and another word for clarity, "mola". They also did not have words to name the basic geometric forms: circle, square, triangle. Rosch created a series of tests in which the Dani were to choose and memorize a color, or a geometric form, out of a group of colors and figures presented. As a result, the tests indicated that the colors and forms insistently chosen were always colors and forms considered basic, the most important and prominent ones. That is to say that, without reference of verbal vocabulary, the Dani answered the tests indicating colors and geometric forms considered to essential or basic for the populations whose languages showed that

[1] National Organization of [E] Spanish [C] Blind People.

primacy. The cerebral processes of selection and memorization were revealed to be the same regardless the language and regardless the presence or absence of a verbal sign to designate the objects. For instance, among the cards with colors: carmim red, red, orange red; or red, orange red, earth red ; the choice of the Dani pointed plain " red ", that is, the basic color. Similarly, they chose "circle" when presented to cards with drawings of: an egg-shaped circle, a middle circle, circle, an incomplete circle etc.

The choices made by the Dani, based on memorization of this or that color, this or that visual form, always pointed towards typical (prototypical) entities, the ones regarded as organizers or central in category systematization. It is the plain red that, in all the languages known, groups and joins all the other tonality of red; as well as it is the square (with its four equal sides) that joins and groups in one category all the quadrangular geometric forms. This investigation, together with several others carried out in the seventies, allowed Rosch to state that:

"I argued that because of the way the perceptual system works, certain areas in the color space are more salient than others, and that those salient colors are first noticed, most easily remembered, and become prototypes around which color categories form in cultures (and are the way colors are learned by children)". (Rosch, 1999)

Thus, according to Rosch, regardless the number of tone variables or names the color "red" may have in that or any culture there will always be a representative one whose tonality, brightness and pigmentation purity will be considered "The red", a prototypical color, first perceived, easier to memorize in all cultures: a universal "red", despite its linguistic variations (red, rojo, rouge etc.). What is universal, Rosch says, "*is the structure of categories and the processes by which category systems are formed*" (Rosch, 1999).

Rosch is globally recognized by her theory of cognitive levels. Working with concrete objects present in the world of the participants of the investigations, she has formulated three different cognitive levels related to fairly wide, fairly abstract categories. She uses the term "abstract" to refer to the most conceptual, the most ideative degree of a category. See the example:

Table 1. Diagram according to Rosch (1978, p. 30)

Superordinate Level	**Basic Level**	**Subordinate Level**
Furniture	**Chair**	Kitchen chair
		Armchair
	Table	Kitchen table
		Living room table
	Lamp	Living room lamp
		Desk lamp

In the example elaborated on the basis of the data suggested by the author (Rosch, 1978), the subordinate level is the one in which the visual mental image of the object is the most concrete and accurate one. Saying "kitchen chair" implies referring to a

specific chair, whose configuration and use are very specific. The subject who says "kitchen chair" does not refer to a concept of chair or to any chair.

On the other hand, the subject who says "chair" refers exactly to any chair, a concept of chair. According to Rosch, he/she refers to an abstract chair, which neither you nor I can specify. We create a conceptual mental image because we know the meaning of the term in our language, and we know that the speaker is referring to an object we use to sit down, which has four feet, a seat and a prop. Chair is a word/object of the basic cognitive level because it represents an idea, a general and abstract concept.

The word "furniture" is in the Superordinate level. It is even more abstract than "chair", once it names a large group of objects and is, therefore, highly imprecise, indicating all and any object used as furniture in any type of environment inhabited by human beings.

In the sense Rosch uses it, a category is a group of objects considered equivalent, similar, based on the following principles: i) gathering the maximum information with minimum cognitive effort (cognitive economy principle); and, ii) the information conveyed is efficient because the perceptive world reaches us in a structured and systematized way rather than in an arbitrary or aleatory way (Rosch, [7], p.28).

Since Rosch, there have been countless investigations on categorization and cognitive levels (for instance: Mandler and Bauer, 1988; Mandler, 1997; Cordier, 1983; Cordier and Labrell, 2000; Troatec, 1999; Richard, 2004). Beyond the cognitive levels, tests have proved that children prefer to group objects according to their perceptive (formal) or functional (actions) properties, and the functional properties depend on the knowledge already acquired by the child (Berger and Bonthoux, 2000).

Componential theory – What is this?

According to this approach (théorie componentielle), a chair is defined as an object composed of four legs, a seat and a backrest. We also say that it was made of wood, plastic or metal, and can tell whether it has lateral arms or not. Feet, seat and prop are the object components; they are features or characteristics that compose the representation of a chair. Those qualifying and defining characteristics of the objects also allow us to classify them using a semantic relationship of opposition: *the object which has only two feet is not a chair.*

Richard (2004) firstly distinguishes two types of properties of the objects: static and dynamic properties. Static properties refer to the way how objects (by themselves) are perceived by us. A chair is an object with four feet, which has a seat and a prop. The dynamic properties refer to actions performed by the objects, when it is possible. The fact of "flying" is an essential dynamic property to characterize the object "bird", just like walking on two feet is an important characteristic of human beings. In case of the object "chair", its dynamic properties mix with its function or use procedures. Based on the actions of the cognitive subject regarding the objects, Richard points out that every property or characteristic of an object is built in dependence of the context in which the observation/action takes place.

Different theories and points of view on object description constitute different types of properties. By mentioning Cordier and Tijus (2001), Richard (2004, p.28 and ff.) enhances the framework of elementary properties making the following distinction:

1. Perceptive properties: are the so called surface or appearance properties. For instance: the shape of the object, its color, its size.

2. Componential properties: are the properties that describe the objects' components. The example of the object "chair", mentioned above, is valid here, or you can even think of head, trunk, legs, feet, arms and hands as components of human beings.

3. Functional properties: are the properties that refer to the use of objects. For instance: a hammer is used to tap and drive a nail (to hammer, to drive), to break a nut.

4. Use procedure properties: are the properties that present how to handle objects in order to make them carry out their functions. For instance: it is held by its handle (for the hammer), it is held by its long part (for spoons and forks), its concave part is scooped up (for a spoon); the food is stabbed with it (for a fork).

5. Behavior properties: are the properties that indicate actions of an entity, they may be either spontaneous, like the action of flying is for birds, or a reaction to someone's action, like the action of stinging, practiced by a bee when someone approaches it (Richard, 2004, p.28).

Although these properties have been introduced by Jean-François Richard on the basis of verbal semantics, I understand that they may help to reveal the process of graphic schemes constitution used by children (and adults) in their drawings, especially if they are associated and related to the cognitive levels proposed by Eleanor Rosch in 1975, particularly, to the "basic level". These theories and data allowed me to build a pragmatics of children graphic communication grounded on properties of the objects, sample types that compose the "basic level" of cognitive categories, and also on the connections between words and graphic schemes (Duarte, 1995, 2002, 2011; Darras, 1996,).

Different properties of objects in the world, highlighted by the cultural context in which language (mother tongue) inscribes its extreme relevance, allow the subject to identify, distinguish, classify and give meaning to objects. Thus, when questioned about the object named "*apple"*, we are able to reply quickly "*– It is a fruit"*. Being a "fruit" means belonging to a general category, which demands a procedure of comparison and identification with a number of other categories equally general such as, being a vegetable or a mammal. When we say "*it is a* fruit", the general properties of the object fruit, which require being sweet when ripe and growing on trees, stick to the object apple without the necessity to be verbally expressed. Then, the object *apple* starts to be characterized by more specific properties: - it is red, round, it has seeds.

The efficiency (pragmatic and of cognitive economy) of communication requires that, first of all, the most general characteristic is verbalized, integrating the object to such a class generic that it will provide easy semantic access to all and any interlocutor: *Apple is a fruit.* After that, the most specific characteristics (red, round) will be added and more easily assimilated to the identifying general feature.

What does the child draw when asked to draw an apple? She or he draws a small circle with a stalk. The circle is colored red and the stalk is used, if that is the case, to hang several apples in the drawing of a tree. Circle and stalk represent the *fruiticitiy* of

the object apple. Compared, verbal text and graphic-visual representation reveal an extreme polissemic similarity. The word "apple" is as general as a child's drawing of this object.

Apple seeds mentioned verbally and absent in the usual drawings of children reveal that the verbal discourse uses a broader set of perceptive modalities than the one required to draw. Drawing is culturally conventionalized to substitute a single perceptive modality: the visual perceptive modality of surface.

Being round and having a stalk that holds it to the branches of a tree is a physical property of countless fruits. In children's drawings apples and oranges are differentiated only by color: apples receive the color red and oranges get the color orange.

Proprieties are constituent elements of the natural category and the cognitive category. The natural category relates to the most usual and common level of spoken language, but the fruit "apple" may be requested by the subject who thinks and/or speaks in different cognitive categories, depending either on the study and discourse used or on the degree of expertise requested by the use of the fruit in the task X or Y, like, for example, a specific degree of ripeness of the apple that may interfere in the preparation of a dish of a determined cuisine. Cognitive categories used depend on the subjects' degree of knowledge or experience about a specific entity.

Richard (2004) reports countless research studies that demonstrate how subjects choose and quickly identify the "prototypes" or sample representatives of a category:

"Si l'on présente des images à des enfants et qu'on leur demande de montrer les animaux, les fleurs, les fruits, etc., on constate que ceux qui sont montrés les premiers sont ceux que l'on peut considérer comme les prototypes et que les omissions concernanent des exemplaires marginaux." (Richard, 2004, p.35)

Similarly, parents answering their children's questions or presenting a new sample of a category also tend to use the relationship typical sample *versus* atypical sample, naming the typical samples using the name of the category and the atypical samples using their own names. Thus, a sparrow is more frequently called "birdie" like swallows or mockingbirds. Owls and eagles, however, for their large size, physical differences and flight quality, are usually indicated by their specific names which point out the differences and stand out their properties with more emphasis.

It seems very difficult to me to intend that a blind child be able to draw or distinguish drawings using tactile-relief figures of different types of birds, for example. However, I consider that it is highly possible that he/she will learn how to draw and to read tactilely a graphic representation of a prototypical bird, that is, a representation of a bird that will allow her to acquire the general and identifying notion of a whole natural and cognitive category based on the formal characteristics. It is important to point out that those formal characteristics compose references of extreme cognitive relevance for other children.

Synthesis and conceptions in children's drawings

Besides the artistic approaches that emphasized creativity and spontaneity of child drawing in the twentieth century, some authors have devoted their work to

understanding, through visual perception and cognitive and conceptual processes, the production of drawings by children. The conceptions of Ernest Gombrich and Rudolf Arnheim are highlighted here.

In "Meditations on a Hobby Horse", the philosopher and art historian Ernest Gombrich questioned the reasons that would make a simple wooden stick represent a horse which the child of that time would ride and have fun with. He found out that the choice of a stick gathers elements that come both from the constraints of available materials and the bigger or smaller wish of the child to ride and the quick solution found to fulfill his/her need. Gombrich (1963) particularly pointed out that the stick could represent the content of a child concept of horse, a "conceptual image". Those observations made it possible for the scholar to comment that the image or the visual representation of an object does not need to be complete or full of details in order to be understood by the human mind, since the mind itself is capable of filling out the spaces and blanks in a way that is minimally suggested.

Gombrich related the production of images to a visual experience that can be extremely transitory, simple and totalizing at the same time. He completed:

"...the conceptual image might be identified with what we have called the minimum image – that minimum, that is, which will make it fit into a psychological lock." (Gombrich, 1963, p.8)

This fact makes it possible to understand that the human mind is able to recognize the formal structure of objects at an early age. Thus, in order to represent an animal one can ride (mounting it and controlling it with reins that are held to a long and inclined neck), the diagonal line provided by a stick/hobby horse is enough. This finding allowed Gombrich also to recognize that

" ... the typical children's drawing of a manikin is really a graphic enumeration of those human features the child remembered. It represents the content of the childish 'concept' of man." (Gombrich, 1963, p.8)

Reiterating his thesis, Gombrich mentions the human capacity, shared with animals, of recognizing an object through its most privileged and relevant aspects. He reminds us that little birds open their beaks to receive food when their parents approach the nest, but they act the same way if we approach two dark spots with their parents' format and size to the nest.

Similarly, Rudolf Arnheim (1974) understood that the child, while drawing, elaborates a specific way to register objects and formulate thoughts. Children's drawings are conceived by him as a two-dimensional representation scheme of three-dimensional visual forms whose genesis requires that "visual concepts" be translated into "representative concepts".

"Normally in his work the child indeed relies on concepts, but on visual concepts. The visual concept of hand consists of a round base, i.e., the palm, from which fingers sprout as straight spikes in sunbeam fashion,..."(Arnheim,1974, 1980, p.156)

According to Arnheim, the data of a primary visuality make it possible to relate the visual and the representative concepts and connect the graphic figures of objects to lines and plans. The idea that the drawing shows us a configurational generality of the object

becomes essential. Following this author, it is possible to state that children's drawings evoke objects as a general scheme of a cognitive category. Visual perception does not initiate with details, but with generalities. Rotundity, triangularity are first and fundamental perceptions like "*the character of dog is perceived before the particular character of any dog*", i.e., the perceived aspects are the "*most simple general structural aspects*" (Arnheim, 1974, 1980, p.158).

The same generalization that Arnheim perceives in the graphic schemes is a condition for word and language learning. When an adult shows the picture of a rabbit to a child in a storybook and says the word *rabbit*, the child learns and repeats the word using it not only to name that rabbit, but to represent all the rabbits (Newcombe,1999, p.220).The child perceives that the word designates a category of objects.

In my thesis in 1995, I deeply exploited the polissemic character of children's graphic schemes and its equalization to a word. That research allowed me to have a first selection of drawings called "graphic schemes" (prototypes), and understanding their highly representative character of a category of objects. The most frequent graphic schemes in the investigation carried out at that time composed the initial corpus of a work to teach drawing and reading of tactile-visual images that has been carried out in recent years. They are: house, sun, tree, bird, cloud, mountain and human figure.

Teaching drawing to a blind child

For seven years I performed with Manuella, a girl who was born blind, a weekly study. My work was to teach her drawing and reading tactile pictures in relief. When Manuella was eight and we started drawing classes she did not know the possibilities of representing the objects of the world through drawing. When asked to draw she would repeat a long line narrative process on the sheet of paper that was very pleasant for her. As she liked to listen to and to tell real and invented stories, her drawing presented a sequence of traces that would gain dimension, direction and rhythm according to the actions of the character. She represented through lines a rhythm of narrative and time, but did not produce any object graphically.

Manuella was able to recognize tactilely a square, a triangle and a circle, but she had never drawn them. A long sequence of exercises was done in order to make the outline of figures possible: the drawing of longer and shorter lines in several directions; sequences of wavy and sinuous movements; lines drawn to the sound of child rhythms and songs. The control of the gestures needed to draw (and to write) was practiced with those exercises. Simultaneously, the figures[2] were discovered tactilely in three-dimensional models and then received in two-dimensional version, but still with enough thickness to be perceived tactilely. Finally, the figure, known through three-dimensional and two-dimensional models, was presented in its linear version through a drawing produced with raised lines in tactile-relief. At that moment, Manuella would receive the "already drawn" drawing for tactile perception that reproduced the graphic scheme that all *standard* children usually have as a model. She would have to imitate the drawing and would be followed, taught, in this imitation, like other children.

[2] In this article I used the word "figure" to mean specially drawn objects, in two-dimensional way, but also simplify objects in three-dimensional version. That is, "figure" is something that substitutes the real thing in some way.

As Hatwell (2003) alerts, the work with tactile perception and its memorization is much more difficult and takes longer than the usual work with visuality. As time passed by, it was possible to realize that I was developing almost two parallel processes of teaching-learning. In the first, through tactile perception, Manuella would know the objects in simplified, schematic, facilitated versions related to the tactile modality of perception used. In that process, and in steps, evolving from three-dimensional to two-dimensional configurations, Manuella was acquiring a conception of drawing that required planning the object and its translation into raised lines. However, in the second process, in which the linear drawing should be traced and repeated, I realized that, besides the tactile memory of the drawing configuration, the motor memory of a needed graphic sequence seemed to act emphatically. This perception had its origin in some important hints: i) keeping the same drawing trace sequence of the figures was essential. If, by mistake, when starting the trace, there was any change related to the conduction of the exercise, this fact would result in clear disturbance and it was not rare that it prevent the conclusion of the task; ii) Manuella demonstrated having pleasure and paying attention when, with her hand over mine, she could perceive the action of drawing, i.e., the sequential motor movement that produced the drawing. This observation gave rise to the teaching procedure which I termed *sensoriomotor imitation* (Duarte, 2004, 2009, 2011).

After learning how to recognize and draw basic graphic schemes like house, sun, tree, flower, cloud, chair, dog, Manuella was introduced to the concept of landscape and spaciality through the same resources of physical experience and tactile perception of models. Besides that, she started, on an autonomous basis, to infer forms and elaborate, without my help, graphic representations of objects found in her daily life. This fact demonstrated that, in the process of repetition and learning, Manuella acquired a conception of drawing and was gaining autonomy to have her own experiences.

The blue lion – choosing colors

One day Manuella told me her favorite color was blue. As I knew she was capable of distinguishing a completely dark environment than one bathed in a bright light, however I was not sure if she could perceive some nuance, some shade, one possible route between darkness and light. But, in Manuella's dream the mane of lion was blue…

Manuella: - I *dreamed that I was on an island with my cousin. A nature trail.*

Researcher: - And then what happened? What was on the island?

Manuella: - *Had cat, even had a zoo.*

Researcher: - A lot of bugs?

Manuella: - *More than 38 animals…*

Researcher: - The animals were big or small?

Manuella: - *The lion was pretty fierce!*

Researcher: - How did you know he was fierce?

Manuella: - *Because I was close and I did see. The lion scowled at me, with white hair, black paws and blue mane… Navy blue mane.*

Researcher: -Did you see that the lion mane was navy blue?

Manuella: - *Yes, I did.*

In the beginning I avoided speaking in color with Manuella. Other pressing problems occupied us all the time and I was not sure about the importance of learning the names of colors if it could not win meaning through the visuality. As the above dialogue denounces, she was the one who made that element present in our meetings of drawing. I heard her dream as a demand, as if she let me know about other data of visual reality she needed to learn.

The same theoretical basis that authorized me to select a particular type of pattern to be used in the teaching-learning drawing process also showed me the kind of relationship I should set between material objects and their color. Rudolf Arnheim established a clear parallel between schematic shape and schematic color. He stated that in childhood the color registers a "general impression" given by the object just as the children drawings shapes present the most significant elements of the object (Arnheim, 1974, 1980 p.159). Generalizing color without graduations or nuances also presents a schematic view of the real object. Henri Wallon (1942) preceded Arnheim to establish this relationship, he was compared the early stages in which the child learns shapes and colors, with the stage of mental restriction of his patient in crisis. For him, at first, children really do not distinguish nuances. First the child learns to distinguish common colors and prefers "prototypical" one as did Dani people in Eleanor Rosch's research.

With Manuella I started teaching color schemes used by children in their drawings. She started to use different colors to plot the contour lines of objects, and we invented a holder for crayons that allowed her to touch and select the desired color from a preset and memorized sequence.

I started to establish relationships between the real object and the selected color that present it in children drawings. I explained that when drawing we are free to choose the color with which we want color our drawings, but that children used similar colors to color theirs similar drawings and that make them more recognizable. I explained that just as all of us write the word "house" with an "h" an "o" an "u" an "s" and an "e" (in Braille or with the Greco-Roman alphabet), also has a similar generality with which all children draw and color theirs houses.

Figure 1. Holder of crayons that allows the tactile chooses of colors.

Source: archives LabDIA (Laboratory of children and adolescents drawings research)

I and my assistant, student Alessandra Klug, create the support for crayons shown in the photograph above (Fig. 1). Manuella with this support can memorize the sequence of colors and choose them independently. In our study meeting I started to verbally inform Manuella about colors that standard children used to color each object, naming those colors that Arnheim (1974) and Wallon (1979) were considered schematic. This verbal information has become part of our common conversations like the color of the jacket used this or that day, or the color of our hairs and eyes.

Figure 2. Manuella's drawing, 2008.
Source: archives LabDIA (Laboratory of children and adolescents drawings research)

Last year I and my PhD student Mari Ines Piekas published a book presenting schematic pictures for use in drawings teaching and learning to children with special needs (Duarte and Piekas, 2013). We do not color these initial drawings. Currently we are researching and studying how and when to introduce the study of color to children with different deficits: cognitive, visual or motor.

Concluding Remarks

The objective of this article was to present the principles for a selection of tactile-visual images that has constitute a type of pictograph vocabulary in which the typical objects of the main natural and cognitive categories are graphically presented for children with special needs. Three factors have been considered to be the most relevant: the objects belonging to the basic cognitive level; the formal properties of those objects; and the children's graphic schemes that have been repeated in time and constituted an almost "natural" code in culture.

Based on Eleanor Rosch's theory of cognitive levels it was possible to understand that in each category by which we classify and group objects, there is invariably one of them that works as a general representative. In this sense, it is a prototypical object because it gathers, in a simple and generalizing way, the essential characteristics of the category to which it belongs. As far as the componential theory is concerned, I highlighted the formal and functional properties that distinguish the objects and their belonging categories from other objects and categories whose formal and functional properties have differences and mark relevant distinctions.

Typical objects from the basic level, presented through the most relevant formal and functional properties to each natural and cognitive category, are exactly the ones that children draw. In child drawing, the graphic schemes show general and polissemic objects in which the formal and functional properties are presented in a simple and direct way making their identification unequivocal.

Then, it is possible to consider that children produce naturally an iconic set capable to present objects which work as indexes of the main cognitive categories that compose the basis of human knowledge.

In the case study described above, I used child graphic schemes successfully to teach a blind child how to draw. The proposal is that this teaching be disseminated and that the same children's graphic schemes begin to compose a large code, a type of tactile-visual vocabulary that will make the visual image, object greatly emphasized in the contemporaneous media, accessible to blind people and to other children with special needs.

My investigation, carried out as a longitudinal case study, is being enlarged, nowadays, with work accomplished in new projects, among them, post graduation projects. Mari Inês Piekas and Liane Oleques are carrying out their research projects under my supervision in the PhD's Degree in Visual Arts in the State University of Santa Catarina, Brazil. They develop transversal quantitative research, investigating the legibility of Pictograph Vocabulary images by blind people and children with special needs. We hope this joined work may soon result in the selection and elaboration of new group of images that will improve and enlarge the set of "universal figures" to be used as informational tactile-visual figures for children with special needs. It is important to reinforce that in our millenarian tradition a drawing is a two-dimensional representation of an object produced in plans and lines. In this two-dimensional representation a simple and color plane if properly delimited can present a whole category of objects like the subtle difference between an apple and an orange indicated only by the red and orange colors in children's drawings. One two-dimensional drawing is the graphic (or pictorial) result of a single and simultaneous view of an object that, if three-dimensional, could be seen from different views throughout a determined process and time. Drawings and colors can be an ellipsis of time.

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Commodity Color Naming Used at Online Shops in Japan Kiwamu

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Abstract

Two surveys were executed to obtain data about the use of color names in online shopping. Then an experiment was conducted to clarify the function of the words that are combined with the word expressing the color itself.
The frequency of occurrence, at two major online shops, of the 269 color names registered in the Japanese Industrial Standards (JIS) was calculated. The result showed that only 8 colors were represented in 72 percent of usage, while 203 color names were not recorded at all. Fifteen basic color names occurred in the top twenty-one color names. The result shows that JIS color names have little influence in informing the color of commodities. Moreover, it was remarkable that the color names expressed by Katakana, the characters for expressing pronunciation of foreign word, occurred in 17 of the top 21. The preference was for pleasing images rendered by abstract Katakana expressions.
In the second survey, 3678 commodity images and the captions indicating the color names were collected from six online shops, within four categories. Seventeen percent of the captions included descriptions containing symbolic expressions of luster, texture, atmosphere, such as "smoky blue," "crystal white," or "urban beige."
Then an experiment was conducted in which the subjects selected the available expression of the combination of these symbolic words and color names to the exhibited images of commodities in four categories. The factor analysis results of the obtained data showed the dimensions of thickness and luster in electric appliances, the word groups expressing texture and color combinations in window treatments, the word groups of grave taste and denim features in casual clothes, and the dimensions of sex and age in Japanese-style clothes.

1. Introduction

This study focuses on the color names of commodities. Color names are sometimes used to distinguish one object from another (e.g. "Out of all these coats, I like the red one the most."). Color names are also used by physical and online shops for the same purpose. The first objective of this study is to compare the recognition rate of colors by determining the usage rate of color names from the data obtained from several online shops.

Some people might think that the color name itself is satisfactory to identify the colors of commodities in online shops; however, others feel that some problems may arise if the imagined color is different from the commodity's actual color (ex. "Oops. I decided to buy this because I heard it was pink. But this is salmon pink!")

This study adapts the latter position. After careful consideration of the color name usage data collected from several online shops, a color naming method will be suggested in order to ease color communication.

The survey data of the color names from online shops showed that other words are often combined with the word expressing the color itself. The study also aims to clarify the function of these words. An experiment was conducted in which participants were asked to rate whether the modifiers fit with the commodities.

2. First Survey

2.1. Method

The frequency of occurrence of the 269 color names registered in the Japanese Industrial Standards (JIS) Z 8102:2001 “Names of non-luminous object colors” at two major online

Table 1. Three types of Japanese characters

Example	Japanese charactor type	Representation type	Main subject for use
仮名 *	Kanji	Idiogram	Native origin word
かな *	Hiragana	Phonogram	Native origin word
カナ *	Katakana	Phonogram	Foreign origin word

*The pronunciation of the examples in the table is the same.

Table 2. Two hundred sixty nine color names registered on Japanese Industrial Standards with their recognition rate and hit number for two online shops (Next four pages)

No.	Color name in Japanese	Color name	Supplementary information	Munsell HVC Hue	Value	Chroma	Rank ing	Acquaintance Rate	Counted usage Shop A	Shop B
8	桃色	Momoiro	*Peach color	2.5R	6.5	8	1	100.0%	-	-
14	赤	Aka	Red	5R	4	14	1	100.0%	52	465
43	茶色	Tyairo	Brown	5YR	3.5	4	1	100.0%	-	1
61	黄色	Kiiro	Yellow	5Y	8	14	1	100.0%	-	1
100	青	Ao	Blue	10B	4	14	1	100.0%	4	55
124	紫	Murasaki	Purple	7.5P	5	12	1	100.0%	26	18
131	白	Shiro	White	N	9.5		1	100.0%	138	843
144	黒	Kuro	Black	N	1.5		1	100.0%	419	4770
147	銀色	Gin-iro	(Silver)	-	-	-	1	100.0%	-	-
180	オレンジ	Orange	*	5YR	6.5	13	1	100.0%	33	181
202	イエロー	Yellow	*	5Y	8.5	14	1	100.0%	55	268
236	ブルー	Blue	*	2.5PB	4.5	10	1	100.0%	208	520
249	ラベンダー	Lavender		5P	6	3	1	100.0%	12	25
256	ホワイト	White	*	N	9.5		1	100.0%	380	139
269	ブラック	Black	*	N	1		1	100.0%	113	758
3	桜色	Sakurairo	*Cherryblossom color	10RP	9	2.5	16	99.2%	-	-
21	小豆色	Azukiiro		8R	4.5	4.5	17	99.2%	-	-
71	黄緑	Kimidori	(Yellowish green)	2.5GY	7.5	11	17	99.2%	-	13
79	緑	Midori	Green	2.5G	6.5	10	17	99.2%	-	53
97	水色	Mizuiro	*Water color	6B	8	4	17	99.2%	2	17
158	ピンク	Pink	*	2.5R	7	7	17	99.2%	165	2260
181	ブラウン	Brown	*	5YR	3.5	4	17	99.2%	63	276
217	グリーン	Green	*	2.5G	5.5	10	17	99.1%	165	564
119	青紫	Aomurasaki	(bluish purple)	2.5P	4	14	24	98.3%	-	4
140	灰色	Haiiro	Gray	N	5		24	98.3%	-	-
164	レッド	Red	*	5R	5	14	24	98.3%	11	47
208	レモンイエロー	Lemon Yellow		8Y	8	12	24	98.3%	7	3
229	マリンブルー	Marine Blue		5B	3	7	24	98.3%	-	-
264	グレイ	Grey	*	N	5		24	98.3%	20	3
253	パープル	Purple	*	7.5P	5	12	24	98.3%	49	315
40	肌色	Hadairo		5YR	8	5	31	97.5%	-	-
101	藍色	Aiiro		2PB	3	5	31	97.4%	-	-
146	金色	Kin-iro	(Gold)	-	-	-	31	96.6%	-	1
155	ローズ	Rose		1R	5	14	31	96.6%	5	12
152	ワインレッド	Wine Red		10RP	3	9	31	97.5%	1	-
192	ベージュ	Beige		10YR	7	2.5	31	97.5%	221	656
4	ばら色	Barairo		1R	5	13	37	95.8%	-	-
44	焦茶	Kogetya		5YR	3	2	37	95.8%	-	-
170	サーモンピンク	Salmon Pink		8R	7.5	7.5	37	95.8%	1	14
178	ピーチ	Peach		3YR	8	3.5	37	95.8%	2	10
109	紺色	Koniro		6PB	2.5	4	37	94.9%	-	-
15	朱色	Syuiro		6R	5.5	14	37	94.9%	-	1
232	スカイブルー	Sky Blue		9B	7.5	5.5	37	94.9%	-	1
83	深緑	Fukamidori	(Deep green)	5G	3	7	44	94.1%	-	12
99	空色	Sorairo		9B	7.5	5.5	44	94.1%		-
130	赤紫	Akamurasaki	(Reddish purple)	5RP	5.5	13	44	94.1%	-	3
219	エメラルドグリーン	Emerald Green		4G	6	8	44	94.1%	4	3
41	橙色	Daidaiiro	Orange	5YR	6.5	13	44	93.2%	-	-
176	チョコレート	Chocolate		10R	2.5	2.5	44	93.2%	-	-
13	茜色	Akane		4R	3.5	11	44	92.4%	-	-
195	セピア	Sepia		10YR	2.5	2	44	92.4%	-	1
9	紅色	Beniiro		3R	4	14	44	91.5%	-	-
196	カーキー	Khaki		1Y	5	5.5	44	91.5%	-	-
47	蜜柑色	Mikaniro		6YR	6.5	13	54	89.8%	-	-
50	小麦色	Komugiiro		8YR	7	6	54	89.8%	-	-
143	墨	Sumi	*India ink	N	2		54	89.8%	2	-
248	バイオレット	Violet		2.5P	4	11	54	89.8%	-	5
25	赤茶	Akatya	(Reddish brown)	9R	4.5	9	58	89.0%	1	-
137	鼠色	Nezumiiro		N	5.5		58	89.0%	-	-
149	ローズピンク	Rose Pink		10RP	7	8	58	89.0%	3	2
160	ベビーピンク	Baby Pink		4R	8.5	4	58	89.0%	1	2
89	青緑	Aomidori	(Bluish green)	7.5BG	5	12	62	88.1%	-	31
120	菫色	Sumireiro		2.5P	4	11	62	88.0%	-	-
35	栗色	Kuriiro		2YR	3.5	4	64	87.3%	-	-
54	山吹色	Yamabukiiro		10YR	7.5	13	64	87.3%	-	-
191	ブロンズ	Bronze		8.5YR	4	5	64	87.3%	35	52
70	抹茶色	Mattyairo		2GY	7.5	4	67	86.4%	-	-
60	芥子色	Karashiiro		3Y	7	6	67	85.6%	-	-
228	ターコイズブルー	Turquoise Blue		5B	6	8	69	85.5%	14	8

No.	Color name in Japanese	Color name	Supplementary information	Munsell HVC Hue	Value	Chroma	Rank ing	Acquaintance Rate	Counted usage Shop A	Shop B
49	土色	Tsuchiiro		7.5YR	5	7	69	83.9%	-	-
197	ブロンド	Blond		2Y	7.5	7	69	83.9%	-	-
237	コバルトブルー	Cobalt Blue		3PB	4	10	69	83.9%	-	-
258	アイボリー	Ivory		2.5Y	8.5	1.5	69	83.9%	35	228
75	草色	Kusairo		5GY	5	5	74	83.1%	-	-
156	ストロベリー	Strawberry		1R	4	14	74	83.1%	-	1
216	ミントグリーン	Mint Green		2.5G	7.5	8	74	83.1%	16	5
242	ネービーブルー	Navy Blue		6PB	2.5	4	74	82.9%	-	-
203	クリームイエロー	Cream Yellow		5Y	8.5	3.5	78	82.2%	1	3
207	オリーブ	Olive		7.5Y	3.5	4	78	82.2%	5	22
11	えんじ	Enji		4R	4	11	80	81.4%	-	-
107	るり色	Ruriiro		6PB	3.5	11	80	81.4%	-	-
73	若草色	Wakakusairo		3GY	7	10	80	80.5%	-	-
255	チェリーピンク	Cherry Pink		6RP	5.5	11.5	83	80.5%	2	3
46	杏色	Anzuiro		6YR	7	6	84	78.8%	-	-
142	黒茶	Kurotya	(Blackish brown)	2.5YR	2	1.5	85	76.3%	-	3
182	アプリコット	Apricot		6YR	7	6	85	76.3%	-	1
218	コバルトグリーン	Cobalt Green		4G	7	9	85	76.3%	-	-
139	鉛色	Namariiro		2.5PB	5	1	88	75.4%	-	-
257	スノーホワイト	Snow White		N	9.5		88	75.4%	-	-
32	れんが色	Rengairo		10R	4	7	90	73.5%	-	-
129	牡丹色	Botan		3RP	5	14	91	72.9%	-	-
117	藤色	Fujiiro		10PB	6.5	6.5	92	72.0%	-	-
148	ローズレッド	Rose Red		7.5RP	5	12	92	72.0%	-	2
112	群青色	Gunjouiro		7.5PB	3.5	11	94	71.2%	-	-
57	ひまわり色	Himawariiro		2Y	8	14	94	70.9%	-	-
48	褐色	Kassyoku		6YR	3	7	96	70.3%	-	-
51	こはく色	Kohakuiro		8YR	5.5	6.5	96	70.3%	-	-
29	柿色	Kakiiro		10R	5.5	12	98	69.5%	-	-
69	鶯色	Uguisuiro		1GY	4.5	3.5	98	69.5%	-	-
262	アッシュグレイ	Ash Grey		N	6		100	67.8%	-	-
267	チャコールグレイ	Charcoal Grey		5P	3	1	100	67.8%	-	-
177	ココアブラウン	Cocoa Brown		2YR	3.5	4	102	66.9%	-	-
184	マンダリンオレンジ	Mandarin Orange		7YR	7	11.5	103	65.3%	-	-
55	黄土色	Oudoiro		10YR	6	7.5	104	64.4%	-	-
76	若葉色	Wakabairo		7GY	7.5	4.5	104	64.4%	-	-
215	アップルグリーン	Apple Green		10GY	8	5	104	63.6%	-	-
174	キャロットオレンジ	Carrot Orange		10R	5	11	107	61.0%	-	-
209	オリーブグリーン	Olive Green		2.5GY	3.5	3	107	60.7%	7	1
261	シルバーグレイ	Silver Grey		N	6.5		109	60.2%	-	-
62	たんぽぽ色	Tanpopoiro		5Y	8	14	110	59.3%	-	-
102	濃藍	Koiai		2PB	2	3.5	110	59.0%	-	-
151	ルビーレッド	Ruby Red		10RP	4	14	112	58.5%	-	-
28	赤橙	Akadaidai		10R	5.5	14	113	56.8%	-	-
240	ミッドナイトブルー	Midnight Blue		5PB	1.5	2	113	56.8%	-	-
6	さんご色	Sangoiro		2.5R	7	11	115	55.9%	-	-
188	マリーゴールド	Marigold		8YR	7.5	13	116	55.9%	-	-
26	赤錆色	Akasabiiro		9R	3.5	8.5	117	54.2%	-	-
58	うこん色	Ukon-iro		2Y	7.5	12	118	54.2%	-	-
10	紅赤	Beniaka		3.5R	4	13	118	53.4%	-	-
39	黄茶	Kitya		4YR	5	9	118	53.4%	-	-
187	ゴールデンイエロー	Golden Yellow		7.5YR	7	10	118	53.4%	-	-
254	マゼンタ	Magenta		5RP	5	14	118	53.0%	-	-
165	トマトレッド	Tomato Red		5R	5	14	123	51.7%	1	-
106	紺青	Konjou		5PB	3	4	124	50.8%	-	-
115	ききょう色	Kikyouiro		9PB	3.5	13	125	50.4%	-	-
116	紺藍	Kon-ai		9PB	2.5	9.5	125	50.0%	-	-
234	ベビーブルー	Baby Blue		10B	7.5	3	125	50.0%	-	-
63	鶯茶	Uguisuiro		5Y	4	3.5	128	49.2%	-	-
243	ウルトラマリンブルー	Ultramarine Blue		7.5PB	3.5	11	128	49.2%	-	-
88	鉄色	Tetsuiro		2.5BG	2.5	2.5	130	48.3%	-	-
53	卵色	Tamagoiro		10YR	8	7.5	131	47.5%	-	-
126	なす紺	Nasukon		7.5P	2.5	2.5	131	47.5%	-	-
33	錆色	Sabiiro		10R	3	3.5	131	46.6%	-	-
118	藤紫	Fujimurasaki		0.5P	6	9	131	46.6%	-	-
260	パールグレイ	Pearl Grey		N	7		131	47.5%	-	-
168	スカーレット	Scarlet		7R	5	14	136	45.8%	-	-
36	黄赤	Kiaka	(Yellowish red)	2.5YR	5.5	13	137	43.2%	-	-
231	シアン	Cyan		7.5B	6	10	137	42.7%	1	-

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59	砂色	Sunairo		2.5Y	7.5	2	139	41.5%	-	-
211	リーフグリーン	Leaf Green		5GY	6	7	139	41.5%	-	-
7	紅梅色	Koubaiiro		2.5R	6.5	7.5	141	40.7%	-	-
133	生成り色	Kinariiro		10YR	9	1	141	40.7%	-	-
128	あやめ色	Ayameiro		10P	6	10	143	39.8%	-	-
157	コーラルレッド	Coral Red		2.5R	7	11	144	39.0%	-	2
108	るり紺	Rurikon		6PB	3	8	145	38.1%	-	-
259	スカイグレイ	Sky Grey		7.5B	7.5	0.5	145	38.1%	-	-
123	江戸紫	Edomurasaki		3P	3.5	7	147	36.4%	-	-
2	つつじ色	Tsutsujiiro		7RP	5	13	147	35.6%	-	-
159	ボルドー	Bordeaux		2.5R	2.5	3	147	35.6%	4	-
171	シェルピンク	Shell Pink		10R	8.5	3.5	147	35.6%	-	-
226	ナイルブルー	Nile Blue		10BG	5.5	5	147	35.6%	-	-
246	パンジー	Pansy		1P	2.5	10	152	35.6%	-	-
244	オリエンタルブルー	Oriental Blue		7.5PB	3	10	153	34.7%	-	-
74	萌黄	Moegi		4GY	6.5	9	153	33.9%	-	-
81	緑青色	Ryokusyouiro		4G	5	4	153	33.9%	-	-
173	チャイニーズレッド	Chinese Red		10R	6	15	153	33.9%	-	-
84	もえぎ色	Moegiiro		5.5G	3	5	157	33.3%	-	-
122	しょうぶ色	Syoubuiro		3P	4	11	157	33.1%	-	-
103	勿忘草色	Wasurenagusairo		3PB	7	6	159	32.2%	-	-
238	アイアンブルー	Iron Blue		5PB	3	4	160	31.4%	-	-
24	金赤	Kin-aka		9R	5.5	14	160	30.5%	-	-
52	金茶	Kintya	*Golden Brown	9YR	5.5	10	162	29.7%	-	1
222	フォレストグリーン	Forest Green		7.5G	4.5	5	163	28.8%	-	-
235	サックスブルー	Sax Blue		1PB	5	4.5	163	28.8%	-	-
127	紫紺	Shikon		8P	2	4	165	28.0%	-	-
205	カナリア	Canary Yellow		7Y	8.5	10	165	28.0%	1	-
223	ビリジアン	Viridian		8G	4	6	165	28.0%	-	-
42	灰茶	Haitya		5YR	4.5	3	168	27.1%	-	-
241	ヒアシンス	Hyacinth		5.5PB	5.5	6	168	27.1%	-	-
93	浅葱色	Asagiiro		2.5B	5	8	170	26.3%	-	-
172	ネールピンク	Nail Pink		10R	8	4	170	26.3%	-	-
5	からくれない色	Karakurenaiiro		1.5R	5.5	13	172	25.4%	-	-
87	青竹色	Aotakeiro		2.5BG	6.5	4	172	25.4%	-	-
161	ポピーレッド	Poppy Red		4R	5	14	172	24.8%	-	-
38	らくだ色	Rakudairo		4YR	5.5	6	172	24.6%	-	-
85	若竹色	Wakatakeiro		6G	6	7.5	172	24.6%	-	-
263	ローズグレイ	Rose Grey		2.5R	5.5	1	172	24.6%	-	-
77	松葉色	Matsubairo		7.5GY	5	4	178	23.7%	-	-
134	象牙色	Zougeiro		2.5Y	8.5	1.5	178	23.7%	-	-
66	きはだ色	Kihadairo		9Y	8	8	180	22.9%	-	-
72	苔色	Kokeiro		2.5GY	5	5	180	22.9%	-	-
56	朽葉色	Kuchibairo		10YR	5	2	182	22.0%	-	-
251	ライラック	Lilac		6P	7	6	182	22.0%	1	1
136	茶鼠	Tyanezumi		5YR	6	1	184	21.2%	-	-
185	コルク	Cork		7YR	5.5	4	184	21.2%	-	15
233	セルリアンブルー	Cerulean Blue		9B	4.5	9	184	21.2%	-	-
250	モーブ	Mauve		5P	4.5	9	184	20.5%	-	-
104	露草色	Tsuyukusairo		3PB	5	11	188	18.6%	-	-
154	オールドローズ	Old Rose		1R	6	6.5	188	18.6%	1	-
214	アイビーグリーン	Ivy Green		7.5GY	4	5	188	18.6%	-	-
80	常磐色	Tokiwairo		3G	4.5	7	191	17.8%	-	-
135	銀鼠	Gin-nezu		N	6.5		191	17.8%	-	-
110	かきつばた色	Kakitsubata		7PB	4	10	193	16.9%	-	-
169	テラコッタ	Terracotta		7.5R	4.5	8	193	16.9%	-	-
227	ピーコックブルー	Peacock Blue		10BG	4	8.5	193	16.9%	4	-
23	海老茶	Ebitya		8R	3	4.5	196	16.1%	-	-
163	カーマイン	Carmine		4R	4	14	196	16.1%	-	-
213	シーグリーン	Sea Green		6GY	7	8	196	16.1%	-	-
45	こうじ色	Koujiiro		5.5YR	7.5	9	199	15.4%	-	-
138	利休鼠	Rikyuunezumi		2.5G	5	1	199	15.3%	-	-
34	檜皮色	Hiwadairo		1YR	4.3	4	201	14.4%	-	-
86	青磁色	Seijiiro		7.5G	6.5	4	201	14.4%	-	-
212	グラスグリーン	Grass Green		5GY	5	5	201	14.4%	-	1
78	白緑	Byakuroku		2.5G	8.5	2.5	201	13.6%	-	-
193	イエローオーカー	Yellow Ocher		10YR	6	7.5	201	13.6%	-	-
16	紅樺色	Benikabairo		6R	4	8.5	206	12.7%	-	-
82	千歳緑	Chitosemidori		4G	4	3.5	207	12.0%	-	-

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105	はなだ色	Hanadairo		3PB	4	7.5	207	12.0%	-	-
1	とき色	Tokiiro		7RP	7.5	8	207	11.9%	-	-
20	とび色	Tobiiro		7.5R	3.5	5	207	11.9%	-	-
98	藍鼠	Ainezu		7.5B	4.5	2.5	207	11.9%	-	-
145	鉄黒	Tetsuguro		N	1.5		207	11.9%	-	-
186	エクルベイジュ	Ecru Beige		7.5YR	8.5	4	207	11.9%	-	-
225	ピーコックグリーン	Peacock Green		7.5BG	4.5	9	207	11.9%	2	2
239	プルシャンブルー	Prussian Blue		5PB	3	4	207	11.9%	-	-
31	樺色	Kabairo		10R	4.5	11	216	11.0%	-	-
201	クロムイエロー	Chrome Yellow		3Y	8	12	216	11.0%	-	-
265	スチールグレイ	Steel Grey		5P	4.5	1	216	11.0%	-	-
141	すす竹色	Susutakeiro		9.5YR	3.5	1.5	219	10.2%	-	-
224	ビリヤードグリーン	Billiard Green		10G	2.5	5	219	10.2%	-	-
113	鉄紺	Tetsukon		7.5PB	1.5	2	221	9.3%	-	-
190	アンバー	Amber		8YR	5.5	6.5	221	9.3%	-	-
221	ボトルグリーン	Bottle Green		5G	2.5	3	221	9.3%	-	-
19	紅海老茶	Beniebitya		7.5R	3	5	224	8.5%	-	-
125	古代紫	Kodaimurasaki		7.5P	4	6	224	8.5%	-	-
198	ネープルスイエロー	Naples Yellow		2.5Y	8	7.5	224	8.5%	-	-
230	ホリゾンブルー	Horizon Blue		7.5B	7	4	224	8.5%	-	-
268	ランプブラック	Lamp Black		N	1		224	8.5%	-	-
167	バーミリオン	Vermilion		6R	5.5	14	224	7.7%	-	-
220	マラカイトグリーン	Malachite Green		4G	4.5	9	224	7.6%	-	-
266	スレートグレイ	Slate Grey		2.5PB	3.5	0.5	224	7.6%	-	-
17	紅緋	Benihi		6.8R	5.5	14	232	6.8%	-	-
18	鉛丹色	Entaniro		7.5R	5	12	232	6.8%	-	-
37	たいしゃ	Taisya		2.5YR	5	8.5	232	6.8%	-	-
64	中黄	Tyuuki		7Y	8.5	11	232	6.8%	-	-
150	コチニールレッド	Cochineal Red		10RP	4	12	232	6.8%	-	-
183	タン	Tan		6YR	5	6	232	6.8%	-	-
252	オーキッド	Orchid		7.5P	7	6	232	6.8%	-	-
12	蘇芳	Suou		4R	4	7	239	5.9%	-	-
22	弁柄色	Bengarairo		8R	3.5	7	239	5.9%	-	-
27	黄丹	Ouni		10R	6	12	239	5.9%	-	-
92	新橋色	Shinbashiiro		2.5B	6.5	5.5	239	5.9%	-	-
121	鳩羽色	Hatobairo		2.5P	4	3.5	239	5.9%	-	-
162	シグナルレッド	Signal Red		4R	4.5	14	239	5.9%	-	-
90	錆浅葱	Sabiasagi		10BG	5.5	3	245	5.1%	-	-
204	ジョンブリアン	Jaune Brillant		5Y	8.5	14	245	5.1%	-	-
30	肉桂色	Nikkeiiro		10R	5.5	6	247	4.2%	-	-
67	みる色	Miruiro		9.5Y	4.5	2.5	247	4.2%	-	-
68	ひわ色	Hiwairo		1GY	7.5	8	247	4.2%	-	-
91	水浅葱	Mizuasagi		1.5B	6	3	247	4.2%	-	-
95	納戸色	Nandoiro		4B	4	6	247	4.2%	-	-
132	胡粉色	Gofuniro		2.5Y	9.2	0.5	247	4.2%	-	-
200	ローアンバー	Raw Umber		2.5Y	4	6	247	4.2%	-	-
210	シャトルーズグリーン	Chartreuse Green		4GY	8	10	247	4.2%	-	-
94	白群	Byakugun		3B	7	4.5	255	3.4%	-	-
153	バーガンディー	Burgundy		10RP	2	2.5	255	3.4%	-	-
166	マルーン	Maroon		5R	2.5	6	255	3.4%	-	-
194	バーントアンバー	Burnt Umber		10YR	3	3	255	3.4%	-	-
245	ウイスタリア	Wistaria		10PB	5	12	255	3.4%	-	-
65	刈安色	Kariyasuiro		7Y	8.5	7	255	2.5%	-	-
175	バーントシェンナ	Burnt Sienna		10R	4.5	7.5	255	2.5%	-	-
206	オリーブドラブ	Olive Drab		7.5Y	4	2	255	2.5%	-	-
179	ローシェンナ	Raw Sienna		4YR	5	9	263	1.7%	-	-
189	バフ	Buff		8YR	6.5	5	263	1.7%	-	-
96	かめのぞき	Kamenozoki		4.5B	7	4	263	1.7%	-	-
111	勝色	Kachiiro		7PB	2.5	3	263	1.7%	-	-
114	藤納戸	Fujinando		9PB	4.5	7.5	263	1.7%	-	-
199	レグホーン	Leghorn		2.5Y	8	4	263	1.7%	-	-
247	ヘリオトロープ	Heliotrope		2P	5	10.5	263	1.7%	-	-

Supplement for Table 1
Supplementary information
( ):Meaning of Japanese color name
*: Direct translation of color name

Counted Usage
Shop A: Nissen:http://www.nissen.co.jp/
Shop B: Rapty:http://www.rapty.com/

shops was calculated from the indicated numbers of the word searching function in the Web site. The main items sold by these two online shops are clothes, shoes, bags, and one of the shops also sells miscellaneous goods for every day use.

2.2. Result

The counted total usage of color names registered on JIS was a large number, 14,997 (Table 2). However, the result showed that only 66 color names were used, while 203 color names were not recorded at all. These 66 occurring color names included basic colors and their compounds written in both Kanji expressions, such as "Kuro (Black)," "Shiro (White)," "Kimidori (Yellowish green)," and Katakana expressions, such as "Black" and "White." They also comprised 90% of the total color names used. Moreover, the result showed that only eight colors (Kuro, Black, Shiro, White, Aka, Blue, Pink, Green) were represented in 72% of color names used, and 15 Kanji or Katakana basic color names occurred in the top 21 color names.

In fact, JIS color names contain many colors that the general public would find unfamiliar. Table 2 shows the acquaintance rates calculated from the former survey in which 118 female university students were asked to recognize several color names. The color names that more than 80% of participants could recognize were only 83 out of 269 (31%).

The results of these surveys show that JIS color names have little influence on informing the color of commodities. Moreover, it was remarkable that the color names expressed in Katakana, the characters for expressing pronunciation of foreign words, occurred in 17 of the top 21. Preference was shown for pleasing images rendered by abstract Katakana expressions.

3. Second Survey

3.1. Method

In this survey, 3,678 commodity images with captions indicating the color names were collected from six online shops within four categories. Table 3 indicates information about the surveyed shops.

Table 3. Information about the online shops from where the commodity images and captions were collected

Commodity category	Shop Name	Site address	Obtained image number
Clothes	Nissen Cecile	http://www.nissen.co.jp/ http://www.cecile.co.jp/	2,225
Furnitures Curtains	Matsusou Yuuai	http://www.matusou.co.jp/ http://www.yuuai.net/	555
Home electric appliances	Yamada electronics	http://www.yamada-denkiweb.com/	156
Japanese-style clothing	Kyoto Kimono market	http://www.kimonoichiba.com/	742

Table 4. Examples of color names with modifiers obtained from the captions at six online shops

Obtained color name	Atmosphere	Treatment	Tone	Object	Color name	Pattern
Earth Green				Earth	Green	
Urban Beige	Urban				Beige	
Ice Gray				Ice	Gray	
Ivory Beige				Ivory	Beige	
Acid Yellow				Acid	Yellow	
Aqua Blue				Aqua	Blue	
Ash Sky				Ash	Sky	
Amegist Purple				Amegist	Purple	
Antique Rose	Antique				Rose	
Amber Yellow				Amber	Yellow	
Italian Red	Italian				Red	
Vivid Pink			Vivid		Pink	
Vintage Blue	Vintage				Blue	
Washed Blue		Washed			Blue	
Woody Brown				Woody	Brown	
Elegant Champagne	Elegant			Champagne		
Orchid Purple				Orchid	Purple	
Old Green	Old				Green	
Mild Silver Gray	Mild			Silver	Gray	
Off-White			Off		White	
Tasteful Mustard	Tasteful			Mustard		
Oriental Blue	Oriental				Blue	
Khaki Brown			Khaki*		Brown	
Khaki Gray			Khaki*		Gray	
Neat Black	Neat				Black	
Cool Black	Cool				Black	
Dingy Malon Brown	Dingy			Malon	Brown	
Cloudy Rose	Cloudy				Rose	
Clear Pink	Clear				Pink	
Cleam Beige				Cleam	Beige	
Green Gradation					Green	Gradation
Green Check					Green	Check
Crystal Brown				Crystal	Brown	
Grayish Oak			Grayish	Oak		
Gray Stripe					Gray	Stripe
Gray Border					Gray	Border
Gray Moku					Gray	Moku**
Golden Oak				Golden	Oak	
Coral Pink				Coral	Pink	
Common Black	Common				Black	

*These "Khaki"s are supposed to mean "dingy" because they are linked with a variety of color names.

**"Moku" is a Japanese word that means fabrics braided using pale and deep color yarn.

3.2. Result

Seventeen percent of the captions included descriptions containing symbolic expressions of texture, and atmosphere, such as "smoky blue," "crystal white," or "urban beige" (see Table 4 for examples). This result suggests the existence of some information that sellers want to convey to customers apart from merely discriminating the item color.

The word order of the combinations are regular even though the number of words in the expressions vary. The order is atmosphere, tone, treatment, object, color, and pattern. Table 4 contains 15 atmosphere terms and suggests the importance of expressing them. There are 19 words used to express objects, which is much more than the five expressing tones. This

result highlights the effectiveness of imaging object to convey the color image.

4. Experiment

4-1. Method

Subjects selected the available modifiers for the exhibited images of commodities from the four categories. The number of commodity images shown to subjects were 10 for casual clothes, 13 for window treatments and wallpapers, 16 for home electronic appliances, and 31 for Japanese-style clothing. The number of words available to choose from were 10 for casual clothes, 11 for window treatments and wallpapers, 13 for home electronic appliances, and 26 for Japanese-style clothing. The subjects consisted of 18 female university students whose ages ranged from 18 to 22.

4.2. Result

Principal component analysis was applied to the obtained data on each category of commodities. Figures 1.1 to 1.4 show the principal component scores of each modifier. The pictures on these graphs are the image that the largest number of subjects voted to apply it to. The number below the images shows the number of people who voted for the image.

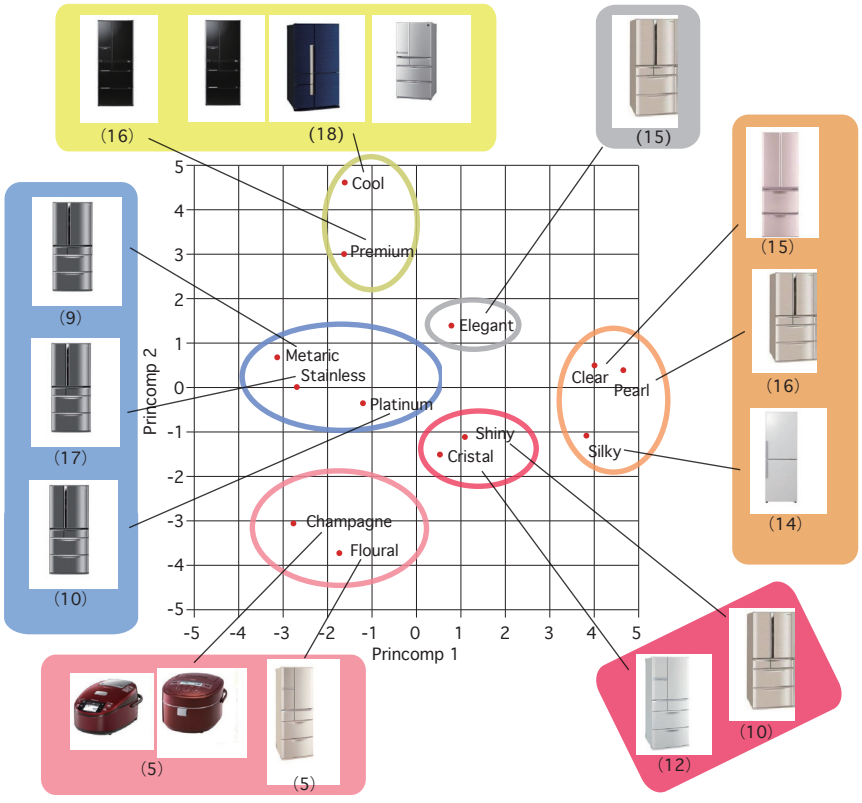
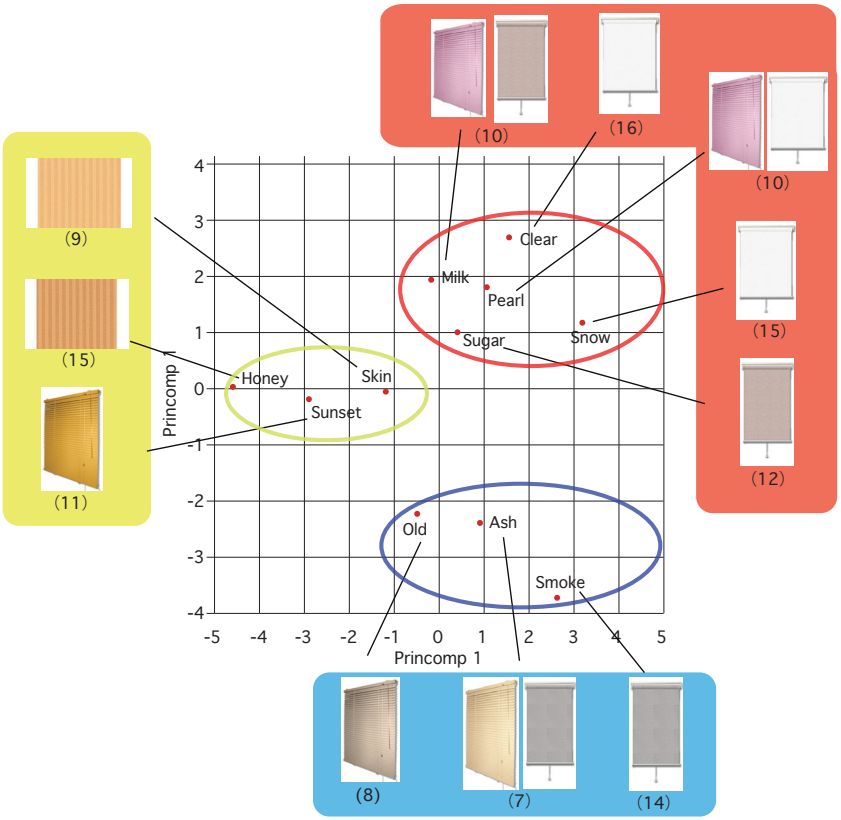
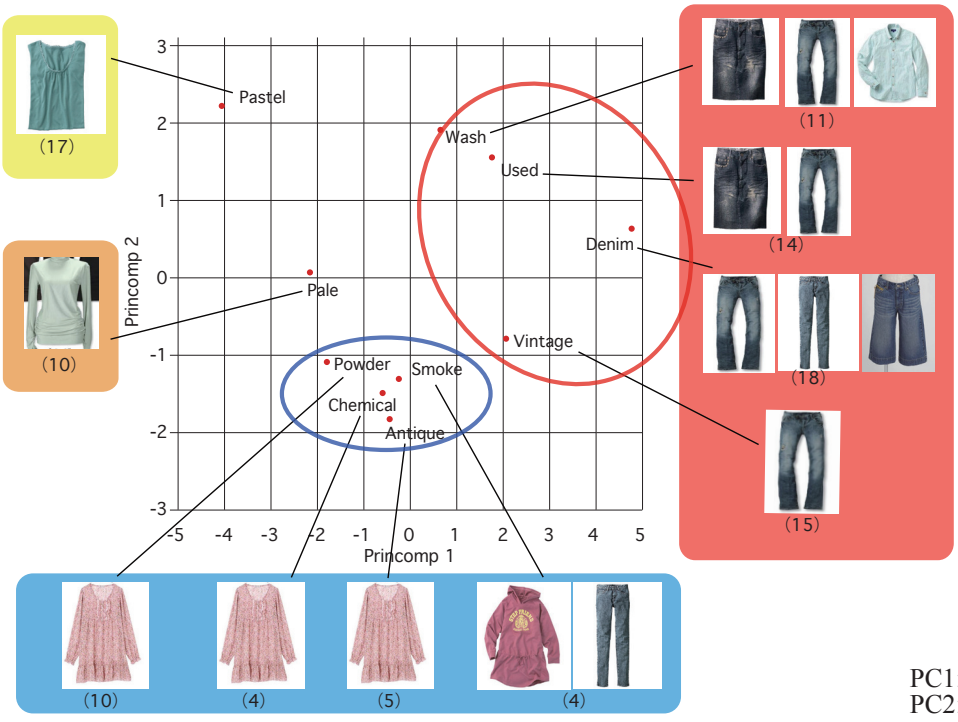


Figure 1.1. Scores of principal component analysis with dummy variables indicating the occasions of modifier fitness for the presented commodity images (Home electronic appliances)



PC1: 41.5%
PC2: 31.6%

Figure 1.2. Scores of principal component analysis with dummy variables indicating the occasions of modifier fitness for the presented commodity images (Curtains and blinds)



PC1: 61.2%
PC2: 22.6%

Figure 1.3. Scores of principal component analysis with dummy variables indicating the occasions of modifier fitness for the presented commodity images (Casual cloths)

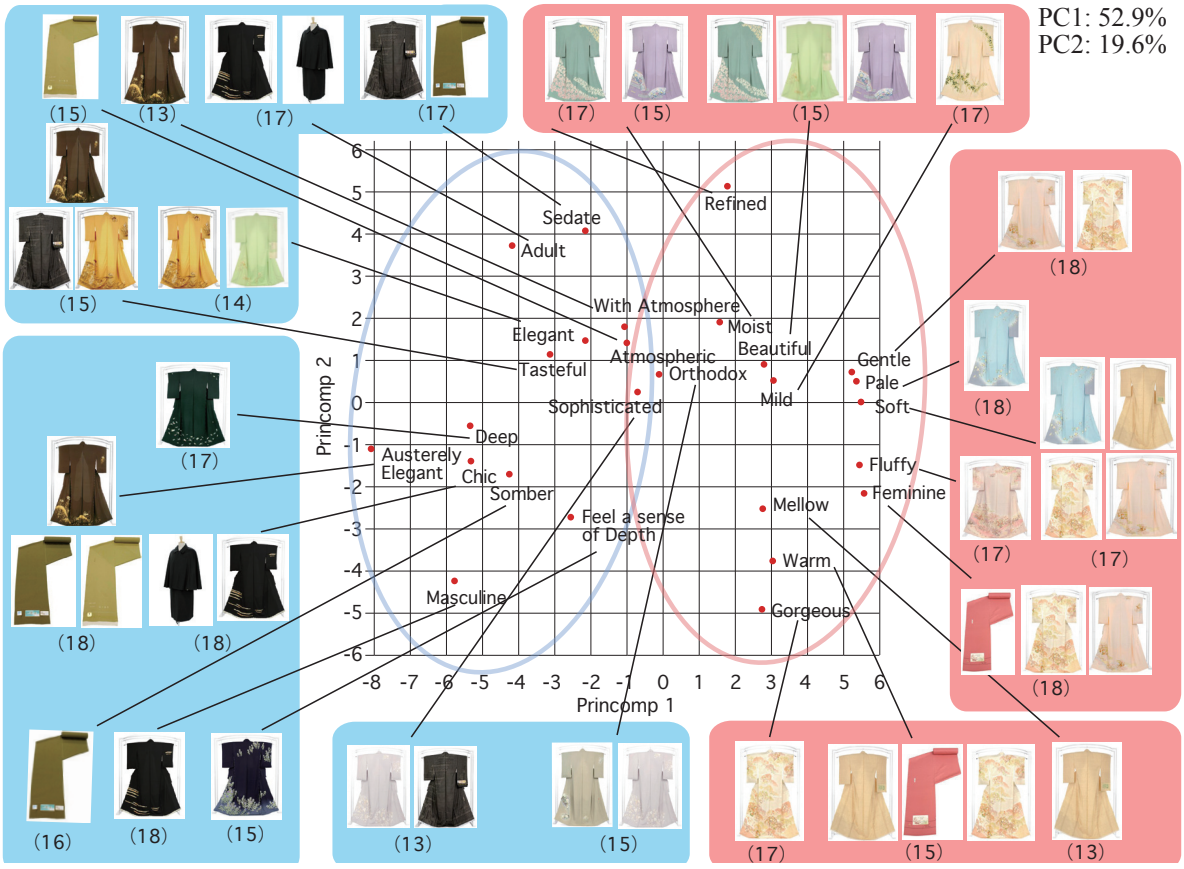


Figure 1.4. Scores of principal component analysis with dummy variables indicating the occasions of modifier fitness for the presented commodity images (Japanese Style Cloths)

Position similarity on these graphs indicates the modifier similarity for the application to the images. In the home electronic appliances category, the upper-left part is occupied by the cold colored items, and pale warm colored items are located in the lower-right part (Figure 1.1). “Cool,” “Premium,” “Metallic” feelings match to dark colored items such as black or dark blue. On the other hand, “Clear,” “Pearl,” “Silky,” “Elegant” feelings match to bright colored items such as white or pink. Dim items and those with less luster are located in the top-left and have a cool impression. The “Champagne” color image is influenced by its liquid color commonly. However, the female university students might imagine it to have a fashionable taste, they thought a deep red with luster fit the word.

Figure 1.2 shows the results for window treatments and stripe wallpapers. It shows that three main groups defined by color exist. “Honey,” “Skin,” “Sunset” were found to fit for bright orange items. “Clear, “Milky,” “Pearl,” “Sugar,” “Snow” fit for white or pink items, and “Smoke,” “Ash,” and “Old” fit for grayish colored items.

Figure 1.3 shows the results for casual clothes. The modifiers that have tight relation to denim clothes such as “denim,” “used,” and so on are plotted in the right half of the figure, while the other items are distributed widely. The locations of “Pale” and “Pastel” seem to correlate with the item colors. “Smoke,” “Antique,” “Chemical,” and “Powder,” which seem to relate to items with a dingy colored tone.

Brightly colored Japanese-style clothing are located in the right half of Figure 1.4 and dark or middle brightness items are located in the left half. It shows the brightness of an item divides applicable modifiers primarily. This difference corresponds to the age of people that should wear them. Bright clothes, called “Furisode,” are for young, unmarried women,

while dark clothes, called “Tomesode,” are for married women. This suggests that there should be an applicable atmosphere depending on age.

5. Discussion

5.1. Other factors of color names besides the color itself

The fact that almost one of five commodity color names contain modifiers expressing atmosphere, texture, material and so on seem to indicate that the necessity to convey this information to customers is recognized.

In the experiment described above, the degree of matching between modifiers and items in each category is determined by largely color. We could only find an unclear group of texture or material. The general tendency of matching in judgment showed in the first and second principal components must be influenced primarily by color. This suggests that modifiers send information of color atmosphere even if the modifiers express texture, material, and such. These information may be used to guide and enhance the color message for customer.

5.2. Color name for communication to customer

Seventy percent of color names registered in JIS Z 8102:2001 are recognized by less than 20 percent of female university students. This result indicates that the availability of this color name for communication between sellers and customers is limited.

To supplement this weakness, JIS also provides another color naming system that is a hue-tone system consisting of registered basic color words expressing hue (Figure 2) and color name designations that express tones. The author proposes a new hue-tone color naming method similar to the one JIS provides, but one that is more familiar to customers. Ten hue

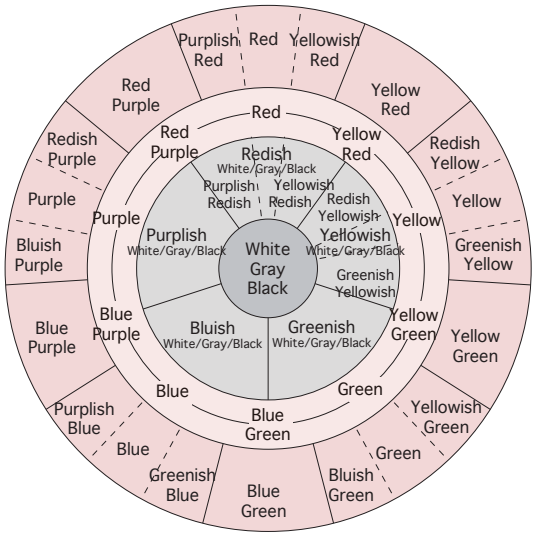


Figure 2. Basic color names prescribed in JIS

In the case that the mixture of the degree of two basic colors is almost the same, the two words are directly combined in Japanese.
(Ki-Midori is a composition of Ki (Yellow) and Midori (Green).)

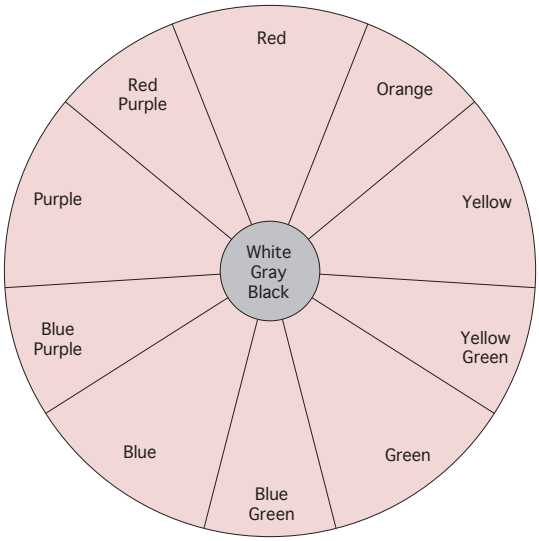


Figure 3. Component word expressing hue for the proposed color naming method

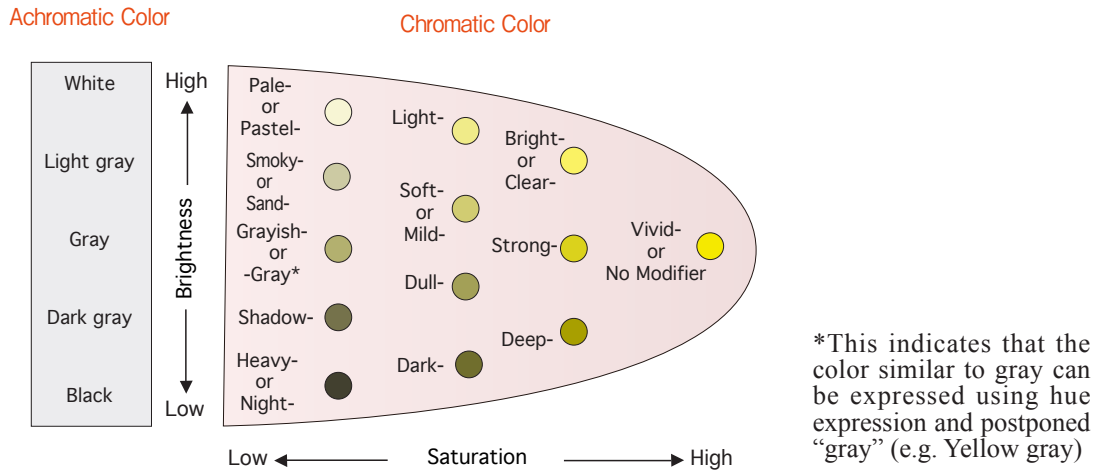


Figure 4. Component word expressing tone for the proposed color naming method

Basic color term expressing hue		Tone Expressing Modifier		Color name
Red Orange Yellow Yellow Green Green Blue Green Blue Blue Purple Purple Red Purple	+	Deep Dark Heavy	=	Deep Orange Dark Orange Heavy Orange
	+	Clear Soft Mild	=	Clear Blue Green Soft Blue Green Mild Blue Green
	+	Light Pale Vivid	=	Light Red Purple Pale Red Purple Vivid Red Purple

Figure 5. Naming examples fro the proposed color naming method

expressions consist only of basic color terms and their combinations in Japanese because no "ish" using expressions such as "Bluish green" or "Yellowish red" are found in the results of the first survey.

Tone expression is different from the JIS system even though the number of tones is thirteen, which is the same as the JIS system. The main difference is the character usage. The JIS system uses Kanji and Hiragana, which means that this system uses traditional Japanese words such as "Akarui (i.e. Bright)" and "Koi (i.e. Deep)". On the other hand, the suggested method uses Katakana words such as "Buraito" and "Dhiipu" in pronunciation. This judgment is based on two reasons. One is because it is preferred by the Japanese for the Katakana expression showed in the first survey, and the other is due to the familiarity showed in second survey. The expressions of tones in Figure 4 are derived from the second survey. This tone expression using Katakana naturally leads to the employment of Katakana for hue expression as well.

This color naming method can express 135 colors. This number is considered adequate for item recognition and atmosphere transmission caused by commodity colors (Figure 3, 4, 5).

5.3. Future research

The sample employed in the experiment described above contains sample number differences, and the feature variety is limited. Large numbers of samples and categories with a large variety of color, material, and shape should be adopted for increasing reliability.

Acknowledgements

The author wishes to convey special appreciation to Saori Kashiwazake and Akiko Kobayashi, the co-researchers of the research.

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La Captura y la Reproducción Creativa del Color y la Luz. "Capturando la luz y manipulando el color".

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Resumen

En 13 años de experiencia en docencia universitaria, todos ellos en programas académicos y en áreas enfocadas a la experimentación con la imagen ya sea para la comunicación o el arte sumado al cambio de las imágenes de lo análogo al digital casi en todas las áreas me ha llevado por ese mismo tiempo a experimentar con el color desde su percepción cognitiva, sicológica, artística, y técnica.

Uno de los objetivos de sensibilizar a los participantes sobre el cambio que genera la utilización y manipulación del color en la fotografía digital desde el proceso de preproducción, la captura y la manipulación de los pixeles que mas que información de luz llevan información de color.

6 años de experimentación con el color análogo en película y hoy en digital, despliegan un abanico inmenso de posibilidades de expresión desde lo cotidiano, lo educativo, lo artístico, lo comercial y lo científico, el proceso coloca el color como código adicional de comunicación en el contexto de la Sociedad de la Informática y la Información.

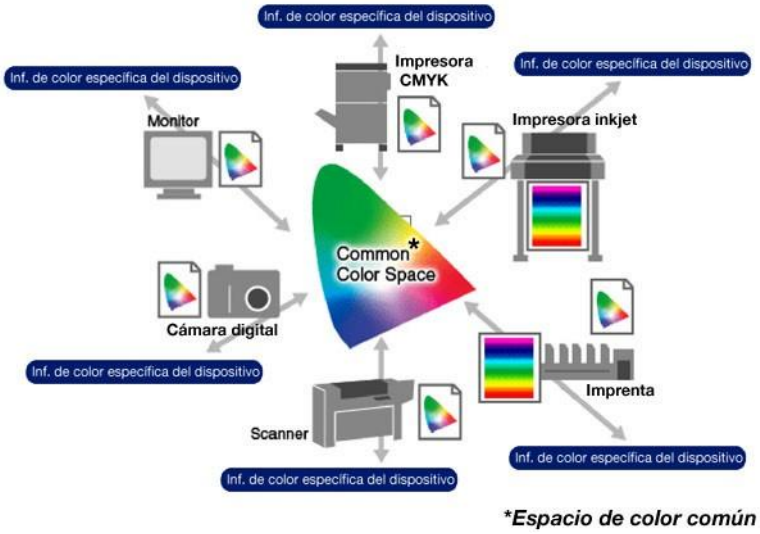
Por último, se presenta la metodología y el resultado de las pruebas piloto desarrolladas junto con un grupo de estudiantes de 2do semestre de la institución durante los 10 últimos años.

Introducción

Desde la invención de los escáneres, hasta las cámaras digitales y sus procesos de captura y manipulación del espectro visible, han servido para desarrollar, proyectos de trabajo académico, experimentaciones con la captura del color que fusionando la técnica, la tecnología, la preproducción y posproducción fotográfica, generan resultados alternos a la fotografía convencional y la forma como interpretamos y entendemos el color.

Flamas y humo de filamento de tugsteno capturadas con diferente iluminación.

El proceso de captura en película dejaba muy poco a la imaginación y el único universo de exploración estuvo centrado en el revelado de la misma y su copiado a papel, estos procesos terminaron por convertirse en la base fundamental de la manipulación, exploración e investigación del color digital y la tecnología de posproducción digital actual.
Luego la fluidez de las imágenes digitales de hoy y su proceso inmediato de captura, proceso, fusión y salida, nunca fueron tan rápidos ni tan tecnológicos, esto da como resultado un amplio espectro de posibilidades de manipulación del color en cada parte del proceso e incluso antes de su captura.



Cada salida de color lleva un espacio diferente de información de color.

Con trabajos fotográficos de estudio y de campo, nos centramos en manipular el color desde la preproducción, disparando imágenes pensando en el resultado final y gratamente sorprendernos con una dimensión poco explorada y que da al artista de la fotografía otro lenguaje, donde la luz para la fotografía esta al mismo nivel que el color y con las nuevas tecnologías digitales nunca fueron tan infinitamente manipuladas, intervenidas y comunicativas.

1. Pre Historia

La luz y el color fueron de las primeras percepciones de los sentidos y sus fenómenos los que más desconcertaron al hombre primitivo; La aurora boreal, el arco iris, el reflejo en los espejos de agua, las estrellas, los rayos en las tormentas, los colores del amanecer y del atardecer, la refracción de la luz en las cuevas que proyectaban imágenes externas del paisaje prehistórico, sumado a la fascinación por reproducir los paisajes y las actividades cotidianas llevaron desde esa época a todas las culturas y a todas las épocas de la historia hasta hoy a representar con imágenes el universo en el que vivimos.

2. Historia

La historia de la técnica fotográfica se desarrolla, fundamentalmente, a partir de dos vertientes:

- Una dirigida al campo de la **física óptica** (cámara oscura y lentes)
- Otra al campo de la **fotoquímica** (sustancias fotosensibles y fórmulas relacionadas) La fusión de ambas vertientes permitió el surgimiento del proceso fotográfico.

LA CÁMARA OSCURA, LA FISICA DE LA LUZ Y LA OPTICA

El principio óptico en el que se basaba la **CÁMARA OSCURA**, ya era conocido en la Antigüedad y es mencionado por:

- **Aristóteles** (384-322 a.c.), por el erudito árabe
- **Alhazen** (965-1038), y finalmente las leyes matemáticas para la cámara y sus parametros de construccion por
- **Leonardo de Vinci** (1452-1519), luego le seguiría en la misma Italia,
- **Gerolamo Cardano** (1501-1576), o por
- **Giambattista Della Porta** (1535-1605),
- luego su aplicación como herramienta de dibujo por
- **Johann Zahn** (1631 – 1707), hasta finalmente encontrarse con la química fotosencible en las manos del frances
- **Joseph-Nicéphore Niépce** (1765 – 1833), para volverse un articulo de

comercializacion masiva y de comunicación grafica social, en la fabrica del estadounidense

- **George Eastman (**1854 - 1932) fundador de la Eastman Kodak Company e inventor del rollo de película, que consiguió poner la fotografía a disposición de las masas.
- **Steven J. Sasson** (1950) ingeniero eléctrico de Kodak e inventor de la cámara de fotografía digital en 1975 y que saldría a la venta 15 años después.

ARISTÓTELES (384–322 A.C.):

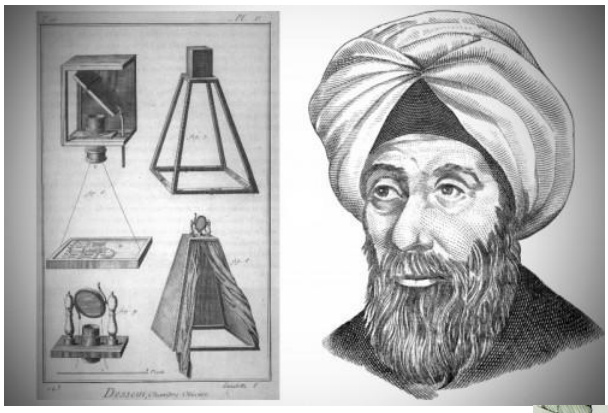
La historia describe que desde el 500 a. C. griegos como Aristóteles y Euclides escribieron acerca de cámaras estenopéicas que ocurrían naturalmente como la luz al pasar a través de una cesta tejida o entretejidos de hojas.

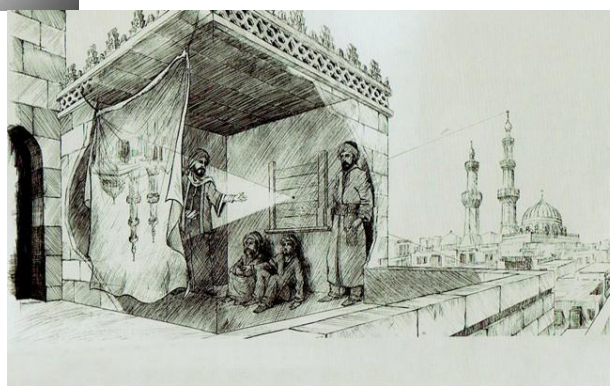
Originariamente, se designaban determinadas habitaciones donde, una vez conseguida la oscuridad, se practicaba un pequeño orificio en una o en varias de sus paredes, a través del cual era proyectada sobre el muro opuesto o sobre una pantalla situada ante él una imagen invertida de la vista exterior.

El filósofo Aristóteles, describe, cuatros siglos antes de Cristo, el principio de la cámara oscura y se dio cuenta, también, de que cuanto más pequeño era el agujero, más nítida era la imagen proyectada.

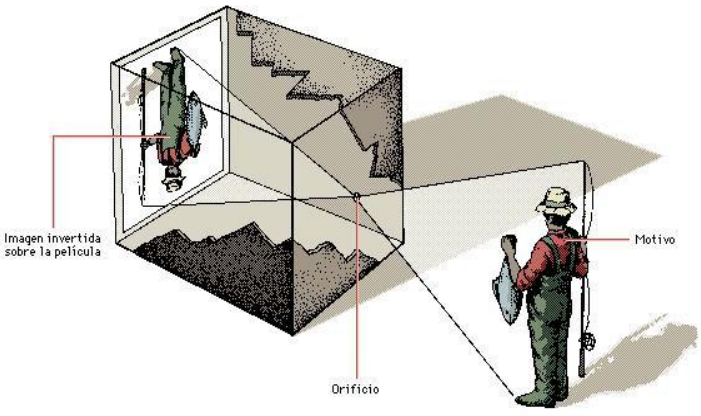
Abū ʻAlī al-Ḥaṣan ibn al-Ḥaṣan ibn al-Haytham (965–1040): (matemático, astrónomo y físico iraquí del siglo X) llamado en Occidente **Alhazen** o **Alhacén** quien realizó importantes contribuciones a los principios de la óptica y a la invención del telescopio.

También inventó la primera cámara estenopéica después de notar cómo salía la luz de un agujero en las persianas. Mejoró la cámara al notar que cuanto más pequeño era el agujero más nítido era la imagen.

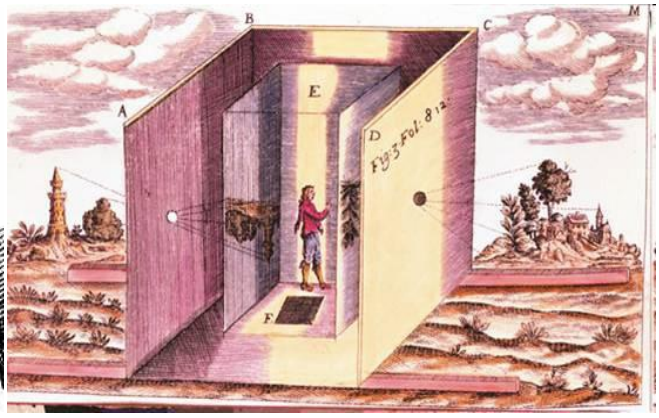




Leonardo de Vinci (1452-1519) Este arquitecto, escultor, pintor, inventor, músico, ingeniero y el hombre del Renacimiento por excelencia. Humanista de primera línea, es considerado como uno de los más grandes pintores de todos los tiempos y con más talentos de la historia; supo explicar con matematica la fisica de la luz en la camara oscura y las leyes opticas que la regian.



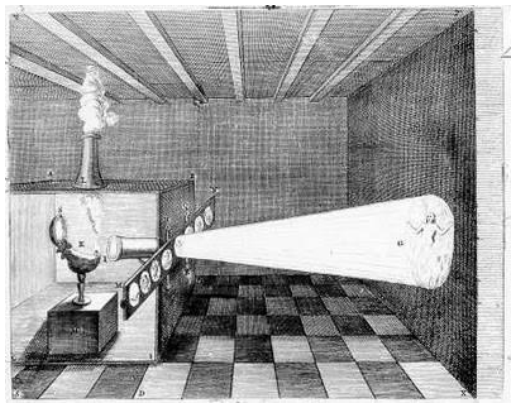
Hacia 1550 **Gerolamo Cardano** (1501-1576): fue un célebre matemático, médico, astrologó y filósofo italiano, recomendó en su obra *De subtilitate* el uso de un disco de cristal biconvexo, adosado al orificio de la cámara obscura, para obtener una imagen más brillante y mejorar así la visión.



Sin embargo, los antiguos griegos creían que nuestros ojos emitían rayos que nos permitían ver. Lo que permitió entender mucho mejor a la cámara estenopéica fue descubrir que la luz entraba al ojo en vez de salir de él.

Giambattista Della Porta (1535-1605),

Erudito y astrónomo italiano, autor de numerosos descubrimientos experimentales tales como la cámara oscura y la "linterna mágica" (también atribuida al jesuita Athanasius Kircher), así como las primeras y rudimentarias propuestas para construir un anteojo astronómico (telescopio).

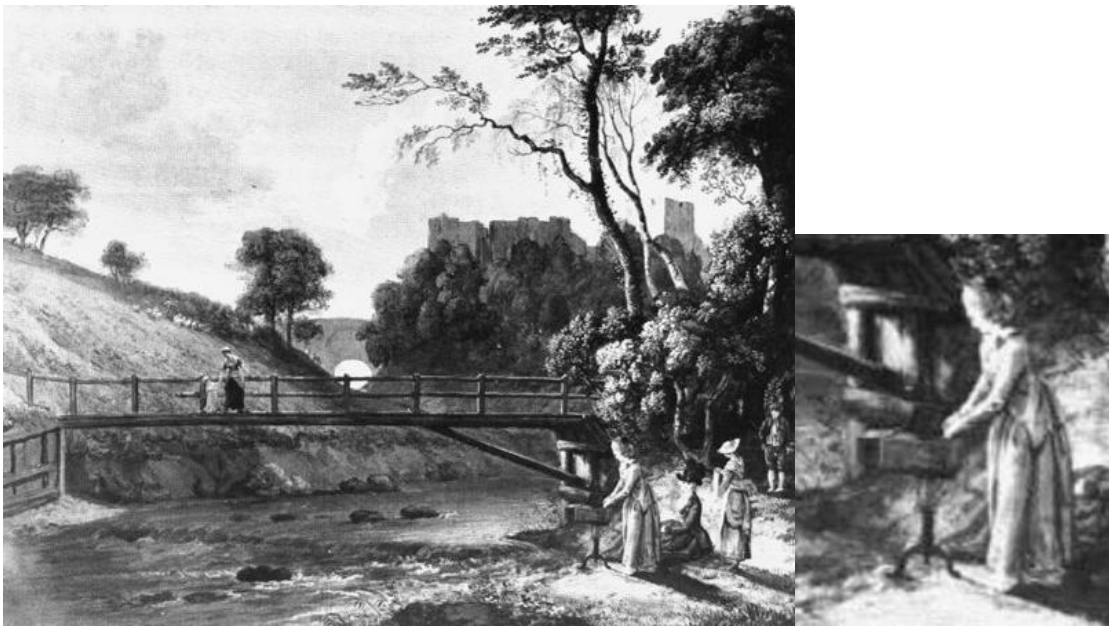


Si no sabéis pintar, con este procedimiento podéis dibujar (el contorno de las imágenes) con un lápiz. Entonces no tenéis más que aplicar los colores. Esto se consigue proyectando la imagen sobre una mesa de dibujo con papel. Y para una persona que sea habilidosa la cosa resulta muy sencilla". (...) **"Cualquiera, aunque ignore el arte del pintor, podrá dibujar la imagen de no importa qué objeto con un lápiz o una pluma".**

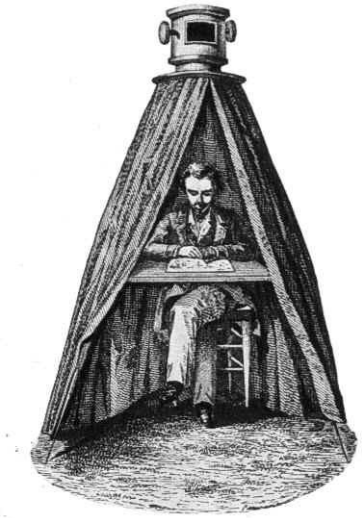
Johann Zahn (1631—1707) fue un escritor alemán del siglo XVII, autor de *Oculus Artificialis Teledioptricus Sive Telescopium* (Würzburg, 1685). Esta obra contiene muchas descripciones y diagramas, ilustraciones y esbozos tanto de la cámara oscura y de la linterna mágica, junto con varias otras linternas, diapositivas, tipos de proyección.

Como estudioso de la luz, Zahn es considerado el escritor e ilustrador de la cámara oscura más prolífico.

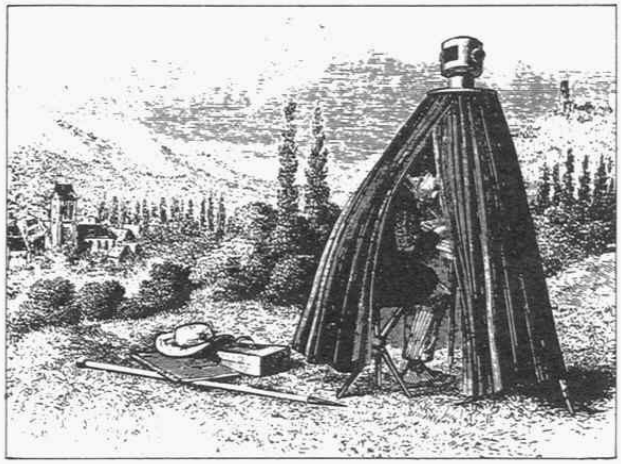
La primera cámara fotográfica, que era lo suficientemente pequeña y manejable para ser práctica para la fotografía y que pudiera capturar la imagen en algún tipo de medio, fue creada por Zahn en 1685, aunque sería casi 150 años antes de que la tecnología llegara a un punto en que fuera posible construirla.



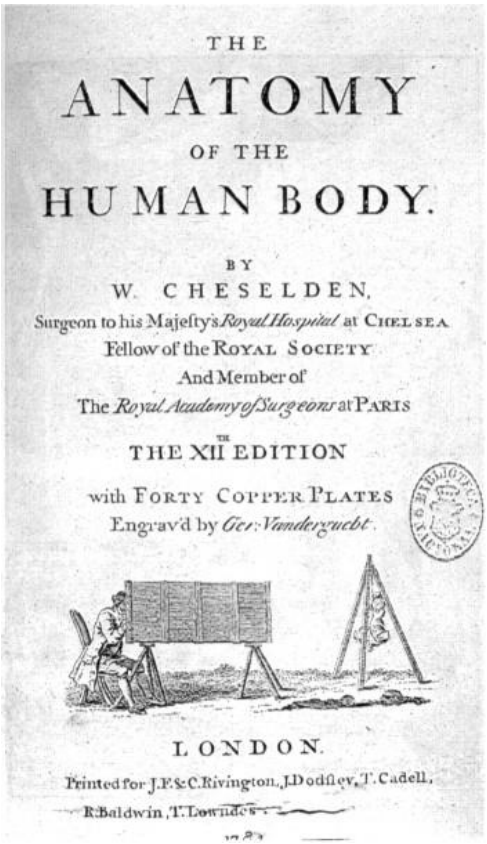
Retrato de una familia aristócrata Alemana, en un día de campo haciendo retratos a lápiz con la cámara de Zahn.



Cámara Obscura en forma de tienda de campaña. siglo XIX



Cámara óptica portátil diseñada por R. Hooke en Londres hacia 1668 del tipo usado "para paisajes". Según grabado en madera de la época.



THE

ANATOMY

OF THE

HUMAN BODY.

BY

W. CHESELDEN,

Surgeon to his Majesty's *Royal Hospital* at CHELSEA

Fellow of the ROYAL SOCIETY

And Member of

The *Royal Academy of Surgeons* at PARIS

THE XII EDITION

with FORTY COPPER PLATES

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LONDON.

Printed for J.F. & C. Rivington, J. Dodsley, T. Cadell,

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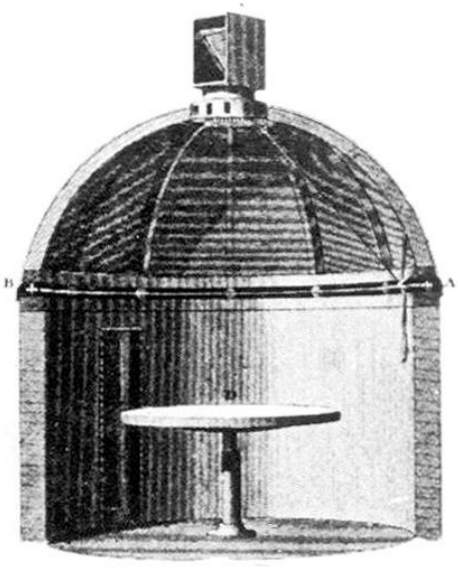
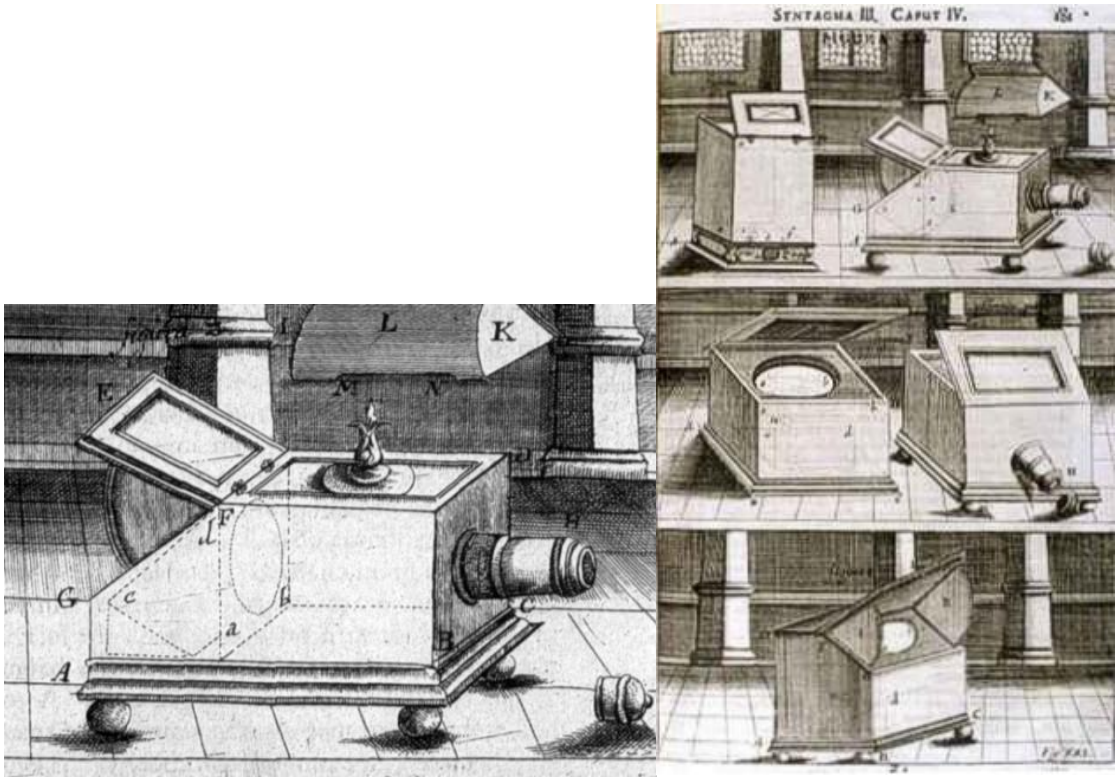
LONDON.

Portada de la edición de 1784 con un grabado del modelo de cámara usada para la realización de los dibujos anatómicos.

La primera cámara óptica construida en edificios, se conserva en el Museo del Castillo de Edimburgo, mediante la cual y gracias al juego de lentes y espejo inclinado a 45 grados hacia el horizonte, las imágenes son proyectadas verticalmente sobre una gran mesa blanca. Todo el dispositivo óptico, giratorio, se hallaba colocado en el techo de la habitación, con lo cual podían verse las escenas panoramicas en 360 grados .





La cámara óptica de cajón y dispositivo "visor réflex" diseñada y descritas por Johann Zahn en su obra "Oculus artificialis teledióptricus", 1685.

Linterna Mágica

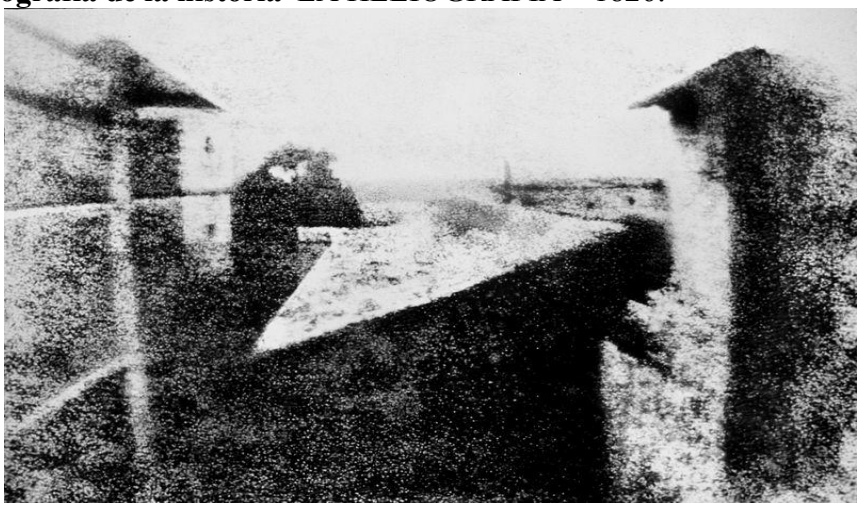
La linterna mágica es un aparato óptico, precursor del cinematógrafo. Su invención se debe al jesuita alemán Athanasius Kircher, quien en el siglo XVII, y basándose en el diseño de la cámara oscura, la cual recibía imágenes del exterior haciéndolas visibles en el interior de la misma, pensó en invertir este proceso, y llevar las imágenes de dentro a afuera.

Y LLEGARIA LA QUIMICA FOTOSENCIBLE EN BLANCO Y NEGRO PARA DARLE PASO LUEGO AL COLOR

Joseph-Nicéphore Niépce (1765 - 1833) fue un terrateniente francés, químico, litógrafo y científico aficionado que inventó, junto con su hermano, un motor para barcos y junto a Daguerre, la fotografía.

La primera cámara construida con propósitos fotográficos fue realizada en 1816 José Nicephore Niepce se refirió a ella como "Una especie de ojo artificial consistente en una caja cuadrada, con un diafragma u ojo ajustable" ; Obtuvo la primera fotografía recubriendo una placa de peltre con betún de Judea, luego, expuso la placa a la luz durante ocho horas, utilizando la cámara oscura.
Por último lavó la placa con aceite de lavanda y trementina para remover el betún no expuesto a la luz logrando una imagen permanente, logrando asi el primer procedimiento quimico para atrapar y congelar la luz.

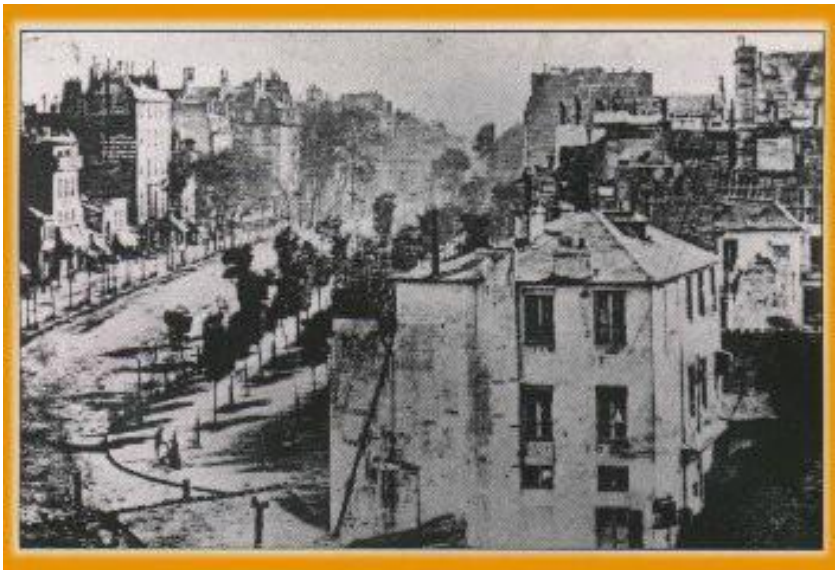
La Primera fotografía de la historia LA HELIOGRAFÍA – 1826:



Vista desde la ventana en Le Gras (*La cour du domaine du Gras*) es la fotografía permanente más antigua que se conserva. Fue tomada por Nicéphore Niépce en 1826 desde una ventana del tercer piso de su casa de campo en Le Gras, Saint-Loup-de-Varennes, Francia.

LOUIS-JACQUES-MANDE DAGUERRE (1789-1851)

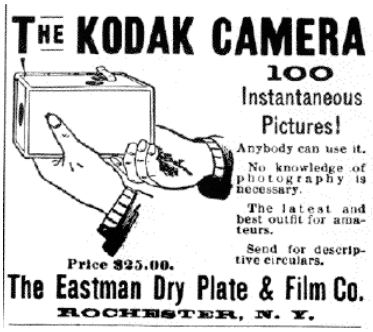
EL DAGUERROTIPO: Procedimiento creado, alrededor de 1831, por Louis Jacques Mandé Daguerre, Pintor parisino a quien se le adjudicó el título de Padre de la Fotografía al crear el método del Daguerrotipo

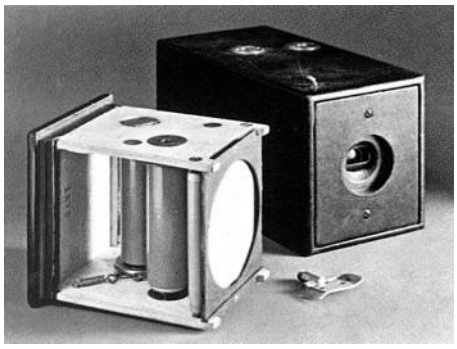


PROCEDIMIENTO QUIMICO:

1- limpieza y el pulimento de la plancha de cobre plateada o de plata. 2- Se somete a los vapores de yodo para sensibilizarla a la luz.
3- Exponer la plancha a la luz, hasta producir en su superficie una imagen tenue. 4- Desarrollar la imagen con los vapores de mercurio.
5- Se fija la imagen sumergiéndola en una solución concentrada de hiposulfito de sodio. 6- Lavado.
El daguerrotipo era un puente entre la cámara negra creada por Zahn y retocada por Niépce, y la cámara de objetivo del alemán Petzvalen.

George Eastman (1854 - 1932) fundador de la Kodak e inventor del rollo de película, que sería fundamental para la invención del cine, ya que su uso se encontraba en las creaciones de los pioneros del cine como Thomas Edison, los Hermanos Lumière.
El año de 1888 lanza al mercado la cámara Kodak 100 Vista, que utilizaba carretes de 100 fotos circulares y para cuya campaña de promoción acuñó la frase «*Usted aprieta el botón, nosotros hacemos el resto*». Lo más importante es que a partir de este momento ya no se requerían grandes conocimientos en fotografía o en la utilización de productos químicos.
Ya en el año 1889 Eastman cambia el carrete de papel por uno de celuloide es por tanto el momento de la popularización de la fotografía y es por la epoca cuando surge la fotografía de aficionado tal y como la conocemos en la actualidad.



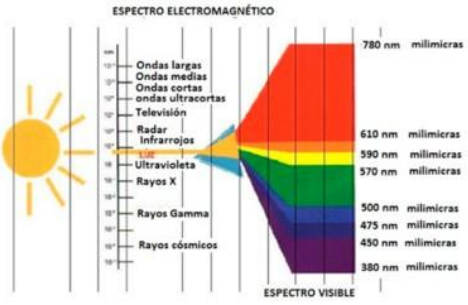


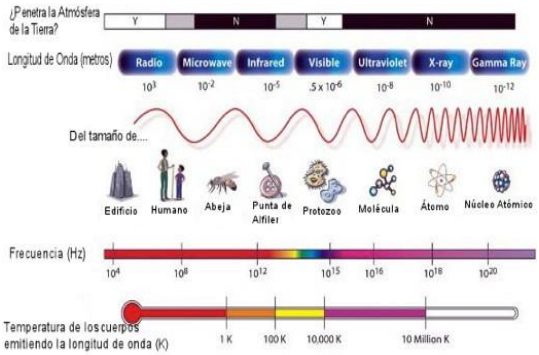

La cámara de 35 mm, que requería película pequeña y que estaba, en un principio, diseñada para el cine, se introdujo en Alemania en 1925. Gracias a su pequeño tamaño y a su bajo coste se hizo popular entre los fotógrafos profesionales y los aficionados.


SE DECODOFICO LA LUZ Y DESCUBRIMOS LA ESENCIA FISICA DEL COLOR

Isaac Newton (1643 – 1727); Fisico, filósofo, teólogo, inventor, alquimista y matemático inglés, autor de los *Philosophiae naturalis principia mathematica*, más conocidos como los *Principia*, donde describió la ley de la gravitación universal y estableció las bases de la mecánica clásica mediante las leyes que llevan su nombre. Entre sus otros descubrimientos científicos destacan los trabajos sobre la naturaleza de la luz y la óptica.

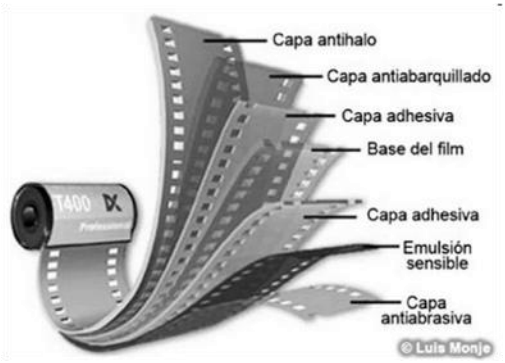
Entre sus hallazgos científicos se encuentran el descubrimiento de que el espectro de color que se observa cuando la luz blanca pasa por un prisma es inherente a esa luz, en lugar de provenir del prisma (como había sido postulado por Roger Bacon en el siglo XIII); su argumentación sobre la posibilidad de que la luz estuviera compuesta por partículas; Luego entre 1670 y 1672 trabajó intensamente en problemas relacionados con la óptica y la naturaleza de la luz. Demostró que la luz blanca estaba formada por una banda de colores (rojo, naranja, amarillo, verde, cian, azul, y violeta) que podían separarse por medio de un prisma.
Sus experimentos sobre la naturaleza de la luz le llevaron a formular su teoría de color y luz que nos a permitido estudiar el cosmos hoy se la debemos a el.





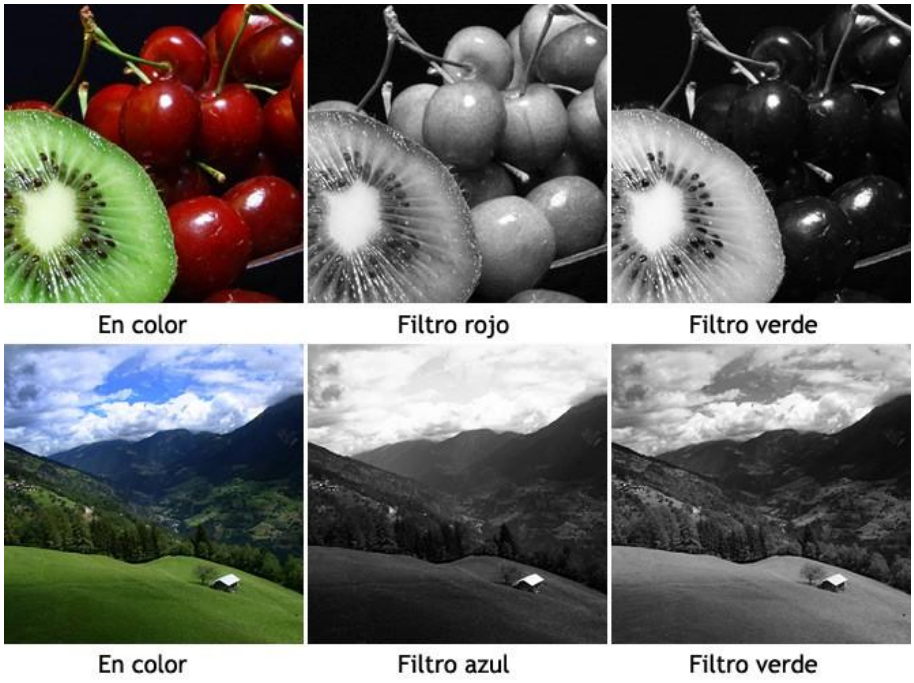
ATRAPAR LA LUZ ES… ATRAPAR COLOR Y VICEVERSA.

La Película blanco y negro:
Aunque no lo parezca las emulsiones de la pelicula en blanco y negro son sensibles a todos los colores llevan en su estructura de fabricacion una capa sensible a cada franja del espectro visible tal y como lo descubrio Newton, Una capasencuible al ROJO, una al VERDE y otra al AZUL como la teoria de captura en los sensores actuales (RGB), lo que permite utilizar gelatinas de color en las fuentes de luz o filtros de cristal en la optica del lente, para cambiar los tonos de los colores y poder registrar a gusto del fotografo diferentes tonos de gris dependiendo del color que se capture.



DE LA MANIPULACION DEL BLANCO Y NEGRO… A LA MANIPULACION DEL COLOR

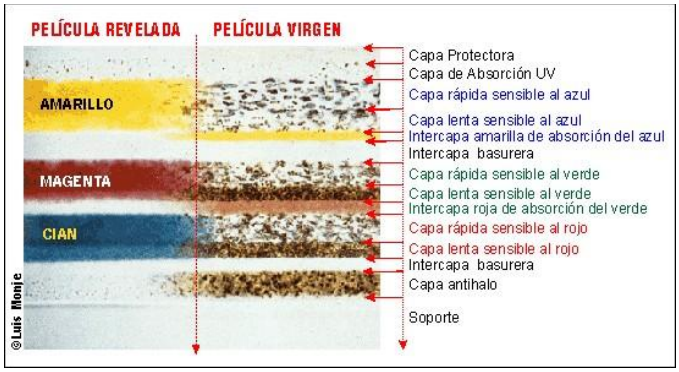
Filtros para tomas en película de blanco y negro y su incidencia en la imagen final.



La película en color:

Anos mas tarde la invención de la pelicula en color dio paso a un mundo cromático

nunca visto hasta la fecha, se perfeccionaron las emulsiones para aumentar la captura de luz y color y con esto la fabricacion de otros tipos de filtros para optica con filtros de correcion de color y filtros de efectos de color que abrieron un mundo de creeatividad y una captura de atmosferas inexistentes ampliando el abanico de posibilidades creativas en la captura del color.

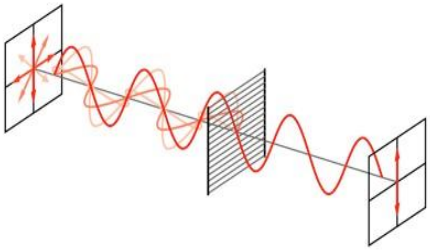


3.2.1 LUZ Y COLOR MANIPULADOS EN TOMA Y EN POSPRODUCCION.

– La luz que vemos… y el color que modificamos !! Manipulacion del color en la toma

Tal vez la filtracion de luz mas comun es el famoso filtro UV que llevan los lentes oftalmicos, solo que estos son para uso solar, los usados en fotografia toman esa tecnologia optica para reducir brumado y neblina creadas por la luz ultravioleta, generando imágenes con contraste mas alto del que ven nuestros ojos.

Otra tecnologia famosa en los lentes de sol y en las peliculas adhesivas de los vidrios de los automoviles es la polarizacion. La luz por ser una radiación electromagnética transversal, es decir la oscilación del campo electromagnético es perpendicular a su propagación, emite luz con campos eléctricos en cualquier dirección a la dirección de propagación (pero siempre perpendicular a esta). Pero por diferentes mecanismos físicos, en este caso los filtros, se puede enviar en una sola dirección de oscilación, en este estado la luz esta polarizada.



A esto se le suman, los filtros para corregir o cambiar la temperatura de color en las fotografias, de la misma manera como se cambia en las escenas de filmacion en el cine ya que el cerebro intenta llevar toda la luz al blanco; este fenomeno es diferente en los soportes fotosencibles ya que estos toman el color como resultado de sus longitudes de onda, es decir, como es el color de cada espectros real.

	Temperatura	Fuentes típicas	Ajustes BB de la Cámara
	1000K	Velas, lámparas de aceite	
	2000K	Amanecer muy temprano, lámparas de tungsteno de bajo efecto	
	2500K	Bombillas caseras	
	3000K	Luz de estudio (continua), "photo floods"	
	4000K	Lámparas de magnesio claras (hoy en día obsoletas)	
	5000K	Luz día normal, flash electrónico	
	5500K	El sol de mediodía	
	6000K	Día muy soleado con cielo despejado	
	7000K	Cielo ligeramente nublado	
	8000K	Cielo brumoso	
	9000K	Sombra amplia en un día despejado	
	10,000K	Cielo muy brumoso	
	11,000K	Cielos azules sin sol	
	20,000+K	Sombra amplia en montañas o en un día muy despejado	

Cada color corresponde a una temperatura en grados Kelvin que los filtros pueden ajustar al blanco (5.000 Grados Kelvin)

Los filtros CC o de correccion de color fueron y son muy usados en cine y fotografia color sin importar si el registro es en pelicula color (negativos de color o diapositivas) o en digital, se usan en la camara directamente o como gelatinas en hojas de acetato para filtrar la fuente de iluminacion, de la misma forma que lo hacen las bombillas caseras de tugsteno, de leds o de luz fria o cuando se ilumina con luces de set o con flash.

Si el color en exceso es:	Utiliza estos filtros
Amarillo	Magenta y Cian (o azul)
Magenta	Cian y Amarillo (o verde)
Cyan	naranja (o rojo)
Blue	amarillo
Green	Magenta
Red	Cian

O en uso creativo de los llamados filtros de color para alterar por completo la escena o para comunicar cromaticamente el color que el fotografo desea pero que no esta en la escena que esta fotografiando.

3.2.1.1 FOTOGRAFIA ANALOGA MANIPULADA.

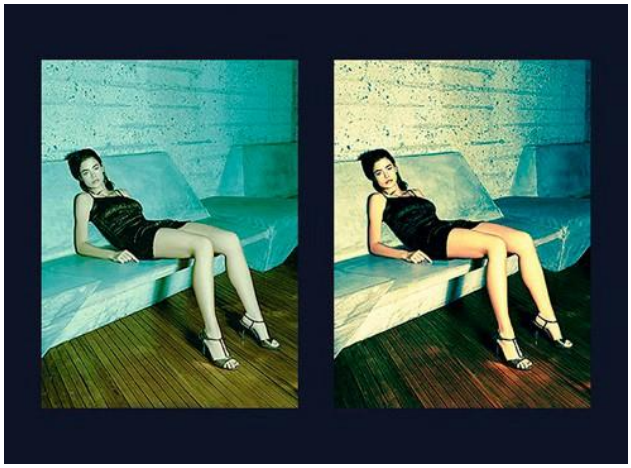
Manipulacion del color en despues de la toma

Tal vez el procedimiento mas conocido es el llamado procesos cruzados de laboratorio consistente en disparar una pelicula de negativos de color para luego revelarla con quimicos para peliculas de diapositiva y vicebersa, asi se combian los tipos de pelicula color con sus reveladores, ofreciendo una alteracion del color muy de moda ahora con el uso de la lomografia.

Aquí algunos ejemplos:

PROCESOS DE MANIPULACION DEL COLOR EN PELICULA FOTOGRAFICA

Procesos cruzados de laboratorio en positivo



Película de negativo (C---14)

revelada como una diapositiva.

Película de diapositiva (E---6)

revelada como negativo.

Procesos cruzados de laboratorio en negativo






Fotos: Bayardo Murcia

Quimicamente se alteran la pelicula de negativos de color para dar imágenes positivas y las peliculas positivas para dar negativos, con esto se altera la composicion de las emulsiones de fabrica y los colores se alteran.

PROCESOS DE MANUPULACION DEL COLOR DESDE EL ESCANER

Manipulación de la captura utilizando el escaner y su software como una cámara digital.

Con los anteriores negativos o positivos resultantes del proceso cruzado, se llevan a un escaner de transparencias y con el software del mismo se hace una captura de color a criterio del fotografo, alterando la informacion del revelado de la pelicula, con los parametros de color en la captura del scaner, con el fin de potenciar y manipular el color ya capturado en la emulsion y ahora recapturado por el sensor del escanar.

Fotografía en positivo, resultado del proceso cruzado de una película negativa de color.

Fotografía leída en negativo, resultado del proceso normal de escaneo.

Resultado del proceso de escaneo alterando los parámetros de lectura de color.
Fotos y Proceso: Bayardo Murcia

3.2.1.2 FOTOGRAFIA DIGITAL… otro color, otra luz, otro universo… otro lenguaje.

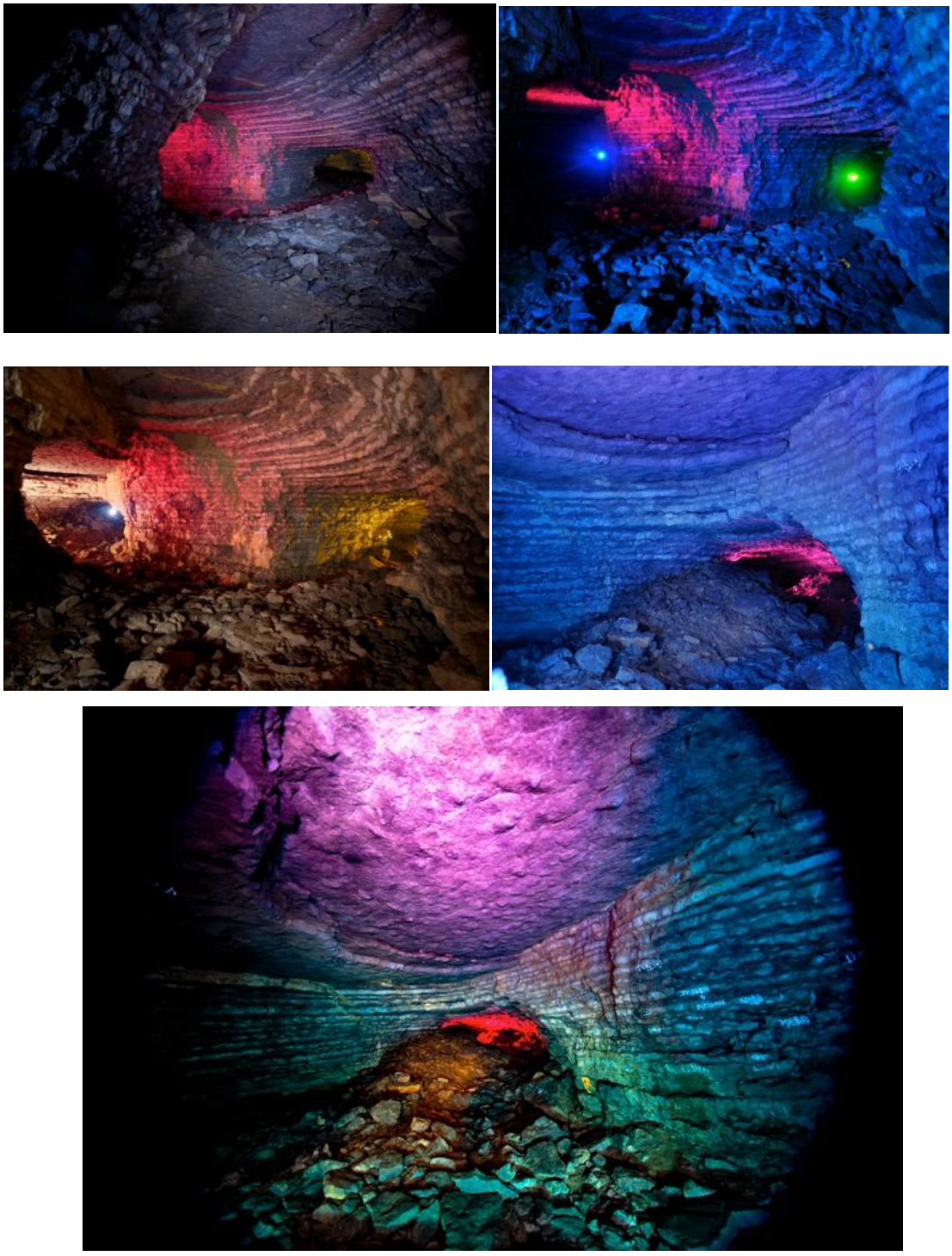
Luego del paso de la tecnologia analoga, al escaner como principio de la fotografia digital vino la combinacion de tecnologias, el color y la luz con los sensores en las camaras reemplazando la pelicula dando como resultado un abanico enorme de posibilidades de manipulacion en camara y en escena jamas antes vistos en la fotografia, creando otra dimension para los fotografos afines con las nuevas tecnologias de informacion y creando desde propuestas publicitarias nunca antes vistas en terminos de manipular el color y la luz como otro lenguaje masivo, pasando por el cine con ejemplos como Avatar, hasta una nueva tendencia artistica basada en el color, el artista digital.

PROCESOS DE MANIPULACION DEL COLOR EN FOTOGRAFICA DIGITAL.

PROCESOS DE MANUPULACION DEL COLOR CON LUZ DE FLASH COMBINADA CON LUZ NATURAL

Fotos: Bayardo Murcia
(Fuente de luz de flash filtrada combinada con los filtros de balance de blancos para temperatura de luz en cámara.)

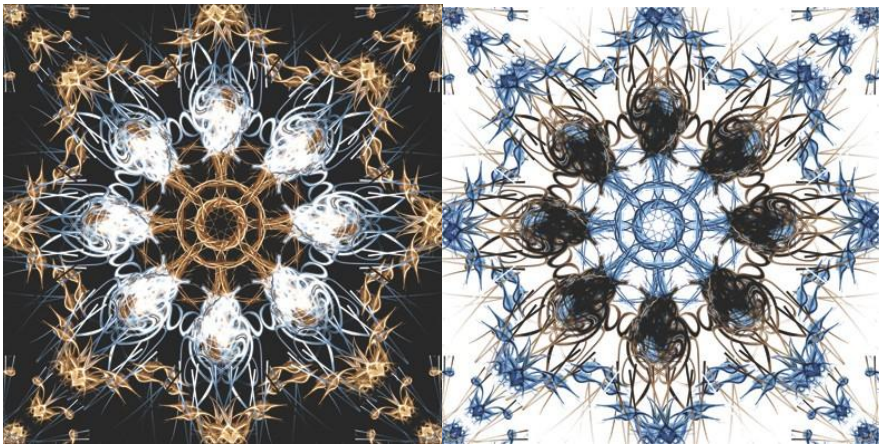
Tomas en absoluta oscuridad, en cavernas secas, iluminadas con luz de flash, filtrado la luz con acetatos de color y alterando la temperatura de color en la camara digital al momento de la toma y posproducidas luego en photoshop.

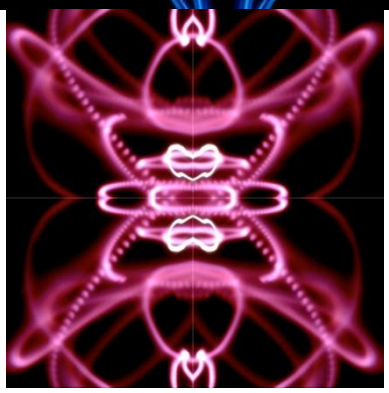


Fotos: Bayardo Murcia

3.2.1.2.1 Edicion del color en el arte:

La luz y el color digital capturados, a la manipulacion de estos por programas de edicion. Fotografias logradas con efectos de iluminacion, reeditadas para construir mandalas o caleidoscopios con simetrias bilaterales y radiales en positivo y negativo.





Fotos: Bayardo Murcia

PROCESOS DE MANUPULACION DE LA TEMPERATURA DEL COLOR EN CAMARA DIGITAL Y LUEGO CON POSPRODUCCION EN SOFTWARE.

Captura del color en cámara digital pensando en la impresión final.

FOTO ORIGINAL

FOTOS CON DIFERENTES BALANCES DE BLANCOS Y SU EDICION







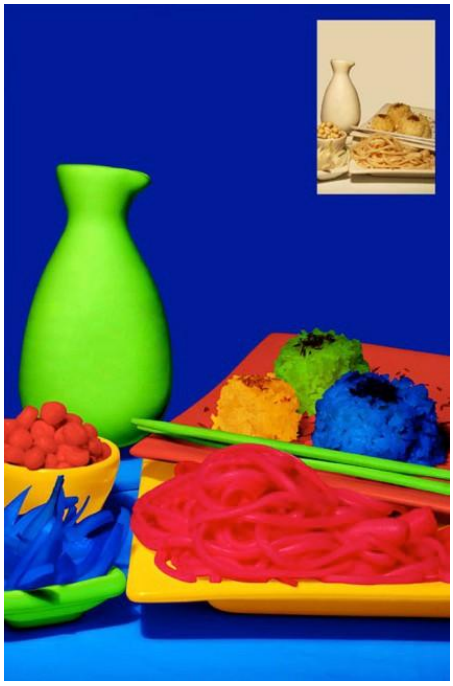



FOTO FINAL CON TODOS LOS ENSAMBLES EN POS PRODUCCION

Fotos: Bayardo Murcia

Misma tecnica aplicada a fotografia de moda.

Fotos: Bayardo Murcia



Fotos: Bayardo Murcia

Misma tecnica aplicada a fotografia de paisaje.
Fotografia realizada por un alumno en mi clase de tecnologia de la fotografia 2 en LaSalle College Bogota. Donde enseno esta tecnica de manipulacion digital y que fue la fotografia ganadora del Sony World Photography en Mayo de 2013.

Ivan Valencia Romero, Winner, Colombia National Award, 2013 Sony World Photography Awards

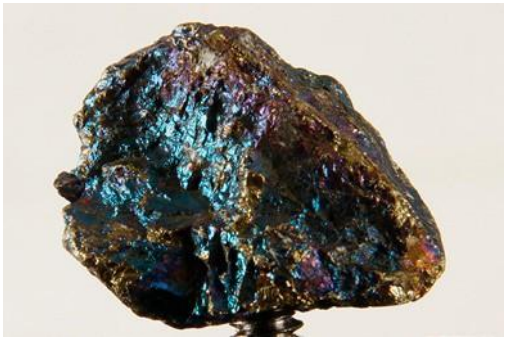
http://es.worldphoto.org/featured-photographers/ivan-valencia-romero/
http://worldphoto.org/news-and-events/wpo-news/2013-national-award-programme-winners-announced

Fotos: Bayardo Murcia

3.2.1.2.2 Edicion del color en ciencia:

Estos proceso s abren un espacio para las tomas de fotografias cientificas en areas nunca antes fotografiadas con tal nivel de manipulacion en el color, los minerales que registran luz an verseles con filtro UV, insectos luminicos fluorescentes que al pasar por luz Infraroja emiten colores que con la fotografia digital permite ampliar de manera cvercreativa su aspecto, fractales formados por descargas electricas sobre solidos transparentes que ahora se ilumnian en estudio buscando entender la ciencia de la luz confotografias mas creativas, el uso de gases pesados como el hidrogeno liquido para iluminarlo en estudio como el sol lo hace con la neblina o efectos de polarizacion espectral que dan los cristales que componen los DVDs y un sinnumero infinito de tecnicas aplicadas a experimentos cientificos y elementos cotidianos en un mundo de tecnologia, captura y color fascinantes.

Las figuras de Lichtenberg capturadas con diferente iluminación y filtrado de color.



Minerales e insectos luminicos
Fotos: Bayardo Murcia

3. Conclusion

Esta pequeña muestra dejo de manifiesto que existen otras propuestas del color en la fotografía, más que socializar un trabajo, se busca que los amantes del color y de la fotografía, tengan a manera de inquietud un nuevo lenguaje cromático que experimentar y que hoy más que nunca una imagen con color vale más que dos mil palabras.

Espero que esta pequeña reseña les despierte el interés y permita estructurar aun más esta ponencia, para nutrir el saber del color que tanto nos apasiona y antes de pensar en capturar un color, es detenerse un momento para pensar…

“ SABER QUE COLOR CAPTURAR, PARA SABER QUE COLOR REPRODUCIR “

¿Qué es el color en proceso fotográfico entonces…?

1 Es la concepción de la obtención de la copia fotográfica a partir de:

2 La fotografía expuesta sobre soporte de emulsiones al gelatinobromuro de plata basada en la química.

3 La fotografía expuesta sobre soportes fotocensores digitales basada en la electrónica.

4 La impresión fotográfica sobre soporte, por medios químicos o por inyección de tinta o láser.

¿Cuáles son los pasos a considerar si la luz atrapada es color…?

1- Interés del creador.
2- Decisión de la producción: el encuadre, el ángulo de toma, el enfoque, el diseño de luces y sombras, etc.
3- La toma fotográfica: selección de la exposición utilizando los mecanismos esenciales de la cámara fotográfica.
4- El procesado de la imagen: revelado de la película o tratamiento de la imagen digital en el ordenador.
5- La impresión o proyección de la imagen final: donde se obtiene el producto del proceso fotográfico.

Asi definir cual es la división del lenguaje fotografico de la luz y la semiotica del color en el mensaje que se quiere transmitir.

- Directa: Objetiva, no manipulada.
Responde a una actitud esencialmente imitativa y reproductiva de lo visible el reportaje periodístico gráfico, cuya finalidad es
captar el mundo exterior tal y como aparece ante nuestros ojos

- Creativa: el de la publicidad y la fotografía como manifestación artística, con fines expresivos e interpretativos.

Y en este volver visible lo invisible para la visión natural o manipulada , está la principal aportación de la Fotografía, es la expresion cromatica del siglo XXI en la desintegración de la forma tradicional de ver la pintura y en comprender a la fotografia digital mas que como una amenaza, como un fenomeno global de expresion a niveles infinitos.

Cordialmente Bayardo Murcia

Eco – Diseño y Color.
Una Propuesta de Innovación y Aproximación Metodológica.

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Resumen

En la actualidad la metodología del eco diseño aplicada al diseño de objetos, presenta un gran auge, con numerosas marcas y firmas que convierten a la reducción de los impactos medioambientales en las etapas de diseño como un valor agregado al desarrollo de sus productos.
Sin embargo en cuanto al uso y aplicación del color en estas nuevas líneas de objetos es muy poco lo que se ha analizado o propuesto e incluso abordado desde el ámbito académico.
Es el diseñador quien conceptualiza y otorga cualidades a un objeto, como lo es entre otras el color. En el marco del nuevo paradigma de la sustentabilidad y el trabajo de diseño pareciera que el tema del color solamente se asocia a escalas cromáticas que nos conducen a los colores neutros o a un imaginario social que se ubicaría dentro del verde. A partir del proyecto de investigación "Innovación y desarrollo de productos para el ITSPV con base en artículos de desuso" se abre un nuevo análisis y enfoque metodológico que pone al color como parte del proceso de diseño, dentro de las opciones a escoger e investigar por los diseñadores, respetando la naturaleza del planteo del eco diseño, pero pensando cromáticamente los objetos.

En el presente artículo se exhiben algunos productos y trabajos en donde el color y el eco diseño se acercan para generar una nueva metodología de trabajo basada en la creatividad , la cromaticidad, la identidad cultural y la disminución del impacto medio ambiental en los procesos de diseño.

Palabras Claves:
eco-diseño, color y diseño, innovación

Introducción:

En la actualidad la metodología del eco diseño aplicada al diseño de objetos, presenta un gran auge, con numerosas marcas y firmas que convierten a la reducción de los impactos medioambientales en las etapas de diseño como un valor agregado al desarrollo de sus productos.

Sin embargo en cuanto al uso y aplicación del color en estas nuevas líneas de objetos es muy poco lo que se ha analizado o propuesto e incluso abordado desde el ámbito académico.

El análisis del uso del color en el diseño de objetos, permite comprender la importancia de este elemento en el proceso creativo, de uso y significación del mismo.

Donis A Dondis explica cómo los elementos visuales constituyen la sustancia básica de lo que vemos, (entre ellos de manera poderosísima el color), materia prima de toda la información visual que está formada por elecciones y combinaciones selectivas. "La estructura de la percepción de estos elementos visuales está conformada por la fuerza que determina que elementos visuales están presentes y con qué énfasis" (1987:54).

Además de la importante función informativa que cumple el color en la naturaleza en general, también está la función estética que tiene en la sociedad humana, donde es utilizado como un elemento para la composición formal y la creación de armonía visual en el entorno habitable.

¿Qué es lo que pensamos cuando hablamos del color en el contexto del diseño? Si pensamos en rojo podemos imaginar un Ferrari , una señal de alto o semáforo ? ¿Qué aporta el verde a la mente?¿un tractor John Deere o el ecodiseño ? ¿Qué tipo de iPhone tienes, negro o blanco ? (Clambaneva, 2013)

Ya sea un producto que poseemos o codiciamos es blanco o negro, rojo o verde, porque fue diseñado de esa manera. El color en el diseño, siempre ha tenido un impacto profundo en las cosas que usamos, las casas en que vivimos , los coches que conducimos y los teléfonos que usamos. Colores inherentemente se han asociado con ciertas acciones o funciones clave, las cuestiones sociales , económicas y ambientales. Tan cerca está nuestra afinidad con el color incluso que la utilizamos para describir nuestro estado de ánimo.

Muñoz (2006) señala que "El lenguaje de los objetos permite transmitir significados por diversos medios: la configuración, el color, la textura, el brillo y la selección material." Por tanto el color es una herramienta de fuerte impacto visual, y su rol comunicativo es intenso.

Dentro del proyecto de investigación "Desarrollo e innovación de productos para el ITSPV con base en artículos de desuso" se ha abierto un espacio específico para buscar un nuevo análisis y enfoque metodológicopara la elección y toma de decisión en la aplicación de color en objetos desarrollados con la metodología del eco diseño.

El diseñador que trabaje bajo este nuevo paradigma deberá además de cuidar la propia metodología "Eco", contemplar para la configuración cromática de un objeto ciertasdirectrices planteadas en la búsqueda de una metodología específica.

El programa de Color pensado desde la perspectiva del eco diseño deberá tomar en consideración los distintos factores que no debieran obviarse al seleccionar una propuesta cromática para un producto de diseño. Así se realiza un mapa de la situación cromática actual para ese objeto y se asientan las decisiones que orientarán y justificarán la nueva propuesta de color.

El esquema cromático de un producto, o de una línea de productos, está regido por decisiones de diseño que incluyen, pero a su vez exceden, los aspectos fisiológicos de la percepción del color.

En general, el entorno de los productos realizados sobre el concepto de eco- diseño es muy limitado en cuanto a propuesta cromática se refiere, reduciéndose generalmente a escalas de verde o colores neutros, propios de materiales como madera, cartón etc. Conviviendo una imagen o percepción que se mueve entre los verdes o lo "rústico". Por lo tanto es bastante difícil pensar o imaginar al eco diseño en múltiples propuestas cromáticas.

Aunque se comprende la limitación que las metodologías de diseño sustentable presentan, se aborda en este trabajo la posibilidad de pensar dentro de ellas la elección de materiales que incorporen nuevos colores al mundo "verde".

Método.

El presente trabajo plantea la necesidad de incorporar a las nuevas metodologías del diseño sustentable un factor más a destacar que es el color, para ello en el proyecto de investigación "Desarrollo e innovación de productos para el ITSPV con base en artículos de desuso" se ha trabajado con una aproximación metodológica que incorpora a éste como un elemento más a la hora de seleccionar los materiales, pero también a la hora de introducir los aspectos positivos que un buen manejo de color pueden aportar al paradigma de la sustentabilidad y al objetivo de la reducción del impacto ambiental.

La etapa inicial de este proyecto estuvo destinada a la formulación del problema, tuvo como resultado la elaboración de una metodología de diseño propia, basada en la literatura consultada y en el trabajo en el laboratorio de diseño, el resultado se puede observar en la Figura 1, donde se explica conceptualmente los pasos a seguir para el diseño de productos bajo la perspectiva del eco diseño.

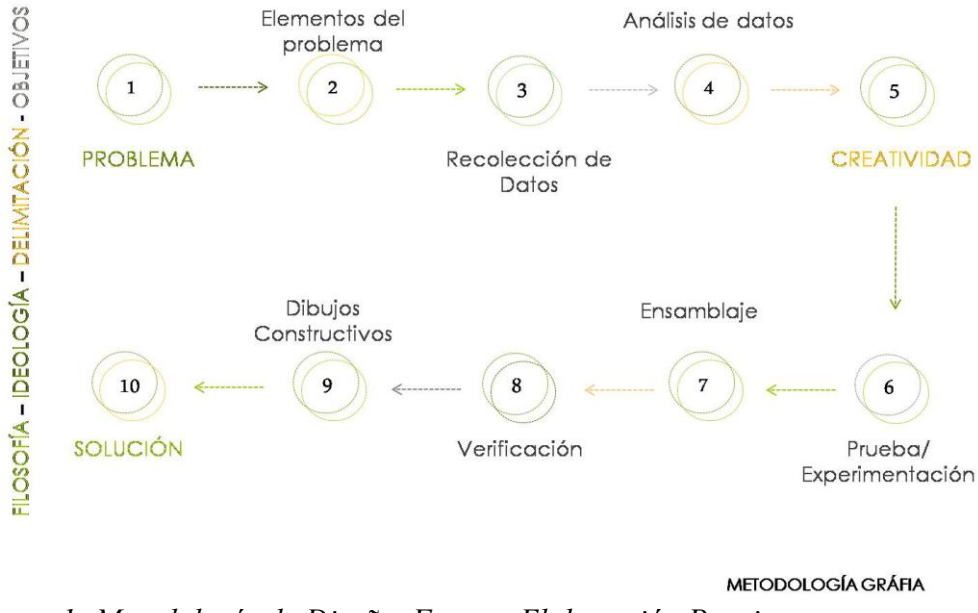

Figura 1: Metodología de Diseño. Fuente: Elaboración Propia.

En las figuras siguientes (2, 3 y 4)se muestra como se incorporó a este proceso de diseño desde la filosofía hasta la ejecución al color como elemento a trabajar.

Figura 2 Filosofía del proyecto de diseño Fuente: Elaboración Propia.

En la figura 3 se puede observar cómo se incorpora el elemento color a la hora de recolectar los datos necesarios para la toma de decisiones de diseño.

Figura 3 Metodología gráfica, etapa de recolección de datos. Fuente: Elaboración Propia.

Ahora bien, fue necesario entonces ampliar la metodología para que la elección de una paleta cromática para un producto de eco- diseño , no fuera un paso más subjetivo, sino que pudiera sostenerse en un análisis de todos los factores que involucran al color como lenguaje perceptivo.

En la figura 4 se plantean una serie de factores que deberán tenerse en cuenta a la hora de considerar los colores en la elección de la materia prima de los objetos.

Figura 4 Metodología gráfica, directrices para la configuración cromática del diseño. Fuente: Elaboración Propia.

Como puede observarse a través de esta metodología el diseñador tendrá que desarrollar su habilidad para la aplicación del color en objetos de eco diseño abordándolo desde todos los ángulos y puntos de vista posibles, para tener entonces una definición más nítida de la problemática planteada.

La metodología se completa con los pasos propios desde la perspectiva del eco diseño, trabajados para este proyecto en el laboratorio de diseño en forma participada, mismos que se sintetizan e ilustran en la figura 5.

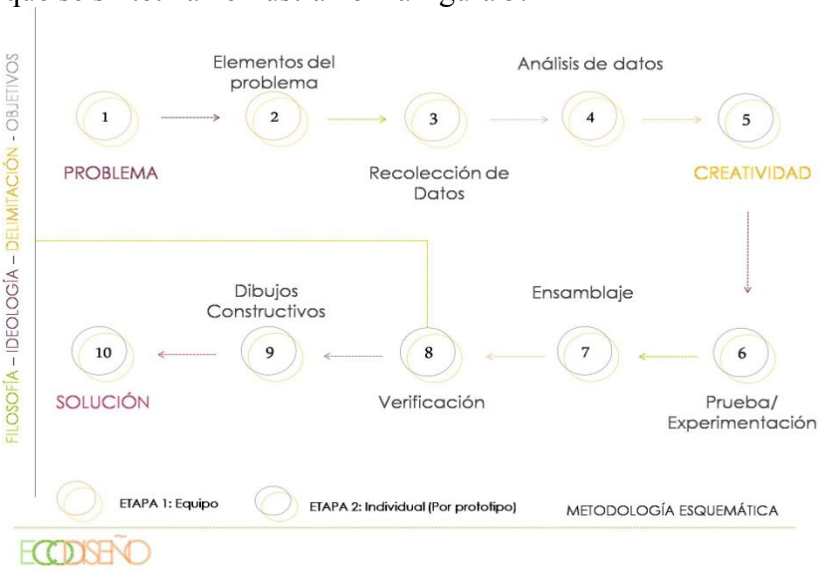

Figura 5 Metodología Gráfica, organización del proceso de diseño. Fuente: Elaboración Propia.

Resultados.

La etapa inicial destinada a la formulación del problema, tuvo como resultado la elaboración de una metodología de diseño específica, que incluye al color como factor innovador dentro del eco diseño, basada en la literatura consultada y en el trabajo participativo en el laboratorio de diseño.

En este planteo se puede distinguir una etapa fundamental que involucra al concepto de eco-diseño que es el paso del trabajo cromático, en la recolección de datos a la hora de seleccionar el material, se agrega la variable cromática, con sus directrices específicas, esto impacta en la complejidad del trabajo creativo del diseñador quien además de pensar en la evaluación de parámetros que tienen que ver con su eficiencia y con su impacto ambiental, incorpora la fase estética y cromática como elementos novedosos a resaltar en su objeto.

La última etapa de este proyecto significó el trabajo creativo, a partir de la metodología elaborada y bajo la perspectiva del diseño participado.

Alumnos y docentes que participaron en el proyecto plantearon diseños conceptuales que comenzaron a dar respuesta tanto a las necesidades planteadas por los usuarios, como al trabajo con el color y la materia prima detectada.

Como ejemplo de este trabajo se encuentra la propuesta de diseño de un mueble como objeto, el cual consiste en una estructura de integración-móvil dentro de un espacio con pequeñas dimensiones.

Join up-mobile

Join up-mobile (Integración-móvil) es el nombre que se asignó al prototipo por sus cualidades específicas como: objeto con posibilidad de ensamble y desmontaje fácilmente, además de ser un mueble que cumple con la funcionalidad sin dejar de lado la estética, la estructura queda expuesta, teniendo la capacidad de armarse en el lugar y momento que sea necesario.

Siguiendo la metodología planteada se llegó a una propuesta de prototipo que involucra todos los pasos del eco diseño y añade el trabajo con el color.

Las figuras 6 , 7 y 8 ilustran ese proceso:

Figura 6. Lámina de trabajo conceptual del prototipo JOIN UP-MOBILE Fuente: Elaboración Propia.

El trabajo cromático de la estructura supuso pensar el color desde el material, con sus cualidades sensoriales, sus asociaciones psicológicas, involucrando el factor de cambio como aporte de dinamismo al objeto.

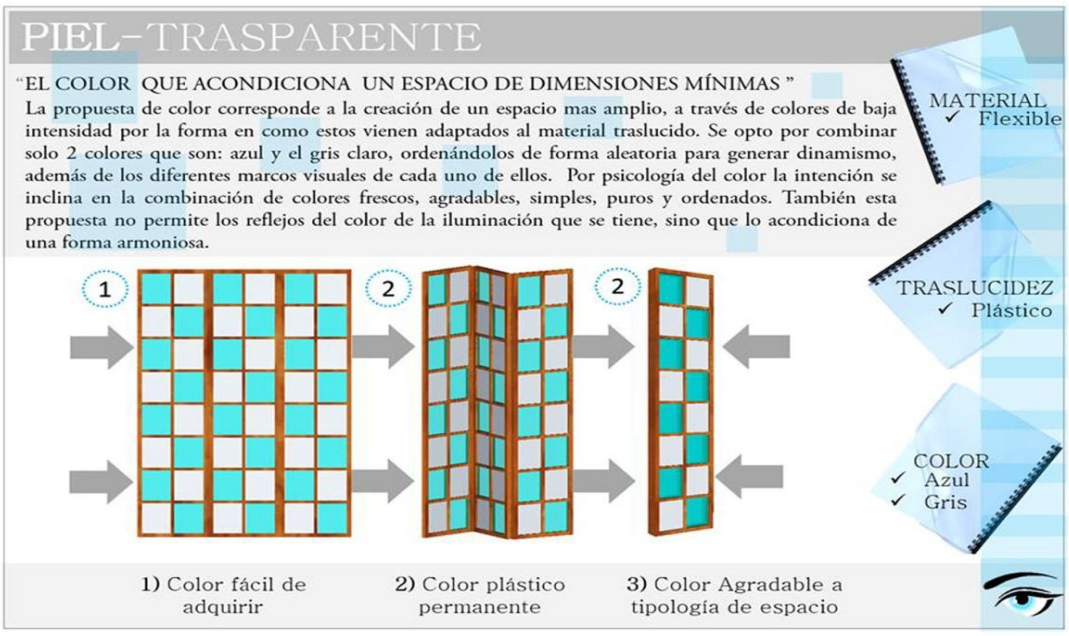

Figura 7. Piel Transparente. Fuente: Elaboración Propia.

A ésta estructura se le añadió una piel que contiene una propuesta cromática en relación con el material elegido, con las sensaciones que provoca y con el contraste respecto a la estructura que lo soporta.

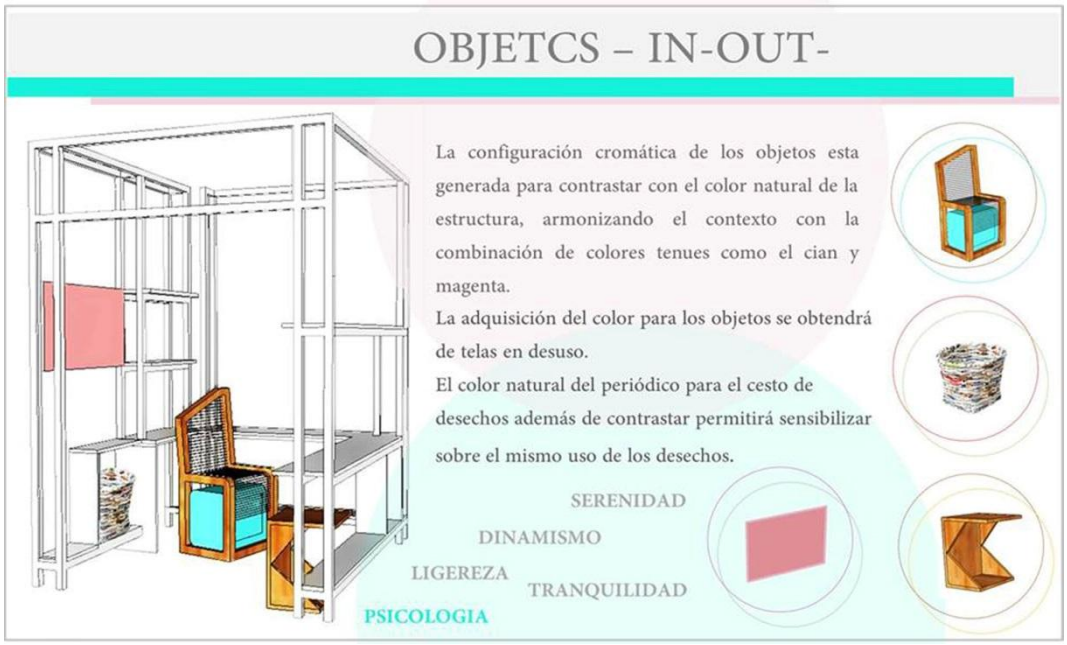

Figura 8. Configuración cromática de los objetos interiores.Fuente: Elaboración propia

Por último la elección cromática de los colores para los objetos interiores, funciona como acento, dialogando con la paleta general y con las texturas de los materiales elegidos.

Discusión.

El análisis y planteo del proyecto de investigación ***Diseño e Innovación de productos para el ITSPV con base en Artículos de desuso*** presentado en este artículo, pone el énfasis en el trabajo cromático como elemento a incluir en las metodologías de eco diseño. En la práctica el proceso de diseño participativo involucra a todas las instancias posibles y a todos los actores que conforman una comunidad educativa, con el objetivo de generar aprendizajes significativos que partan desde la teoría a la práctica y viceversa para poder garantizar un cambio en la concepción de paradigmas tan complejos como el eco diseño y la sustentabilidad.

Por esto se destaca el planteo del proyecto de incluir al color en el proceso de diseño con artículos de desuso como parte de un desarrollo creativo, que abra al diseño y la producción de los objetos a la participación de la comunidad, involucrándola en todo el circuito de producción y en la posterior difusión poniendo especial acento en la concientización desde la practica hacia la teoría.

Cuando escuchamos "medio ambiente" y "sustentabilidad", automáticamente pensamos en el color verde. Es obvio, este color está asociado a plantas, oxígeno y desarrollo.

La Sostenibilidad pretende realizar un diseño más compatible con la naturaleza y la naturaleza sin color es prácticamente inexistente.

La mayoría de los seres vivos dependen de una paleta rica para navegar en su mundo , y los seres humanos no somos diferentes.

Los anuncios en color se leen hasta un 42 por ciento más a menudo que los mismos anuncios en blanco y negro , y el ojo humano puede distinguir más de 10 millones de colores , por lo que es lógico pensar que la percepción del color tiene un propósito biológico.

El color puede ser un persuasor sutil o un poderoso atractivo, que influye en la salud , el bienestar y el estado de ánimo . En color y la respuesta humana , Faber Birren (1978) señala que el rojo puede aumentar la presión arterial , el pulso , la tensión , la respiración y la transpiración, mientras que el azul tiene el efecto inverso. ShashiCaan(2003)a través de su experimento "**Spatial Color**" desafió algunas ideas preconcebidas sobre el color. Por ejemplo, que las personas en un ambiente rojo tienden a estar más tiempo y gastar más dinero, en relación con el azul, donde se sienten desanimadas, y con el amarillo, donde están contentas porque lo asocian con la luz del sol. O que en el cuarto rojo, la gente comió más; en el amarillo consumió hasta dos veces más que en el cuarto rojo; y en el azul, permaneció más tiempo y tuvo un comportamiento que podríamos llamar antisocial".

En la metodología planteada se conciben cinco directrices para analizar a la hora de generar una propuesta cromática:

El Color Funcional: que abarca al color como signo y símbolo y la que se refiere a la aplicación del mismo a las superficies de los objetos y formas funcionales que están en el entorno humano.

El color en su manera funcional supera lainstancia meramente estética y se adapta a las condicionesambientales facilitando el contacto del individuocon los datos que se le quieren transmitir.

Los colores en este caso hacen más operacional el desplazamiento por un espacio, reconcilian con elentorno, permiten memorizar información y todo eso eslo que se requiere para adquirir conocimiento desde losdatos, el diseño facilita la relación del sujeto con el entorno y hace supuestamente más sencillaslas operaciones diarias, que de otra manera serían máslentas en la recepción y el contacto con el exterior.

El Color Productivo: como se mencionó el color puede tener distintos efectos sobre las personas, pueden cambiar el carácter y las emociones, en el campo industrial o de trabajo (como es el caso del ejemplo que se mostró como prototipo) los colores pueden afectar el desempeño de un trabajador, pueden hacer un ambiente de trabajo más agradable o atrayente, pueden señalar zonas de peligro, etc. Influyendo directamente sobre la productividad de una empresa desde el color de la silla en la que el empleado se sienta, hasta el color de la caja o artículo que un empleado tiene que transportar.

*El Color "de mercado"*en donde el color es fuente de información, que nos ayuda a decodificar el mundo que nos rodea,es por eso que son indispensables para dar a conocer, para vender o para posicionar un producto o un servicio. (En este sentido el Eco diseño parece escoger al verde como "marca cromática" para sus productos.)

El Color Ambiental es el"color local", que es el propio del objeto o elemento, a diferencia del color simbólico o del color circunstancial, se refiere al uso de colores en el medio en el que se sitúe un objeto (urbano, rural, etc.)

El Color Semiótico que involucra la significación del color, el carácter simbólico del mismo, simbolismo que se establece de manera intuitiva al relacionar el parentesco con la naturaleza. Pero a su vez, cambia de acuerdo con las diferentes culturas, grupos humanos, e incluso entre personas de un mismo grupo. Esto permite que para un mismo color existan significados duales y en algunos casos opuestos.

Entender al color desde esta perspectiva obliga a concebirlo desde sus múltiples cualidades, incorporándolo al eco diseño con el fin último de mejorar en todos los sentidos la calidad de vida del usuario.

Conclusiones.

Los principios ambientales y buena parte de los postulados que definen hoy día al diseño ambiental, las corrientes ecológicas y los nuevos paradigmas de sustentabilidad están integradas a las nuevas propuestas en múltiples sectores del diseño, la arquitectura y también la gestión de instituciones comprometidas con el medioambiente y con los principios del desarrollo sustentable.

Actualmente hay soluciones que evidencian este interés en los principios ecológicos, se ha avanzado en el tema experimentándose un importante auge, en la consideración de estos aspectos, todo ello, gracias a un importante número de profesionales que intentan implementar soluciones para construir con respeto y en armonía con el entorno, reduciendo el impacto en el uso operativo, actividades y gestión de instituciones amigables con el ambiente, aprovechando las fuentes de energías renovables para el abastecimiento energético, manifestando una clara conciencia del valor del reciclado, la cultura y la práctica de las 3 "R" : **REDUCIR - REUTILI AR - RECICLAR**

Principios estos que enmarcan el proyecto de innovación y desarrollo de productos para el ITSPV con base en artículos de desuso.Teniendo como meta, disminuir el impacto ambiental del ITSPV en su funcionamiento como institución educativa promoviendo estas prácticas a la región y la comunidad.

Pero además, en este proyecto se incorpora la variable del color a las ecológicas, de diseño, naturales y humanas, ratificando así la relación, hombre, medio ambiente y sociedad.

La importancia de emprender este tipo de investigaciones radica en los resultados tangibles de la misma resolviendo las necesidades operativas de la institución con productos hechos con materiales de desuso, reduciendo el impacto ambiental de los mismos y generando un proyecto innovador que destaca el rol del color como componente importantede la calidad de vida en sus diversas actuaciones.Este último objetivo para aportar al conocimiento teórico instrumentaldel color en relación al logro de ambientes sustentables.

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Red Lighting Does Not Have A Negative Effect On Intellectual Performance Of Japanese Students

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Abstract

Following the lastpresentation (Takahashi, 2013), in which the effect of briefly watching redcolor printed on paper upon intellectual performance was examined, the presentstudy retested the red effect by using different way of color presentation;color lighting. Sixty Japanese university students were divided into threegroups; white, red, and blue groups. They took two sets of 20-item numericsubtest of the Intelligence Structure Test (IST), a German IQ test (Beauducelet al., 2010). For each item, a sequence of seven numbers was given with thefinal number unspecified (e.g., 18, 16, 19, 15, 20, 14, 21, ?); the task is tofind the final number (the correct answer: 13). All participants took the firstset under the white lighting. Then, after a short rest, they took the secondset under the assigned color lighting (white, red, or blue). White lighting wasmade by white fluorescent lamps. Red and blue lightings were made by color beambulbs (National BF110V 80W-R, -B). Chromaticity of the top surface of a tablein front of participant, which was covered with white paper, was x = .668, y = .320under the red lighting, and x = .140, y = .201 under the blue lighting.Illuminance measured on the table was 470 lx under all lightings. Time allowedfor each set was 3 minutes. After finishing two sets, participants answered shortquestionnaire asking how they are satisfied with the results, how they feeltired, relaxed, concentrated, and so on. As the results, color lighting did nothave any effects on the test performance nor on
the participants' selfevaluation. Taken together with the null results obtained in the previous study(Takahashi, 2013), a negative effect of red color would not be applied to theJapanese young people, suggesting its nature of cultural dependency.

Introduction

Elliot et al. (2007) and Maier et al. (2008) reported a negative effect of red color in an achievement context. They showed that glancing at red impaired performance in various intellectual tasks conducted soon after; for example, an anagram task, a words-analogy task, and a numerical inference task. These authors argued that this effect may be mediated by the association of red color with negative meanings such as 'failure,' 'danger,' and 'anxiety.' Participants who looked at red may be unconsciously motivated to avoid such negative outcomes, inclined to process given information locally rather than globally, thereby resulting in poorer performance. However, as the authors pointed out, this finding is limited to a certain culture at present (they tested U.S. or German young people only), and the question of generalization to other cultures, particularly those other than Western cultures, remains open.
Takahashi (2013) reported the results of four experiments employing Japanese participants and the same task and color manipulation as in Maier et al. (2008). In

experiments 1, 2, and 3, in which a total of a hundred and forty high school or university students were tested, the results showed no effects of color condition on the test performance. Finally, in experiment 4, in which thirty university students were tested with an additional procedure adopted for elevating their avoidance motivation, the results showed an inverse effect of those of the previous studies; red had a positive effect on the test performance. These contradictory results were discussed from the viewpoint of various associations red color can have; it may trigger positive approaching motivation in some condition or for some people, as well as negative avoidance motivation as the previous authors argued.

In the present study, possible effect of red, whether positive or negative, was retested by using different way of color presentation; color lighting. Compared to a printed color at which participants take a glance, color lighting is expected to have more direct effect on participants to change their motivational state, and therefore influence the task performance more dramatically.

Methods

Participants

Sixty Japanese university students (30 males and 30 females; mean age 20.9 years old) participated as volunteer. They were divided into three groups, white, red, and blue groups, each of which consisted of 10 males and 10 females.

Lighting Instruments

Experimental room was illuminated with any of white, red, and blue lightings. White lighting was made by white fluorescent lamps. Red and blue lightings were made by color beam bulbs (National BF110V 80W-R, -B; see Figure 1). Chromaticity of the top surface of a table in front of participant, which was covered with white paper, was x = .668, y = .320 under the red lighting, and x = .140, y = .201 under the blue lighting. Illuminance measured on the table was 470 lx under all lightings.

Figure 1. Experimental room illuminated with red lighting (left) and blue lighting(right).

Task

A numeric subtest of the Intelligence Structure Test (IST), a German IQ test (Beauducel et al., 2010), was employed as an experimental task. It was the same task as that used by

Maier et al. (2008). For each item, a sequence of seven numbers was given with the final number unspecified (e.g., 18, 16, 19, 15, 20, 14, 21, ?); the task is to find the final number. The mathematical rule in the sample item above is -2, +3, -4, +5, -6, +7, and the solution is 13, which is obtained from '21 minus 8.' Two different sets, each of which consisted of 15 items, were employed for each participant.

Questionnaire

Two sheets of questionnaire were used; Q1 and Q2. Q1, which was used between the first set of the task and the second set, asked participant to estimate his/her performance of the second set by comparing with that of the first set. For example, if he/she estimated to be able to solve two more items in the second set than in the first set, he/she answered '+2.' Q2, which was used after the second set, asked 'how do you feel satisfied with your result,' 'feel tired,' 'feel relaxed,' 'feel good,' and 'feel excited,' on 5-point scale (1: not at all – 5: very well), and also asked to evaluate degree of concentration and calmness felt in the second set compared to the first set on 7-point scale (1: very low – 7: very high).

Procedure

Each participant conducted two sets of the task. Time allowed for each set was 3 minutes. For all participants, the first set was conducted under the white lighting. After a general instruction of the test, they completed two, relatively easy, sample items. Then, the experimenter informed participants that the test includes 15 items of similar (but generally more difficult) problems and they must try their best to solve as much items as they can.
After finishing the first set, lighting was changed according to the assigned color group. The meaning of color lighting in the red and the blue groups was camouflaged by a dummy instruction, saying that 'it is for the subsequent visual experiment that requires pre-adaptation to the color lighting.' (This was not conducted actually.) After 30 seconds of adaptation to the color lighting Q1 was conducted, and then the second set of the task started. After finishing the second set, Q2 was conducted and finally participants were debriefed and thanked.

Results

Task Performance

For each participant, two indices of performance measure were calculated by subtracting the number of correct/incorrect answers in the first set from those in the second set, indicating individual's relative change in productivity and accuracy (actually indexing 'inaccuracy') of performing the task. Then these indices were averaged among participants in each group and group differences were analyzed. As a result, mean productivity change was 2.70 in the white group, 3.05 in the red group, and 2.30 in the blue group, which showed no statistically significant difference; F [2,57] < 1, n.s. Mean inaccuracy change was -.20 in the white group, .45 in the red group, and .40 in the blue group, which showed no statistically significant difference; F [2,57] = 2.16, n.s.

Questionnaire

Results of Q1 and Q2 are summarized in Table 1. It was shown that, for all asked items, no statistically significant difference was found among group means.

Table 1. Group means for each asked item in Q1 and Q2

color	Q1	Q2						
group	estimate	satisfied	tired	relaxed	good fl	excited	concen.	calm.
white	.30	2.55	2.40	3.05	2.80	2.70	5.15	5.00
red	.40	2.50	2.55	2.50	2.60	2.35	4.60	4.85
blue	.20	2.25	2.45	2.70	2.55	2.35	4.45	4.50

Discussion

The present results showed no color effect on the task performance nor on the participants' self-evaluation. Differently from color manipulation in the previous studies (glancing at the red color immediately before starting the task), the color lighting employed in this experiment should have been explicitly noticed by the participants. In other words, participants should have received some influence that the color lighting had on them spontaneously. Therefore it would not be probable that the color lighting has an effect of changing people's motivational state or the way of cognitive processing automatically. As for the negative effect of red in particular, a series of experiments by the author, in which more than two hundred Japanese participants have been tested (together with Takahashi, 2013), have repeatedly failed to replicate the original finding obtained with Western participants, suggesting its nature of cultural dependency. It would be important in the future research to clarify factors that influence appearance/disappearance of the color effects, which may be situational, personal, or cultural.

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Chromoland. Designing the Color Culture

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Abstract

Chaos, turbulence and clouds seem to be aspects we must beware, except when they represent some of the fundamental assumptions of our contemporary life. All the rules previously in force appear to have been pulverized under pressure of the contemporary. The new territory that obeys these conditions require that all pure color (white or achromatic as in SANAA, Meyer, etc.) or form, geometric, as banal or simplistic, who prefer the purity, regularity, certainty of any rule must be ripped. The colors that belong to our contemporary landscape are ambivalent. They are cold, grey or blue-tinted, unfriendly and aloof. In a way they relate with the buildings glass covered and steel skins, representing the architectural design of the technological power (Gehry, Foster, Ned Kahn, etc.). One side of the contemporary seems to be aseptic, where the survival of natural organisms is very difficult. This is not the only message coming out from the contemporary world.

The technological landscape is definitely disguised under façade cladding that will do everything, heavily colored by day and night. The basic message coming out from these new landmarks is functional to not have time to think and allow a multitude of humanity to spend their existence within strict rules of which it is difficult to beware. This landscape of painted and color-lighted cities and metropolis stand as evidence of another way to design and use color, where the chromatic landscape, here named Chromoland, is reserving a very big emphasis to the contemporary cultural use of color and light (Herzog&DeMeuron, Sauerbruch&Hutton, Miralles&Tagliabue, etc). This way of color use is assumed by many ideologies to represent their ideals (i.eg. publicity or the green design: they simulate the undertone colored part of the nature). The paper will synthesize some results carried out at the IUAV Colour&Light in Architecture research unit about this topic.

Introduction

Some aspects of the private and social life characterizing our age in the past would have been considered highly destabilizing and therefore to be carefully avoided. The rules in force in the past, developed by experiences having a long period of time to be stabilized often result of behaviors able to be improved minutely, put order and organized society strongly influenced by the rhythms and rituals that didn't leave much space to arbitrary digression. Any deviation from the path outlined by the laws, rules, regulations, customs, habits, formalized behavior, were a source of great and severe disappointment than in most cases could be punished in various ways, both direct and indirect.

"A code is therefore necessary, and must be sufficiently precise and present in a clear way for each type of infringement. In the silence of the law, the hope of impunity may

not need to settle. It's required a comprehensive and explicit code, which defines crimes, fixing penalties" (Foucault 1975 [1993:107]).

Juxtaposed, the contemporary time seems to be based on the total absence of rules, rituals, rhythms established *status quo*. The main rule seems to be the current chaos, chased, pampered, celebrated as the new god, standing at the basis of an alleged freedom of action generating and liberating from any constraint, this last seen as coercion and not as any necessary rule.

The turbulence, understood as result of generation of disorder produced by any action, acquires a value that never has been attributed. If the previous rule was fond of certainty resulting from the consideration that at every action (usually) there is a contrary reaction, today the reaction is more celebrated than the primitive action, because in the disorder lurk opportunities, experiences, and often unexpected interesting chances.

The condensations of unpredictable events and unexpected situations, not by affinity but for exceptions and casualness, in the turbulent clusters where nothing is replicable are the fertile soil in which sow unlikely combinations. From these clouds may arise unstable events and original and then innovative objects, economically exploitable. A context governed by the market and by the profit abhors any other purpose, and therefore fights or embeds for the sole purpose of making it economically favorable.

In this context it can be seen that in every man-made environment any reference to the simplicity and purity of color is viewed with suspicion and then not allowed. You can't obey to conditions involving the use of colors resulting from nuances, palettes, combinations or calming chords. Bandits are white and each achromatic color, still considered as standard by some architects. Examples of this type can be mentioned: Richard Meyer, Peter Zumtor, Tadao Ando and SANAA or the thousands of followers of that sort of minimalist choice living of absence, elimination down to its essence, to represent the supremacy of the rule, its sublimation, celebrate it by erasing any possibility of interfering with the inert space.

A society substantiated in a state of constant crisis doesn't express any regular process, but it feeds on complexity and constant repositioning. The rules, defined as any attempt to put in order, are an obstacle to the constant mutation, which is the daily life of those who live in this era. The empire of pseudo democracy presupposes in its DNA a supposed unregulated freedom, allowing everyone room to maneuver even based on incongruity. Examples of this are the various manifestations of the suburbs, sprawl and scraps of survival that each person plays in the most personal possible way, of living "onnipolitan", to quote Paul Virilio. The case of Italian building is a prime example, along with the locations of the empire of populism distributed patchily across the planet and often concentrated in places of (cultural) poverty, where the color is just one of the most obvious ways of unbridled subjectivism. Against this there is no dominance of "*baukustlerische problem*" ("aesthetic problem" by Mies Van Der Rohe), but the prevalence of the "aesthetics of ugly", where "the ugly can only come from good as its negation" (Rosenkranz 1853 [1994:136]).

These are the assumptions that underlie the contemporary where are possible interpretations of the effects on the landscape, on the material world and in particular on architecture, which is visited by one of his peculiarities, namely through the color.

The colors that characterize the architectural landscape of each of the parties involved in today uncertainty clearly reflect the real context. These colors are, if not arbitrary and ambiguous, certainly at least ambivalent. On one side are the aseptic disconnection from nature, celebrating the overcoming of technology over the nature and the other must dive deep into the chaos of globalization.

The aseptic colors of technique

The first are the colors of glass sheets and metallic skins, of shiny and mirroring materials, definitely unfriendly and aloof. These represent the technological domain on the architectural design, crushed under every imaginable and unimaginable form, generated by algorithms that guide the hand and the thought of the followers of this genre of architecture. Many famous names in the world panorama fill this space that generates artifacts from the most diverse forms, producing results in every imaginable color. Among these "videogamers" are the forerunners Frank Gehry, Sir Norman Foster, Ned Kahn, and some other but also a multitude of young and mature architects dedicated to the use of computer programs specialized in this kind of game simulation (and concealment).

A part of the contemporary world seems highly gratified making explicit this aseptic part, capable of putting at risk the survival of living organisms. The use of materials and technologies shows the power and cancellation of any limit in the performance of solutions interacting with both the absolute simplicity of perfectly geometric shapes or simple (even simplistic) as well as allows any move away from pure form. Therefore it's granted any more extravagant configuration, often made explicit very naturally and even required by the ease of making real the shaping of any fantasy. The consequences of these colored forms obviously aren't controllable by the designer experience, which relies on the case, what happens once the building is constructed. So it may happen that the effects aren't appreciated by the clients and users, sometimes producing some serious damage. A few aforementioned big name of the architectural star system had to make opaque the mirrored walls because they produced an excessive concentration of sunlight on pedestrians. It is known, however, that more we thrust is the innovation, the greater the chances of getting critical consequences. In fact, innovation is nothing more than a critical response to even simple problems. Each new solution usually involves the creation of additional problems, which in turn, in a game of continuous growth and impact, tend to multiply. "The positive response to a single problem often affects situations that have already achieved stability. It follows that a technological system shows a likelihood of instability, and therefore unreliable, directly proportional to the increase of its complexity, something that affects the system of higher degree and the reference environment" (Zennaro [2000:38]).

An aseptic world may not defile him with manual operations, managed with low-tech facilities, but specifically requires everything to be able to self-immunize, to regulate itself, to control every movement and every performance without human intervention. Computer technology with its widespread expansion manages every single part by cold color expressing the technological power, which doesn't require manual and inaccurate intervention being just to be a servant and serving at the same time. It should obey the demands of machine building from subjects managed and protected since their birth in a white hospital shutting-of their existence in an equally candid and artificial hospital. Each building is wired in every small meander to ensure the maximum of performance. Some rare exceptions are allowed, as calculated in percentage and returning in the

probability of failure of artifice. Aseptic is the birth, aseptic would like to be a certain kind of interpretation of life, topped by a myriad of reassuring objects capable to fill the futility of life, the sterile passing. The architecture adapts and configures formally and chromatically this world of security. As argued G. Braque, the "Art is meant to disturb, science to reassure". An art (architecture) that adapts passively to science may have taken an unorthodox road, though every attempt is still a way to put questions to its statutes.

The colors of global chaos

Plunging deeper into chaos appear experiences strongly characterized by globalized approaches to architectural design that will stand out clearly from the experiences of the statutory framework. No longer is the thickness of the material, the size of the tectonic construction that flow in the forms that have evolved slowly long centuries of refinements, deviations, rules and exceptions determine the perception of the essence of artifacts. With the advent of the buildings confined by the perimeter layered walls skipped many points that have governed the thinking of every designer at least until the advent of point structures, in steel or concrete, having released the constraint of the functions sum attributed to masonry. The introduction of the structure/coating system enabled the architect to focus almost exclusively on liminal performance. The importance of skin perception inside or outside, in direct contact with the sight and touch, was crucial to put to rest definitively statutes that many advocates to the Modern Movement, not yet fully understood and some nostalgic yet continues to follow. "Some buildings are used in two ways: through direct use and through perception. Or, in more precise terms, tactically and optically " (Benjamin 1955 [1966:45]). The perception becomes essential in a society that feeds images as it had never happened in previous eras. Even in medieval times, where the transmission of thought, or rather when the coercion and the conviction passed through the image, was made wide use of visual communication. In consideration of this our age may be congruent to be intended as a sort of neo-medieval time if we take into the match even common aspects with that period, not only limited to the use of the image.

So it happens that the contemporary technological landscape is carefully masked beneath facade coatings able to generate any perceptual chromatically expressive effect. The architectural skins are therefore strongly colored by day and or night. The continued strong push which has produced this fast kind of innovation, discovery and change, has put on the market a lot of new products and technical solutions capable of generate the most varied colors, to be shown on any media to an acceptable cost. In parallel, a society that can no longer survive without communication through colorful screens, where saturations are transmitted at the highest technically possible level introduce deformation of interpretation in the thought of the subjects of this society: the color cannot be considered if it isn’t strongly saturated. This has the consequence that the colors used for the architecture are decidedly different from those of the past. The manufacturers of dyes have adapted to the new requirements by entering the market chromogenic substances and paints able to answer the question. A vicious circle is undermining the history and heritage of civilizations having long history, such as those in Europe where the *picta civitas* (painted city) had allowed a moderation creating and foreshadowing its landscapes. Today each humble artifact competes to get noticed. In

this way, the landscape is marked by products of banality and social indulgence paying not too much attention to the evolution of his around.

On the other hand, the primary message that comes out of these new landmarks is functional to the deprivation of time to think and to enable a multitude of humanity to spend one's life within the strict rules difficult to follow. Therefore, the transgression has become the rule, the rule that intellectuals have certainly not missed. This colorful city landscape constitutes evidence for a more enlightened approach to design and color use, where the chromatic landscape, defined here as Chromoland, reserve a large cultural emphasis on the use of color and light (as do, for example, Herzog & DeMeuron, Sauerbruch & Hutton, Miralles & Tagliabue, and many other authors).

The ideological colors

Alongside of the above situations expressions of protest against the system and its rules are becoming more invasive. These rebellions are interpreted by hackers, graffiti artists, writers, unusual designers, if we can call them. The latter deserve much more space and are looking for new approaches to architectural design, little obvious, but very widely distributed, consisting primarily of young people who go to fill the spaces considered marginal by traditional designers.

There is also a parallel world of color and light producers and users, as well as the communication that makes extensive use of these tools to convey their messages. They make use of color and light to take action to convince towards specific areas of population. Social networks have helped this new approach to break the old patterns of belief. So the color and light constitute an incomparable ground for communication on the global communication era.

The widespread distribution of portable, wearable, or free software applications tools for free and instant communication and global at affordable prices reverses the way to communicate between subjects. No longer we have direct contact (physical, tactile, visual, auditory) between individuals, but within the shapeless and subjectivized mass coagulate unique thoughts that detect the banality of everyday systematically and make it public. Any action taken by hand-held cameras is fed into the circuit of global stakeholders not properly involved in first person, while fulfilled to show what they were spectators. Beyond pathological conditions, which are not negligible and that can seriously interfere with weak minds, there is a whole world of more or less interesting idiosyncrasies that can hardly be studied and analyzed scientifically.

A new way to use color is easily assumed by many ideologies to represent their ideals or to proselytize. We are becoming increasingly aware that the phenomena that can be transmitted from the network are able to overthrow political regimes and to involve those who until recently was completely ignorant of news and practices thought to be very far away. As it happens, in many new color aggregations, as happened in the history, it activates flags easily identifiable. Just remember the so-called Arab Spring and the various squares occupations recently involved in protests. Like these, other protests take colors and are colored (black block, secessionist, populist, and so on), reporting of a collective imagination that cannot exist without that factor.

In short, the contemporary landscape color is able to synthesize the evolutionary processes that underlie our *Zeitgeist*, the spirit of our time. In this, architecture and landscape are among the first to be involved in the change.

Conclusions

Chaos, turbulence and clouds are essential phenomena in which the society of globalized economy may not do without. They carry in their transfer to objects phenomena involving color and light that surround each biological rhythm, being ceaseless thanks to the empire of the technique that feeds them.

The architecture, which asserted itself through procedures, rules, complex systems fulfill the simplification of its statutes, spreading behind a myriad of parts in favor of reduction of the redundant communication. In fact, the era of globalizing communication isn't able to phagocyte the localisms and the complexities. The global dominance requires uniformity, or better to standardize the diversity, so that the multiplicity is reduced to unity. Only one language have right to survive and expand at the expense of all others (one color or multicolored, has the right to survival?). This is done by a supine acceptance by the civilized world of slang able to express only basic needs. The communication itself becomes basic, popular, without any reference to the top, because none will be able to grasp the subtleties that different cultures have managed to hone along long periods.

By principle the culture is destabilizing and then must go banned especially in places where it proliferates, namely universities. The economy, which constitutes the backbone along which everyone must put all other aspects of survival, impose the laws because everything must be functional to its expansion. In this context, the environment, landscape, art and architecture must walk along itineraries marked by a small oligarchy that has decided that, since the technologies available are expressed through screens with high color saturation, each product and thought must adapt practicing the hyper color and the ultra saturation ways. A few words and concepts explained from many colors, preferably saturated: this seems to have become the slogan of the new millennium.

Just as a century ago, when around the middle of the second decade laid the foundations of the two world wars, so today we are laying the foundations for a new global order, which de-localize conflicts and condense the profits. The colors in this new order are strongly calibrated, organized in systems globally accepted, knowing that their basis are highly uncertain, especially from a cultural point of view. The new chromatic territory (Chromoland) is, however, continuing its long history, knowing that at its base there is a culture and not a science. The first arise openings, the second, trying to reassure, dissects and reduces areas hardly to systematize. "We are literally immersed in the colors full of meaning, and we are programmed with colors. They are an aspect of the coded world in which we live " (Flusser 1997 [2004:3]).

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DYES AND PIGMENTS

El Genero *Dahlia*, Portador del Color a Traves del Mundo.

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Abstract

The Dahlia genus of the botanical family Asteraceae, is conformed from 35 endemic species wild of Mexico, only four of which constitute the genetic basis with that have developed cultivated species, at altitudes ranging from 500 to 3500 m, now has been extended by almost all countries. The Dalia is deeply rooted to our culture and traditions. On May 13, 1963 was declared by presidential decree as the National Horticulture symbol. Cultivation of this flower, which is actually an inflorescence (group of flowers that function as a single flower), dates back to pre-Hispanic times, when its petals were have been used as natural dyes for cotton fabrics. After the Spanish conquest, the dahlias were successfully introduced to Europe. In 1818 began genetic investigation that led to the creation of clusters with different shapes and colors.

The synthesis of compounds that determine the colors is genetically regulated through metabolic pathways that meet the needs of the organism to survive, as a defense mechanism, to favor reproduction or play an ecological role. The major compounds in flowers are anthocyanins, anthoxanthins and carotenoids. The change in color depends on the presence or absence of one or more of these substances, structural alterations in their molecules, changes in the pH of the cell sap, or quantitative changes affecting the amounts of pigment produced.

The purpose of this paper is to disseminate through the history, chemistry and biology of genus Dahlia the close relationship between the color and nature, constant reason of research in the area of ornamental plants.

El género *Dahlia* de la familia botánica Asteraceae, se compone a partir de 37 especies, de las cuales 32 son endémicas de México, de las cuales sólo cuatro constituyen la base genética con la que se han desarrollado las especies cultivadas, en altitudes que van desde los 500 hasta los 3500 m, actualmente se ha extendido por casi todos los países del mundo.

El propósito de este trabajo es divulgar a través de la historia, la química y la biología de éste género, la estrecha relación entre el color y la naturaleza, impulsora constante de investigaciones en el área de plantas ornamentales.

Historia

La dalia, como se conoce comúnmente, es una planta muy arraigada a nuestra cultura y tradiciones por lo que el 13 de mayo de 1963, fuera declarada por decreto presidencial como símbolo de la Floricultura Nacional.

El cultivo de esta flor, que en realidad no es una flor sino una inflorescencia (conjunto de flores que funcionan como una sola flor), se remonta a la época prehispánica, cuando las dahlias silvestres eran conocidas de diversas maneras en la lengua náhuatl:

- Acocoxóchitl o acocotli - flor doble con forma de pelota.
- Cohuanenepilli - flor de tallos huecos con agua.
- Xicamiti - flor de camote (por su raíz de bulbo).

Los indígenas mexicanos, como hábiles horticultores que fueron, la domesticaron, la cultivaron y la reprodujeron, obteniendo numerosas variedades.

Las dalias fueron utilizadas en tiempos prehispánicos para adornar templos y casas durante los rituales; servían de inspiración para crear vasijas o elaborar collares. Además, sus pétalos se utilizaron como tintes naturales para las prendas de algodón, se hacían con ellos mezclas aromáticas. Por si fuera poco tenían fines medicinales y eran importantes en la comida, pues sus pétalos y el tubérculo eran cocinados. En la actualidad los indígenas mixtecos de Oaxaca siguen consumiendo los tubérculos frescos de dalias silvestres para obtener carbohidratos y agua (Mera, 2006).

La principal referencia bibliográfica que documenta la antigüedad de la dalia en México es el Códice Badiano, importante documento de la herbolaria mexicana, donde aparece una ilustración de una planta denominada “Cohuanenepilli” que muestra una “Flor Sencilla” (cabezuela) que se supone es *D. coccínea* (De la Cruz, 1964).

En el Museo Arqueológico de Xochimilco, México se exhiben algunas formas florales talladas en piedra, que corresponden a la cultura Xochimilca, (anterior a la cultura azteca) lo que se interpreta como una dahlia de forma sencilla, con lo que se comprueba la importancia de esta flor entre los floricultores de la cultura Mexica.

Posterior a la conquista española, las dalias fueron introducidas exitosamente a Europa en 1784. Vicente Cervantes, primer catedrático de botánica, Director del Jardín Botánico Virreinal de la Ciudad de México y miembro de la Real Expedición Española, envió semillas de varias flores mexicanas al abate Antonio José Cavanilles y Palop, director del Jardín Botánico de Madrid, España; entre ellas iba las primeras simientes de la acocoxóchitl. Las dalias maravillaron al padre Cavanilles, quien la cultivó con esmero, y le asignó el nombre de *Dahlia pinnata*, en honor al botánico sueco Dahl, alumno de Linneo.

En 1818 se iniciaron los trabajos de mejoramiento genético que permitieron la creación de inflorescencias con diversas formas y colores, la cantidad de formas o tipos distintos de dalia es innumerable. De aquella época al presente, cuatro especies han dominado la horticultura floral: *D. coccinea, D. pinnata, D. merckii* y *D. imperialis*. La dalia más

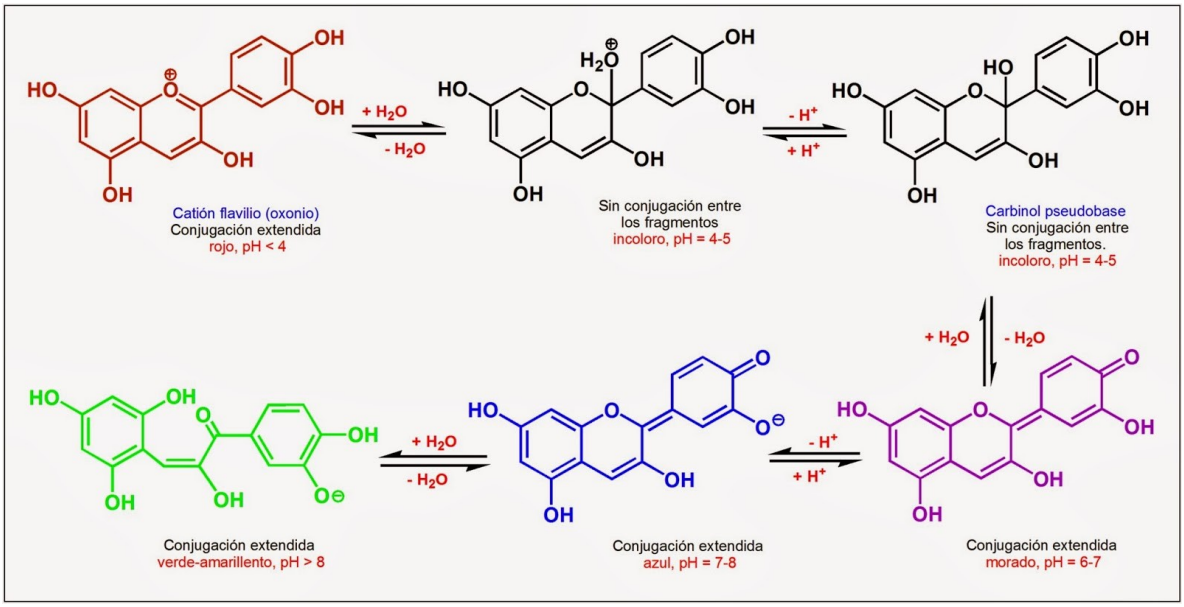
conocida es *D. pinnata* la cual se deriva de un híbrido fértil entre *D. coccinea* y *D. sorensenii* producido probablemente en México hace más de 500 años (Bye, 2008).

Química

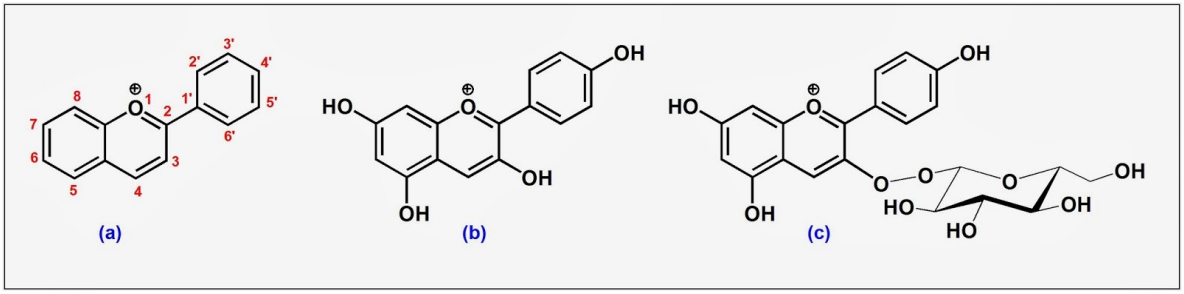
La producción del color es debido a moléculas con específica estructura, en donde ciertas secciones moleculares funcionan como cromóforos, pues absorben parte de la luz del espectro en la región visible y reflejan y/o refractan la energía no absorbida, la cual es capturada por el ojo y a través de un impulso eléctrico es transmitido al cerebro e interpretado como color. La absorción y la emisión de la energía, transformada en color por el ojo humano, es dependiente de la forma en que están enlazados los átomos que conforman la mólecula. Los principales compuestos en flores son las antocianinas, antoxantinas y carotenoides. La variación en el color depende de la presencia o ausencia de una o más de estas sustancias, las alteraciones estructurales en sus moléculas, los cambios en el pH de la savia de la célula, cambios cuantitativos que afectan a las cantidades de pigmento producido, temperatura, presencia de oxígeno y actividad de agua de la matriz determinan la estabilidad del pigmento.

El cambio de color puede ser atribuido a las diferentes conjugaciones -deslocalizaciones de electrones entre cromóforos de una molécula- en antocianinas y flavonoles a diferentes valores de pH. Debido a esta característica, las flores de dalia sirven como indicadores ecológicos de pH, en medio ácido dan un rosado rojizo y en uno alcalino se torna azul verdoso (esquema 1).

Los colorantes de origen vegetal principalmente contienen flavonoides, el componente colorido principal en las dalias pertece a éste grupo químico y se denomina antocianina, que son pigmentos hidrosolubles que se encuentran en las vacuolas celulares de prácticamente todos los tejidos vegetales (hojas, flores, frutos, tallos y raíces). Desde un punto de vista químico, las antocianinas son los glicósidos que resultan de la unión de una aglicona (antocianidina) unida a una molécula de azúcar a través de un enlace □-glucosídico. Las antocianidinas, por su parte, son compuestos polifenólicos derivados del catión flavilio (esquema 2). En la naturaleza, las antocianidinas siempre presentan sustituciones glicosídicas en las posiciones 3 y/o 5 con mono, di o trisacáridos que incrementan su solubilidad y estabilidad (Ortíz, 2011).



Esquema 1. Transformaciones moleculares en función del pH para la cianidina. (Imagen tomada de: Espino, 2014).



Esquema 2. (a) Catión flavilio: estructura general y numeración;
(b) Pelargonidina (antocianidina); (c) Pelargonidina-3-O-glucósido (antocianina).
(Imagen tomada de: Espino, 2014)

La familia de las antocianidinas se conforma por aproximadamente 20 compuestos, las más importantes son la pelargonidina, la delfinidina, la cianidina, la petunidina, la peonidina y la malvidina, las tres primeras son más frecuentes en frutos, en tanto que el resto lo es en flores, sus nombres derivan de la fuente vegetal de la cual fueron extraídas por primera vez (figura 1). La combinación de éstas con los diferentes azúcares genera aproximadamente 150 tipos de diferentes antocianinas que abundan en la naturaleza.

Las antocianinas son responsables de los colores rojo, naranja, azul y púrpura.

El color depende de varios factores intrínsecos, como son los sustituyentes químicos que contenga y la posición de los mismos; por ejemplo, si se aumentan los hidroxilos del anillo fenólico se intensifica el color azul, mientras que la introducción de metoxilos provoca la formación del color rojo.

El rango de colores en las flores es el resultado de la mezcla de flavona y antocianina en proporciones e intensidades variadas. El color blanco, amarillo y naranja de las flores,

denotan baja concentración de antocianinas y pudieran estar dados por los carotenoides presentes (Mishra, 2012).

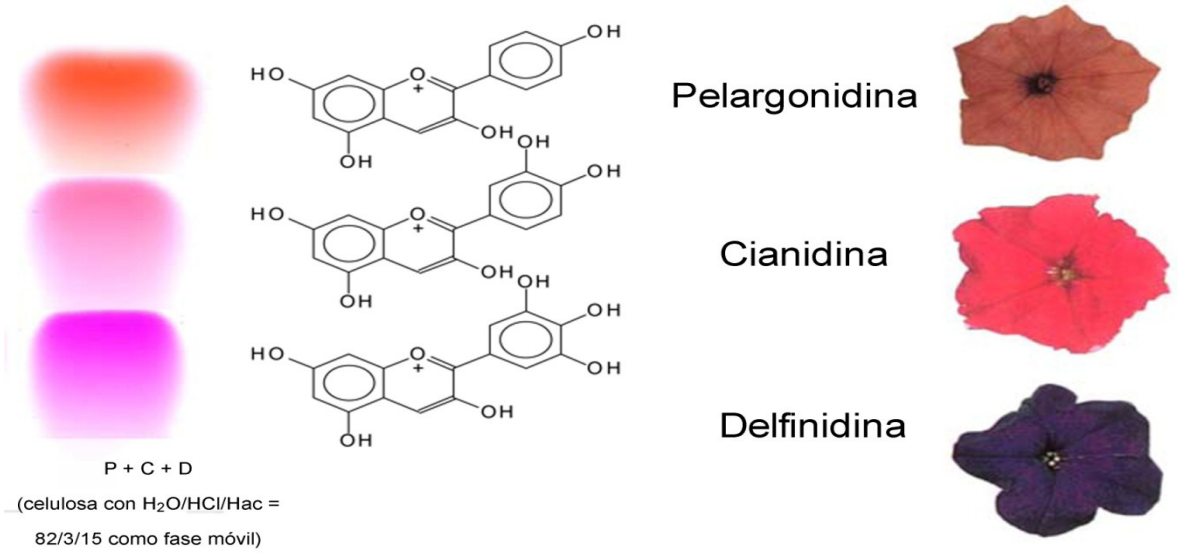


Figura 1. Estructuras químicas de las antocianidinas más comúnes. Se muestran en cromatografía en capa fina los colores de la respectiva antocianidina derivada (el color naranja proviene de una petunia modificada genéticamente). (Imagen tomada y modificada de: Halbwirth, 2010)

El interés en los pigmentos antociánicos se ha intensificado debido a sus posibles efectos terapéuticos y benéficos, dentro de los cuales se encuentran: la reducción de la enfermedad coronaria, los efectos anticancerígenos, antitumorales, antiinflamatorios y antidiabéticos; además del mejoramiento de la agudeza visual y del comportamiento cognitivo (Paredes, 2005). Por lo que estos compuestos, potencialmente son incorporados en la industria de alimentos y bebidas, ya sea como colorantes naturales, alimentos funcionales y suplementos alimenticios (Lara-Cortés, 2014).

Biología

Las dalias son plantas perennes de tallos herbáceos o lignificados y raíces tuberosas que pueden ser utilizadas en la propagación vegetativa. La mayoría son herbáceas o arbustos, mientras que *D. macdougalii* Sherff es una hierba epífita. Las dalias crecen con mayor frecuencia en bosques de encino o de encino y pino, entre los 1500 y los 3700m, sin embargo, *D. Coccinea* también se encuentra en bosques tropical caducifolio, subcaducifolio y perennifolio y en elevaciones cercanas al nivel del mar (Castro, 2012).

La síntesis de los compuestos que determinan los colores, está en función de factores bióticos y abióticos y se encuentra regulada genéticamente a través de rutas metabólicas que cubren las necesidades del organismo vegetal para sobrevivir, como mecanismo de defensa, para favorecer su reproducción o cumplir un rol ecológico.

El estudio de los pigmentos de las dalias data desde 1956, cuando la presencia de las antocianinas, flavonas, flavonoles, chalconas y auronas fueron elaboradamente descritas en especies del género *Dahlia* (Ohno, 2011).

Las antocianinas poseen diferentes funciones en la planta como son la atracción de polinizadores y posterior dispersión de semillas, la protección de la planta contra los efectos de la radiación ultravioleta y contra la contaminación viral y microbiana.

Se han realizado investigaciones que han informado los factores transcripcionales que afectan la biosíntesis de antocianinas (Thill, 2012), gracias a esos avances pueden obtenerse nuevas flores con tonalidad azulada (Yoshida, 2009); todas estas plantas son transgénicas y el estudio de las rutas sintéticas contribuyen a la descripción de los genes responsables de la expresión de las distintas gamas de colores que podemos disfrutar.

El propósito de contribuir con la difusion dentro y fuera del país, del conocimiento sobre la Dahlia como una importante aportación de México para el mundo, es impulsar sus cualidades no sólo para el sector industrial, sino también para el amplio campo de la investigación actual y futura sobre el género y sus constituyentes.

Dahlia barkerae. Foto tomada por Erika Pérez Mojica.

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Production of Natural Pigments from Antarctic Fungi *Epicoccum sp.*

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Abstract

Currently natural pigments industry is on the rise. The consumer preference for compounds of natural and no harmful origin has led to the demand for the replacement of synthetic dyes. The most common sources of natural pigments are plants, animals (insects) and microalgae. However, the access to an annual stable production of pigment from them is a complex and costly process. The use of microbial strains, particularly fungi, as stable and controlled source of pigment is an interesting option. So far, research and use of fungal natural pigments have been focused on strains of the genus Monascus. However, fungi of the genera Epicoccum, Penicillium, among others, have also shown the ability to secrete pigments.

Currently, in our laboratory we have three strains of the genus Epicocum isolates from Antarctic sponges. These strains produce pigments with colors ranging from red to yellow. A study of the pigments produced by these strains sequentially varying the culture medium (carbon source, salt concentration) and culture conditions (temperature), has shown that these variables are critical in controlling the color of the pigment majority secreted into the medium. Interestingly,all the pigment extracts of these strains have a high antioxidant activity.

Therefore, in this study, we present an Antarctic microbial source of natural pigments with the capacity to produce pigments of different colors according to the culture conditions employed. In addition, these pigments have antioxidant activity. These pigments have good projection for their use in the food, cosmetic , pharmaceutical and textile industry.
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Natural Pigments

The color in food is an important indication of their status (freshness) and also plays an important role in the sensory value when consumers choose food. Dyes has been used traditionally to enhance the natural color of certain foods and thus attract the attention of consumers. However, color is not only used in food, but also in pharmaceutical, cosmetic, textile, etc., where synthetic dyes have been widely used.
In recent years, consumers have set the standard with respect to the progressive replacement of synthetic dyes for natural food dyes. The difference between these two is their origin and treatment:

Natural dyes are derived from naturally occurring sources such as plants (e.g., indigo and saffron); insects (e.g., cochineal beetles and lac scale insects); animals (e.g., some species of mollusks or shellfish); and minerals (e.g., ferrous sulfate, ochre, and clay) without any chemical treatment (Chengaiah et al., 2010 [144]).
The trend to consume natural products is growing stronger and using them is considered an attribute of product quality, as well as being innocuous compared to synthetic, can provide other health benefits such as pigments with antioxidant, anti-cancer, vitamin properties, among others (Carmona 2013 [1], Malik et al., 2012 [361]).

According to the report by Mintel Food Research & Leather head in 2011 was the first time that the value of natural dyes have surpassed that of artificial / synthetic colors globally. In 2011, worldwide sales of natural colors have increased 29% since 2007, which shows the annual growth of over 7%.

The decision of the additive manufacturers to produce natural colors for the food industry was accelerated by the publication of a study by the University of Southampton ..... The aim of this study was to verify the effect of the mixture of six synthetic dyes with sodium benzoate, often used as a preservative in soft drinks and other products consumed by children. The result found that childhood hyperactivity could increase by the use of this mixture .... this study has accelerated the trend towards the use of natural dyes in Europe and other markets, as consumer demand for more natural formulations and major producers and retailers looking to phase out synthetic ingredients (Carmona 2013 [2])

Currently, most of the natural dyes marketed, derived pigments extraction from raw materials such as plants, flowers, fruits. (Mapari et al., 2009 [2]). Some of the best known sources and marketed worldwide natural pigments correspond to:

• Anthocyanins: Match red pigments derived from fruits such as berries, grapes, cherries, vegetables, flowers.
• Caramel Color: drift gently heating certain carbohydrates
• carminic acid: It comes from an extract of cochineal insect
• Carotenoids: The main sources of this color are carrots and tomatoes
• Beta carotene and lycopene: Pigments from various fruits such as tomatoes, watermelons, carrots.
• Curcumin: Pigment extracted from Curcuma longa plant

One of the main disadvantages of obtaining natural pigments from plants, is the dependence of the raw material for agro-climatic conditions and the chemical variation generated between different production batches. Along with this, the pigments may be sensitive to light, air, heat and pH (Mapari et al., 2009 [2]). According to this and the growing demand for natural pigments, it is essential to explore new sources of natural pigments.

Microbial Pigments

Microorganisms are known to produce a variety of pigments; therefore they are promising source of food colorants (Aberoumand, 2011 [71]). The pigments obtained from these

organisms is carried out by fermentation under controlled and specific conditions according to each to microorganism. The industrial production of pigments by microbial fermentation has several advantages as a production with lower cost, ease of extraction, higher yields, stability in the raw material and not dependent on the seasonal variation (Malik et al., 2012 [361-363]). Among the non-conventional sources of natural pigments, filamentous fungi are known to produce a varied amount of pigments such as carotenoids, melanins, phenazinas flavins, quinones, monazcinas, violaceinas or indigo (Dufossé et al., 2014 [56]). The diversity of fungal pigments is not only found in the diversity of chemical structures, but also in different colors that may add new colors to the commonly used (Mapari et al., 2008 [2183])
Additionally, some of these pigments may also possess anti-cancer activity, contain provitamin A and physical properties such as light, heat and pH stability. These advantages have allowed the use of fungal pigments in recent years. In fact, some fungal pigments are already available in the market:

Pigments of Monascus sp.

This corresponds to a fungi cultivated for centuries in Asia, which is fermented in a solid phase, usually rice. This fermented product is known as Angkak or red rice. For centuries angkak has-been extensively consumed in Asia as natural food coloring of fish, Chinese cheese, and red wine. The molecules that make up the color corresponding to monascorubrin and rubropunctatin (Dikshit et al., 2011 [164-165] (Figure 1).
Annual consumption of *Monascus* pigments in Japan moved from 100 tonnes in 1981 to 600 tonnes at the end of the nineties and was valued at $1.5 million. New food applications, like the coloration of processed meats (sausage, ham), surimi and tomato kétchup were described" (Dufossé 2006 [316]).

Arpink red color from Penicillium oxalicum:

Ascolor Biotech company commercializes Arpink as a color red pigment that is produced by a strain of *Penicillium oxalicum*. The fungal strain produces a chromophore of anthraquinone type (Figure 1). The colorant gives a raspberry-red color in aqueous solution, stable at pH over 3.5. Neutral solutions are stable even after 30 min of boiling and color shade does not change in relation to pH. This pigment is used in both the food industry (meat, beverages, etc.) and cosmetics (Dufossé 2006 [316])

Riboflavin

Riboflavin is a yellow water-soluble vitamin produced by many micro-organisms. Traditional chemical synthesis of riboflavin is now being replaced by commercially competitive biotechnological processes using ascomycetes *Ashbya gossypii*, filamentous fungi *Candida famata,* or bacterium *Bacillus subtilis*…. It is used in baby foods, breakfast cereals, pastas, sauces, processed cheese, fruit drinks, vitamin-enriched milk products, and some energy drinks (Figura 1) (Malik et al., 2012;[362]).

B-carotene

It can be produced by several organisms, however, the most recognized is *Blakeslea trispora*. This is a commensal fungus of tropical plants and is not toxic or pathogenic (Defussé 2006 [315]). Company Gist-brocades were the first to market b-carotene from this source. *Blakeslea trispora* b-carotene is equivalent to the chemically synthesized used as food colorant and therefore, is acceptable for use as a coloring agent in foodstuffs (Figure 1) (Malik et al., 2012 [362])

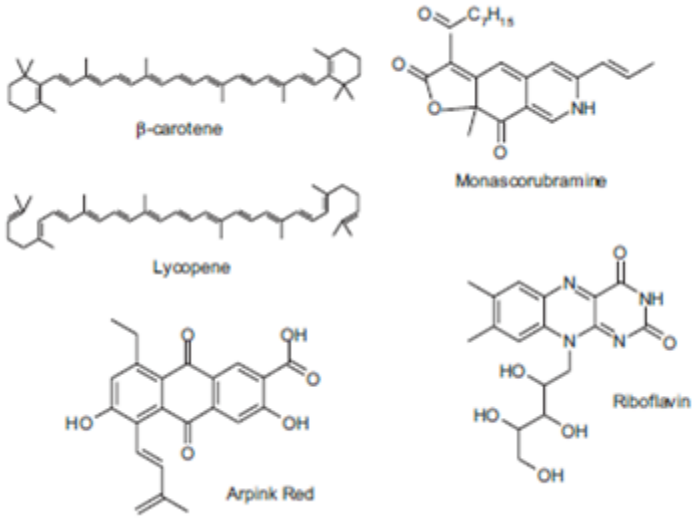

Figure 1. Chemical structure of natural pigments of fungal origin (Modified from Dufossé 2006 [314]).

The search for new natural pigments due to high consumer demand, stimulate the search for new sources of natural pigments. Particularly, fungi have the potential to compete with any other type of production, due to their (highly controlled)production, which would allow unlimited production of pigments. In this regard, exploring fungal chemical diversity is a worthwhile route for the identification of novel pigments (Mapari et al., 2006 [7027]).

Pigments from *Epicoccum sp.* isolated in Antárctica

During the expedition to Antarctica in 2009, samples of marine sponges were obtained. From these samples, after cultivation and successive purification steps, 109 filamentous fungi were obteineD. All fungal strains isolated were studied for their potential as producers of bioactive secondary metabolites.

Within this 109 isolates, 3 isolates were identified as *Epicoccum sp.* using molecular techniques. These 3 isolates, that were named *Epicoccum sp.***C**, *Epicoccum sp.* **D** and *Epicoccum sp*. **A** , in solid medium exhibited the ability to secrete yellow, red-pink and orange pigments, respectively. Additionally, each fungus was fermented in liquid medium at 22 °C and by extraction with organic solvent, extracts with secondary metabolites secreted by each were obteined. Each of these extracts were subjected to analysis to determine their antimicrobial, antitumor and antioxidant property. Accordingly, all the

extracts showed antimicrobial activity against *Staphylococcus aureus*, also anti-tumor properties and high antioxidant capacity (Henríquez et al., 2014 [70]).
With this background, research for the production of microbial pigments from these strains with the above properties was continued.
Firstly, we proceeded to optimizing pigment production by the strain *Epicoccum sp.* **D**. This procedure was carried out by 4 successive rounds of fermentation in a liquid medium at low temperature. The effect of different carbon sources on the production of pigments, in conjunction with the effect of the degree of oxygenation of the culture in the fermentation and the initial amount of fungal biomass was assessed in the first round of optimization.
The pigment production kinetics were monitored by measuring the absorbance of culture medium at different wavelengths during 10-17 days. After the fermentation, the culture medium that showed higher absorbance value and evidenced high color production in the medium (Figure 2) was chosen. To continue with the optimization, the selected medium was modified to increase pigment production.

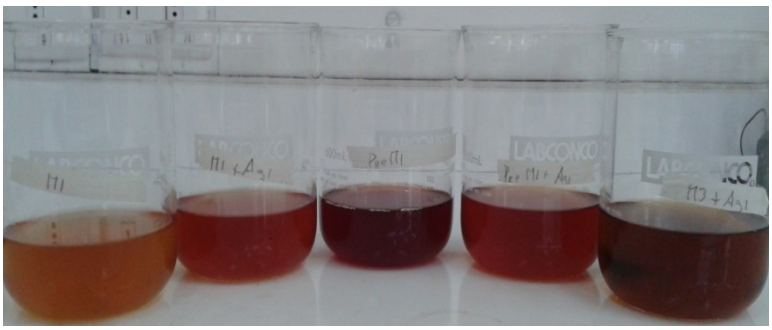

Figure 2. Optimize production of coloring pigments from Epicoccum sp. ***D****. From left to right:. Medium 1, Medium 2, Medium 3, Medium 4 Medium 5. Medium 5 was selected for its color intensity and higher absorbance values.*

In the selected medium, Medium 5, two variables were modified: concentration of carbon source and salt concentration. This allowed us to intensify the color of the pigments, increasing the production of red pigments over orange (Figure 3).

Figure 3. Second optimization. From left to right: Medium5-1, Medium 5-2 Medium 5-3, Middle 5-4 East5-5. The Medium 5-2 that had an average salt concentration and showed higher levels of absorbence and color was selected.

After 4 optimization processes, where other variables were evaluated, it was possible to vary the pigment production of *Epicoccum sp*. **D** from the orange-red to deep red color as shown in Figure 4. Pigment produced has high polarity which facilitates their use in certain manufacturing and food.

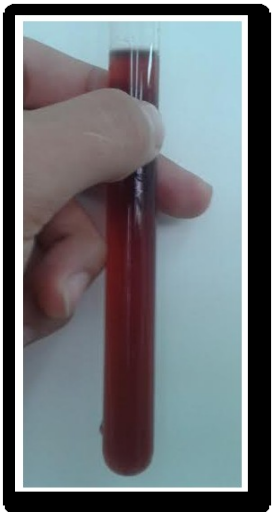

Figure 4. Pigment produced by the strain Epicoccum sp. D.

Once determined the culture medium which produces the greatest amount of pigment, we proceed to a large-scale fermentation to obtain the largest amount of pigment. The yield was 1 g per 20 mL of crude pigment.

Currently, we are working on the process of chemical characterization of these pigment and also study its stability at different temperatures and pH. Also, assessing their possible uses as a pigment for coloring food, beverages or use as a textile dye. In parallel we are also analyzing the safety and toxicity of these pigment.

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Registro Cromático de Textiles Precolombinos de la Costa Sur del Perú como Elemento para Fortalecer la Identidad Nacional en Proyectos de Arqueología y Diseño

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Abstract

The visual perception of color range plays such an important role in our lives as it is a communication tool and identity trait that man since prehistoric perceived according to its environment, forming part of its history. Peru has a wide variety of cultures over twenty thousand years of history that can be seen in one of the largest networks of archaeology in the world, ancient Peruvians valued the tissues as surfaces transmitting symbolic information, with a wide range of colors that could establish interethnic communications, taking this cultural wealth this country does not have its own palette of color identification system, causing a limited registration of color in archaeological field and conservation field, also provokes an inexact application of color gamut in design projects related to cultural issues for strengthening national identity, so the opportunity to use color as an identity element is wasted. In this project was developed a color register of precolumbian textiles from the southern coast of Peru (Ica), since in this region were found the most important textiles parts of the cultures from Paracas, Nasca y Chincha, with a variety of colors, design and good condition, this will permit define its color characteristics for future application in contemporary projects for archeology, conservation and design, thus contributing to the dissemination and preservation of pre-Columbian textile heritage color, and the strengthening of national identity in issues related to these areas. The end result obtained nearly 500 colors of Paracas, Nasca and Chincha cultures. Also, this project aims to serve as a reference for future investigations of other pre-Columbian cultures, colonial, republican and contemporary in the other regions of Peru.

La Historia del Perú abarca de manera continua más de 15 milenios según Luis Valcárcel en su libro Memorias (1981), de los cuales la etapa más extensa de la historia peruana es la que precede a la conquista española a fines del siglo XV. En este periodo, surgieron las primeras civilizaciones que con el pasar del tiempo se fueron extendiendo y creando un gran número de culturas, las cuales valoraban ampliamente los tejidos como superficies que transmitían información simbólica, la gran diversidad de textiles andinos se halla en la complejidad de sus estructuras, sus técnicas y amplio repertorio de colores que lograba establecer identidades y comunicaciones interétnicas (Iconofacto, Volumen 7-2011). Según las investigaciones de Hoces de la Guardia en su proyecto "Fondecyt 1100914" (2010), en el mundo andino los textiles han sido los máximos exponentes de la capacidad de comunicar contenidos culturales a través de formas estructuradas en colores.

Para identificar y jerarquizar estas culturas en la arqueología, se investigan los materiales encontrados en los centros arqueológicos, como por ejemplo textiles que se clasifican estudiando el material y seleccionando colores comunes entre culturas. Este trabajo arqueológico se realiza para comprender si hacían intercambios en los aspectos políticos y sociales, saber su aplicación funcional, o saber sobre el medioambiente en cuanto a la obtención de materia prima, su conservación y entorno.

Hugo Zumbühl en su Manual de tintes de origen natural para lana de oveja (1979), indica que los antiguos peruanos lograron más de 150 gamas de tintes y matices que han quedado registrados en la variedad de vocablos que distinguen muy sutilmente los tonos de un color. Por ejemplo, en el quechua de los tintoreros, cuando querían resaltar un tono más intenso y vivo en el mismo color, añadían la palabra "llanca", es decir, "llanca panti" venía a ser un encarnado encendido anaranjado; "llanca puka" sería el rojo oscuro, grana o carmesí, etc. De esto se deduce, la existencia de una práctica popular de miles de años y un gran desarrollo tecnológico artesanal de asombrosa calidad en materia de colores, que no han sido sistematizados ni estudiados con detenimiento.

El color ha sido siempre un elemento importante en la cultura de los pueblos, no solo para el embellecimiento personal o la decoración de objetos, sino también para indicar diferencias de estatus (Wouters y Chirinos, 1999). En este sentido, desde la antigüedad el color ha sido un factor para generar identidad, donde cada cultura representaba su realidad. Así, los colores variaban por periodos y servían de diferenciadores culturales y sociales. Por ejemplo, el color de sus vestimentas podía connotar tanto su estatus social, como su ascendencia étnica y grupal.

Descripción Del Problema Encontrado

En el Perú no se cuenta con un registro cromático de las culturas precolombinas que habitaron en su territorio y por ende carece de material en forma física o digital de los colores de sus textiles. Esto ha ocasionado que los arqueólogos utilicen solo tablas de colores internacionales como la tabla Munsell para dar una cierta clasificación de color a los textiles, a pesar de que esta tabla solo debe ser usada para estudios de suelos y tiene limitaciones en la gama de color con respecto a los textiles precolombinos. Así mismo, los diseñadores gráficos se limitan a usar el Pantone, tabla de colores internacional, que si bien tiene una diversidad de colores, también limita su trabajo de diseño debido a que no se sabe qué colores son los que pertenecen a las culturas precolombinas; siendo finalmente aplicados con imprecisión en productos contemporáneos, desvinculándose así de su propia identidad nacional.

Al no haber un registro colorimétrico de los textiles peruanos de la costa sur, se pierde una gran fuente de información histórica colorimétrica y el legado histórico de las culturas precolombinas, esto debilita el fortalecimiento de una identidad nacional peruana, al desperdiciar la oportunidad de usar el color como elemento identitario.

Salazar Bondy, filósofo peruano, en su libro Entre Escila y Caribdis, Reflexiones sobre la Vida Peruana (1985), lleva al extremo su razonamiento negando la existencia no solo de una nación peruana, sino de una identidad peruana. Este pensamiento ha predominado en la sociología hasta la actualidad, debido a la no aceptación de su multiculturalidad y a la debilidad de la conciencia nacional o una identidad inconsistente,

esto provoca que el peruano se olvide de sus raíces y adopte costumbres extranjeras. Al no valorar su riqueza de culturas se convierte en un asesinato cultural.

Problema Principal

La falta de un registro cromático de los textiles precolombinos, en especial los de la costa sur del Perú, limitan la identificación de colores reales de dichas culturas en proyectos de arqueología, museografía, restauración, diseño, y otras disciplinas que tengan al color como elemento identitario ocasionando que el fortalecimiento de la identidad nacional se vea afectado en los temas ligados a estos ámbitos.

Problema Secundario

El desconocimiento de los colores precolombinos, en especial los de la costa sur del Perú por parte de arqueólogos, museógrafos, restauradores, diseñadores y otras disciplinas que tengan al color como elemento identitario, provoca que no haya una correcta aplicación en proyectos contemporáneos.

La pérdida de información sobre la diversidad colorimétrica de los textiles precolombinos en especial de la costa sur, provoca un desvínculo con las raíces culturales peruanas, teniendo como consecuencia una escasa información al respecto en las demás regiones del Perú.

Justificación E Importancia Del Proyecto

La textilería es la manifestación más antigua del arte precolombino peruano, esta apareció y se desarrolló mucho más temprano que la cerámica, orfebrería y otras artes menores, debido a que cumplía varias funciones y usos, por ejemplo: la identificación de estatus a través de la vestimenta, almacenamiento de conocimientos contables y administrativos, narración de sucesos familiares, históricos y míticos de la comunidad. Su multifuncionalidad e impacto estético hizo de los textiles soportes fundamentales para la comunicación. Además, a la muerte del individuo, los textiles tuvieron el rol final más importante de acompañarlo, llevando consigo toda la información del sujeto a su nueva forma de vida, esto obedece a antiquísimas creencias acerca de la existencia de una forma de vida luego de sobrevenir la muerte (Tocapu Viracocha: Deidad textil - exposición itinerante, 2012).

Así mismo, es importante aprovechar el potencial textil para identificar los colores precolombinos y elaborar un registro de colores de la costa sur del Perú que sirva de base para futuras investigaciones. Según Elba Manrique en Tejidos Milenarios del Perú (1999), la cultura Parcas de la costa sur es importante por su gran aporte a la tradición textil peruana. El color como elemento cognitivo que registra y almacena información, usado en su sentido más amplio permite comprender no solo su espectro solar, sino también sus variaciones tonales, cromáticas y neutras.

La utilización del color contribuye en la realización de los más importantes objetivos de la comunicación gráfica: atraer la atención, ser legible y comprensible, y causar una impresión. Además interviene en la estimulación visual y cumple un papel importante en la vida emocional del ser humano. Históricamente los colores han tenido una influencia importante en cada civilización. Por medio de ellos se pueden conocer ciertas costumbres y tradiciones en una sociedad. Son los colores los que definen las características de una civilización; por ejemplo, para Occidente, el color negro es símbolo de muerte, en cambio, para Oriente el color blanco es el que tiene esa connotación (Larissa Castillo, 2009). Por ende el impacto psicológico de los colores precolombinos, fortalecerá la identidad nacional al ser aplicados o incorporados en proyectos de arqueología, museografía, restauración, diseño y cualquier otra disciplina que tenga al color como elemento identitario.

La identidad se entiende como aquella singularidad que posee y define a una determinada cosa o ser vivo. Los grupos sociales, culturales o mercantiles tienen también una identidad que tiene que estar fortalecida por medio del cuidado de su imagen. Cada elemento posee características que le son propias y por medio de ellas se las distingue y almacena en la memoria. Estos rasgos de identidad propios de cada elemento, individuo o entidad los hacen, por tanto, reconocibles. Por ello en el presente proyecto se propone utilizar el color como un signo identificador de las culturas precolombinas, para ser utilizado en proyectos de arqueología y diseño que contribuya al fortalecimiento de la identidad nacional por medio del color. Así mismo, un registro colorimétrico evita la pérdida de información de nuestro legado histórico, que puede desaparecer si no es registrado, descrito o difundido.

Objetivo Principal

Elaborar un registro cromático de textiles precolombinos de la costa sur del Perú para la identificación de colores reales de dichas culturas en proyectos de arqueología, museografía, restauración, diseño y otras disciplinas que tengan al color como elemento identitario, teniendo como resultado el fortalecimiento de la identidad nacional en los temas ligados a estos ámbitos.

Objetivo Secundario

Definir las características cromáticas de los textiles precolombinos de la costa sur del Perú para que sean aplicados en los proyectos contemporáneos de arqueólogos, museógrafos, restauradores, diseñadores y otras disciplinas que tengan al color como elemento identitario para una correcta aplicación.

Difundir la conservación del patrimonio cromático textil precolombino de la costa sur a través de la publicación de un libro informativo acerca de la importancia del color e identidad y textiles investigados, además de organizar exposiciones para su promoción dirigidas a arqueólogos y diseñadores, a fin de que se realicen investigaciones en las demás regiones del Perú.

Explicación Del Desarrollo Del Proyecto

Para la realización del presente proyecto, se buscó comunicación con museos que tengan textiles precolombinos de la costa sur del Perú; para ello se presentaron documentos de presentación, solicitudes y trámites de carnet de investigador (Anexo 2). Los museos con los que se trabajó fueron los siguientes:

- Museo de Arte de Lima
- Museo Nacional de arqueología, antropología e historia del Perú

Debido a que los textiles precolombinos son muy delicados y son sensibles al contacto del flash de una cámara, se optó por solicitar a los museos material fotográfico digital de textiles Paracas, Nasca y Chincha. Luego de adquirir las fotografías, se procedió a la obtención y clasificación de los colores por medio de programas de diseño, en este caso Adobe illustrator, cada color tendrá su codificación CMYK y RGB, para medios de impresión y digital respectivamente con una perforación en cada área de color para la más fácil comparación de colores con los textiles.

De cada textil se extrae una paleta de colores, cada color es corregido en su codificación a números exactos, no pueden tener comas decimales, ni variar menos de tres puntos de porcentaje, lo preferible es que el porcentaje de CMYK varíe de 5 en 5 o de 3 en 3, ya que al ser impreso a la menor variación del código de CMYK no se nota el cambio de tono, en cambio a mayor porcentaje de variación de código si se nota el cambio de color.

Al finalizar la corrección de la codificación cromática de cada color, eliminando todas las comas decimales, se procede a ordenar todos los colores de los textiles de una determinada cultura, por tonos que varían del más claro (amarillo) al más oscuro verde o marrones.

Cada color tiene 3 variaciones de tono e intensidad que van disminuyendo su codificación CMYK de 5 en 5 o de 3 en 3, esto depende del matiz del color, ya que si es un color muy claro como el amarillo, la variación de 5 en 5 afecta mucho el cambio de tonalidades volviéndolo blanco, por ello en los colores más claros se utiliza la variación de matiz disminuyendo en CMYK de 3 en 3.

Los 3 tonos de color por cada color que se extrae del textil, son para tener una idea de cómo puede aclararse este color con el paso del tiempo.

El catálogo está clasificado en 7 colores principales y estos son el amarillo, naranja, marrón, rojo, morado, azul y verde. Cada tono lleva el nombre de un color principal, acompañado con el nombre de la cultura a la cual pertenece, todas las tonalidades de cada grupo de un color principal están enumerados, por ejemplo:

Amarillo Paracas 1, Amarillo Paracas 2, Amarillo Paracas 3, Naranja Paracas 1, Naranja Paracas 2, Naranja Paracas 3, así sucesivamente.

Con respecto a la variación de tono e intensidad de cada color, son 3 variaciones que están nombradas con las letras iniciales del nombre de uno de los colores principales seguido de la letra inicial de la cultura a la cual pertenece con la numeración, seguido de

una de las tres primeras letras del abecedario (a,b,c), por ejemplo: El amarillo Paracas 1 tiene 3 variaciones que son, AP1a, AP1b, AP1c.

Luego de la clasificación de colores, se procede a la impresión del catálogo, esta impresión es una prueba de color, para luego hacer una comparación con cada textil precolombino, para así descartar los colores menos parecidos a la realidad del textil.

Luego de descartar y hacer anotaciones de ajustes de los códigos de color comparando con los textiles, se procede a la corrección de códigos digitalmente en el Programa de Adobe illustrator.

Finalmente, se hace la impresión del catálogo, y se da a un especialista en textiles precolombinos, para que dé su opinión con respecto al uso del catálogo y a la vez haga una comparación con algunos de los textiles precolombinos investigados.

Justificación del proyecto:

La presente investigación, elaboró tres registros cromáticos de los textiles precolombinos de la costa sur del Perú -Paracas, Nasca y Chincha- estos han sido creados con la finalidad de clasificar, ordenar o dar un lenguaje estándar al color de cada una de las culturas mencionadas, para que al ser aplicadas, cumplan su función de comunicación gráfica, estimulación visual y emocional del ser humano, como un rasgo identitario.

Jose Luis Caivano, especialista en color, menciona en Sistemas de Orden del Color (1995), que los colores están presentes en nuestra vida diaria con una variedad, riqueza y complejidad, ya sea en una forma simultánea como cuando detienes la mirada en algo estático o el entorno. También dice que el deseo de ordenar u organizar el basto conjunto de colores que somos capaces de distinguir, se remonta a la antigüedad y se dan a lo largo de toda la historia humana; desde Aristóteles hasta Munsell o Pantone en la actualidad, por mencionar algunos destacados, por haber formulado y construido sistemas de ordenamiento del color.

El concepto con el que se quiere llevar el proyecto es el de fomentar identidad nacional, como ya se explicó en el marco teórico, la identidad nacional se refiere a la pertenencia que se tiene hacía determinada área geográfica, considerando su aspecto sociocultural, en este caso Perú. El color a lo largo de la historia ha tenido muchos significados en las diversas civilizaciones y territorios, ha servido de identificador de estatus, registro de datos y es lo primero que se percibe en un objeto. Utilizado como un signo comunicacional puede ser usado para fortalecer la identidad nacional de un país; inclusive la Asociación Internacional del Color, una sociedad científica que promueve investigaciones sobre color, tiene como tema central de debate en el 2014, el color y la cultura, para descubrir cómo influye la cultura en el uso, aplicaciones, mitos y creencias en la identidad, nacionalidad, lenguajes y simbolismo del color.

Así mismo, acompaña al registro cromático, un libro informativo de investigación titulado Costa a Color, cuya función es dar a conocer y difundir la importancia del color, identidad y los textiles precolombinos investigados, de esta forma se contribuye al

fortalecimiento de la identidad nacional en proyectos de arqueología, museografía, diseño y otras disciplinas que trabajen con el color y temas ligados a estos ámbitos.

En el ámbito arqueológico, se realizó una exposición del proyecto en el Museo Nacional de Arqueología, Antropología e historia del Perú, donde se debatió acerca de la utilidad de los registros cromáticos, al respecto la arqueóloga Carmen Thays indico que estos registros cromáticos mejorarán significativamente el trabajo de registro de textiles, donde se detallan las características físicas y cromáticas de una determinada pieza, con los códigos cromáticos se podrá dar una clasificación más exacta, también se sabrá el grado de degradación del color de una pieza a lo largo del tiempo que ha estado expuesta, para saber si necesita ser guardada. También se utilizará en documentos de formación científica y de divulgación internacional, al utilizar una codificación cromática internacional, podrá ser vista como una investigación más científica, adquiriendo un carácter más sociable y universal. Así mismo, será útil en el área de conservación, al momento de la adquisición de insumos, como colores de telas e hilos.

En el ámbito del diseño, el registro cromático será utilizado, como una herramienta para facilitar el trabajo de los diseñadores en el momento de realizar proyectos culturales o relacionados a la identidad nacional, ya que tendrán una paleta de colores peruanos (por ser sacados de textiles precolombinos de la costa sur del Perú). Los diseñadores deben generar identidad nacional reinventando de manera confiable los motivos propios de cada cultura y actualizarlos de tal manera que los individuos que pertenecen a esta multiculturalidad se sientan identificados. Al respecto, Patricia De la Cuba, directora de producción en la agencia Young & Rubicam Perú, en una entrevista personal menciona, que si sería útil un catálogo de colores peruanos o precolombinos, aplicando los colores a campañas en las que se busque comunicar identidad nacional, teniendo como tema inspirador las culturas precolombinas. También serviría para dar el mensaje de identidad nacional de manera correcta, ya que por desconocimiento se podría utilizar una paleta de colores que no se relacione con las culturas de inspiración.

Este registro servirá como modelo para nuevas investigaciones en cerámica y textiles de otras culturas precolombinas, fomentará la conservación del patrimonio cromático y mantendrá intacto parte de nuestro legado histórico cultural. Además, permitirá definir las características cromáticas de la civilización peruana para que puedan ser comparadas con sus similares de otras regiones del mundo. Cabe resaltar que conocer las raíces de una identidad cromática contribuye al fortalecimiento de la identidad nacional, donde el diseño muestre los colores de sus raíces culturales brindando personalidad al país con colores propios que lo diferencien.

Conceptualizacion y nombre del proyecto:

Perú a Color “Fomentando Identidad Nacional” es un catálogo de colores, el primer prototipo está basado en textiles precolombinos de la costa sur del Perú (Paracas, Nasca y Chincha), para la identificación de colores reales de dichas culturas en proyectos de arqueología, museografía, restauración, diseño y otras disciplinas que tengan al color como elemento identitario, teniendo como resultado el fortalecimiento de la identidad nacional en

los temas ligados a estos ámbitos. El nombre PERÚ A COLOR comunica que es nativo u originario del Perú. La preposición "a" según la RAE es la que precede al complemento de nombres y verbos de percepción y sensación, para precisar la sensación correspondiente. Por ejemplo: Sabor a miel. Huele a chamusquina. "Perú" (nombre, verbo de percepción) a "color" (sensación correspondiente, percepción). Por lo tanto, se da a entender que el color es la sensación o percepción que se tiene del Perú.

El Perú es un país con una herencia cromática que se mantiene hasta la actualidad, esta gama de colores definiría la historia del Perú fortaleciendo la identidad nacional. Esta idea se refuerza con el descriptor "Fomentando Identidad Nacional", indicado en el logotipo final, muestra la finalidad del proyecto que es usar el color como un elemento para fortalecer la identidad nacional.

Público Objetivo:

El proyecto está dirigido a arqueólogos, diseñadores y otros disciplinas que tengan al color como elemento identitario o requieran una guía de colores peruanos.

Diseñadores:

El diseñador es un investigador constante, que no se conforma con lo que existe y está alerta a los cambios que se producen en la dinámica social para estudiarlos y trabajar acorde a la realidad. El concepto de identidad se constituye como punto de partida para poder establecer comunicación, no sólo desde el interior de los clientes, sino de la misma sociedad. El diseñador es gestor de identidad que educa al receptor en su propia realidad, en base al conocimiento, la experimentación y la relación con su entorno. Por tanto la identidad individual y colectiva es el verdadero motor de la comunicación visual. (Rafael Vivanco y Sandra Tineo, 2012)

Hacen uso del color en todos sus diseños basándose en conceptos, y un catálogo de colores impreso con códigos de impresión (CMYK) y códigos de color digitales (RGB) facilita su trabajo. Los diseñadores son los elementos clave para generar identidad peruana, ya que son ellos quienes utilizan los colores para comunicar a las personas un determinado concepto, por tanto este catálogo fortalecería las bases de su concepto por medio del color al momento de trabajar con temas relacionados a identidad peruana.

Nivel Socioeconómico: Según el estudio realizado por Ipsos Apoyo sobre los Niveles Socioeconómicos de Lima Metropolitana 2011, están dentro de los niveles socioeconómicos A,B Y C por haber realizado sus estudios en universidades privadas o estudios técnicos.

Según la clasificación de estilos de vida de Rolando Arellano los sofisticados son hombres y mujeres entre los 25 y 45 años pertenecientes a los niveles socioeconómicos A, B y C, muchos de ellos todavía estudian y se describen como de raza blanca y mestiza, como integrantes de las clases altas y medias de la sociedad. Son citadinos sofisticados que les gusta moverse en círculos sociales de su misma clase o superiores.

Son personas muy confiadas en sí mismas, cosmopolitas, sociables, innovadores y con mentalidad muy moderna. Cuidan mucho de su imagen por lo que la ropa es un aspecto muy importante. Para ellos la educación es una vía de liderazgo económico y social. Son el Estilo de Vida más instruido. Son modernos e innovadores en su consumo y en su modo de pensar.

Arqueólogos:

Hacen estudios de material arqueológico y los clasifican de acuerdo a las características físicas que poseen, tal como el material que se utilizó y el color característico de cada una. Para ello utilizan un catálogo de colores con sus códigos respectivos, clasificando así las piezas arqueológicas.

Generalmente los arqueólogos hacen trabajos de campo, viajan a centros arqueológicos, son profesores en universidades, trabajan en museos, les gusta investigar y seguir haciendo historia (Carlos Roldán del Águila, 2007)

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Pieza Principal

El proyecto del registro cromático de colores del Perú está dividido por regiones (costa, sierra y selva), de las cuáles solo se realizó el estudio de textiles precolombinos de la costa sur, que está subdividido en tres registros de las culturas de la región (Paracas, Nasca y Chincha), esta servirá de modelo para futuras investigaciones en las demás regiones del Perú.

El formato utilizado para el registro cromático es el de abanico unido por un tornillo chicago, para la fácil comparación de colores. El tamaño de las cartillas de color son de 16.4 x 4 cm, un formato pequeño que será de fácil portabilidad para diseñadores y arqueólogos.

El registro cromático posee 7 colores principales (Amarillo, naranja, marrón, rojo, morado, azul y verde). Cada página del registro, lleva el nombre de un color principal, seguido del nombre de la cultura a la que pertenece, enumerado (Anexo 6: Registro cromático completo).

Cada cartilla de color tiene 3 variaciones de intensidad, yendo a una tonalidad más clara del color principal (disminución del valor CMYK). Las variaciones de intensidad, llevan las iniciales del color principal, seguido de las iniciales de la cultura, su numeración, seguido por las letras “a” (más oscuro), “b”(tono medio), “c”(más claro).

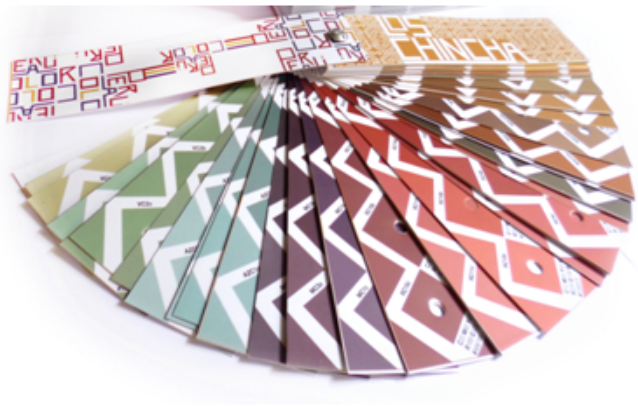
El presente proyecto de investigación tiene como referente a la guía internacional de color PANTONE que contiene varias tarjetas de 15x5 cm aproximadamente, tiene un formato pequeño, cada color está organizado en cada ficha y están unidas en un abanico que facilita la comparación de colores, cada ficha maneja un color con su respectiva gama, que es la intensidad de color variando del más claro al más oscuro.

Así mismo, el presente proyecto se basa en la tabla MUNSELL usado más en casos de arqueología, facilitando el trabajo del arqueólogo al poseer en el catálogo perforaciones en cada área de color para la directa comparación e identificación de colores en material arqueológico. Estas perforaciones serán incluidas en cada color del catálogo del presente proyecto. Las guías de color mencionadas han sido elegidas por ser las más conocidas en el área del diseño gráfico y en el área de la arqueología.

PERÚ A COLOR (Costa a color- Paracas) cuenta con 15 tonalidades de amarillo, 31 tonalidades de naranja, 83 tonalidades de marrón, 67 tonalidades de rojo, 20 tonalidades de morado, 52 tonalidades de azul, 28 tonalidades de verde y 1 gris.

PERÚ A COLOR (Costa a color-Nasca) cuenta con 3 tonalidades de amarillo, 50 tonalidades de marrón, 31 tonalidades de rojo, 5 tonalidades de guindas, 5 tonalidades de morado, 27 tonalidades de azul y 9 tonalidades de verde.

PERÚ A COLOR (Costa a color-Chincha) cuenta con 5 tonalidades de amarillo, 28 tonalidades de marrón, 16 tonalidades de rojo, 9 tonalidades de morado, 5 tonalidades de azul y 9 tonalidades de verde.



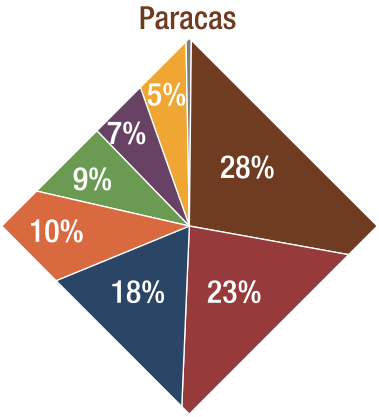
Conclusiones

El Perú es un país grande, con una gran diversidad de culturas, razas y credos; motivo por el cual se dice que su identidad nacional no es consistente o posee conciencia colectiva débil, esto debido a su formación étnica muy variada. Cabe indicar que hubo diferentes tipos de identidad, algunos basados en el territorio, en el modo de gobierno, de acuerdo a la raza, etc, pero no logró sintetizar una identidad nacional única, a pesar de ser seres sociales por naturaleza.

Las culturas precolombinas, son un claro ejemplo de las habilidades y preferencias estilísticas en el manejo del color y el uso del mismo en el medio escogido, sea éste textil o cerámico, que expresan manifestaciones culturales de un individuo o de un grupo humano y las relaciones culturales entre las regiones del sur peruano; siendo el color de gran significancia en la construcción de sus identidades, ya que estaba asociado a lo divino, a la fertilidad de la tierra y a la mujer.

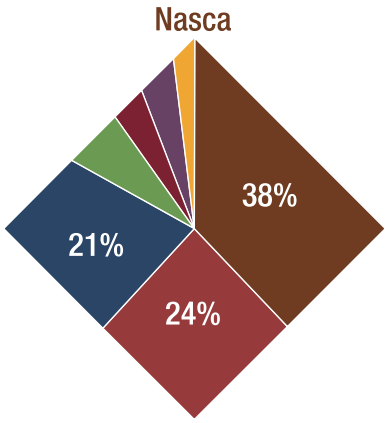
El registro cromático del presente proyecto, está compuesto por tres registros de las cuturas Paracas, Nasca y Chincha. El registro Paracas está dividido en 8 colores principales (Amarillo, Naranja, Marrón, Rojo, Morado, Azul, Verde y Gris), son un total de 297 cartas de colores (con alrededor de 891 niveles de desaturación de color), de las cuales, los colores principales con más cantidad de tonalidades son: El marrón abarca un 28% del total de cartillas de color, el rojo abarca un 23 % y el azul un 18 %, ver *Tabla1*.

Tabla1.



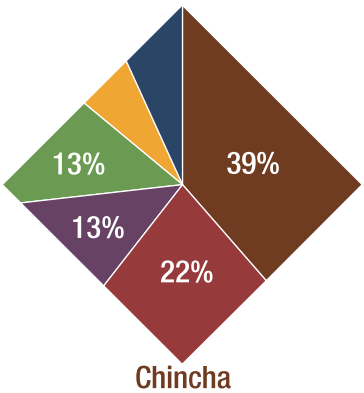
El registro Nasca, está dividido en 7 colores principales (Amarillo, Marrón, Rojo, Guinda, Morado, Azul y Verde), son un total de 130 cartas de colores (con alrededor de 390 niveles de desaturación de color), de las cuales, los colores principales con más cantidad de tonalidades son: El marrón abarca un 38% del total de cartillas de color, el rojo abarca un 24 % y el azul un 21 %, ver *Tabla2.*

Tabla2.



El registro Chincha, está dividido en 6 colores principales (Amarillo, Marrón, Rojo, Morado, Azul y Verde), son un total de 72 cartas de colores (con alrededor de 216 niveles de desaturación de color), de las cuales, los colores principales con más cantidad de tonalidades son: El marrón abarca un 39% del total de cartillas de color, el rojo abarca un 22 %, el morado y verde un 13 % cada uno, ver *Tabla 3.*

Tabla 3.



Así mismo, con respecto a la composición del color en los textiles Paracas analizados, hacian uso del claro oscuro, contrastes de colores. Se puede observar la predominancia de un determinado color, por ejemplo el rojo usado de fondo con motivos de colores; el amarillo usado de fondo con motivos marrón y rojo. En cambio en los Textiles Nasca investigados, es más complicado percibir la predominancia de un determinado color, pueden predominar en una misma pieza, por ejemplo, 3 colores (azul-amarillo-rojo).

Los textiles precolombinos de la costa sur del Perú (Paracas, Nasca, Ica, Chincha), que fueron analizados para esta investigación fueron 24 piezas en total. La predominancia del color rojo en la composición de los textiles fue 14 de 24 piezas; 22 de 24 textiles utilizaban colores cálidos como el rojo, amarillo, naranja, verde, ocres, marrón. Por lo tanto, la predominancia de los rojos y colores cálidos en la composición de los textiles lleva a pensar que podría estar ligado a su entorno de clima desértico.

El color también fue un elemento de identificación, de la sociedad precolombina, por que permitía al portador de la prenda textil evidenciar su identidad y procedencia, como lugar de origen, cargos públicos, edad, entre otros. Toda esta información se conoce gracias a la Arqueología, puesto que ésta disciplina se preocupó en conservar las evidencias culturales del pasado como los textiles y permite investigar los procesos de desarrollo, los sistemas de valores y la tecnología como parte de la cultura para entender nuestras raíces como nación.

El registro cromático de la presente investigación, mejorará significativamente el trabajo de registro de textiles, donde se detallan las características físicas y cromáticas de una determinada pieza, con los códigos cromáticos se podrá dar una clasificación más exacta, también se sabrá el grado de degradación del color de una pieza a lo largo del tiempo que ha estado expuesta, para saber si necesita ser guardada. También se utilizará en documentos de formación científica y de divulgación internacional, al utilizar una codificación cromática internacional, podrá ser vista como una investigación más científica, adquiriendo un carácter más sociable y universal. Así mismo, será útil en el área de conservación, al momento de la adquisición de insumos, como colores de telas e hilos.

El color de la mano con el diseño, puede fortalecer la identidad nacional a través de proyectos de diseño y arqueología en los que se plasmen los colores precolombinos, ya que el color atrae, logra atención, causa impresión, es un elemento básico en la estimulación visual, actúa en la vida emocional y estética propia del ser humano o un pueblo; y el diseño informa, comunica, clasifica y diferencia un mensaje determinado; por tanto una manera de transmitir mensajes es por medio de imágenes o símbolos y estas influyan en la conducta del individuo.

La identidad cromática precolombina puede y debe ser una estrategia competitiva para posicionarse en los mercados internacionales, inmerso dentro de la identidad de marca Perú, afirman sus valores de pertenencia y “conciencia nacional”, conciencia de ser uno mismo, diferente de los demás.

El presente proyecto, solo se basó en el trabajo del color con los textiles precolombinos de la costa sur del Perú (Paracas, Nasca y Chincha), y pretende que esto sirva como modelo

para futuras investigaciones de gamas cromáticas de otras culturas precolombinas en todas las regiones del Perú, para que sean conservadas como patrimonio cultural de nuestra historia e identidad.

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Sustainability and Natural Color Cotton in America

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Abtract

The use of colour in textiles has acted as a paradigm as regards attitudes and behaviour towards environmental matters over the past decades. During the 1990s a new trend of thought set forward a deeper awareness of the environment in danger. An emphasis on conservation was the most remarkable trend, taking on board themes such as humanity's relationship with the environment, ecology, the protective home, native roots and traditions. The new commandments were avoiding pollution, the efficient use of resources, the importance of quality rather than quantity, and respect for nature. Several companies, at first in Europe and the USA, and later throughout the world, began to propose textiles and colours with a much reduced environmental impact in their manufacture and use. Colours related to the nature were much in evidence and products using naturally coloured cotton produced without any chemical treatment began to be commercially viable. The aim of this paper is to present a survey of the development of naturally coloured cotton in America, since the ancient pre-Columbian times to nowadays. (Musso 2005)

Introduction

In the 1990s, the end of the Cold War brought about a hope for the end of the nuclear menace. A new trend of thought emphasized a deeper awareness of the environment in danger. The Earth Summit, more properly known as the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro, in June 1992. (UN 1992). The two-week Earth Summit was the climax of a process, begun in December 1989, of planning, education and negotiations among all member states of the United Nations, leading to the adoption of Agenda 21, a wide-ranging blueprint for action to achieve sustainable development worldwide. The programme of action recommended ways to strengthen the part played by major groups, such as women, trade unions, farmers, children and young people, indigenous peoples, the scientific community, local authorities, business, industry and non-governmental organizations (NGOs), in achieving sustainable development. The Earth Summit, with 172 governments participating, had the environment and sustainable development as its principal themes. (Cleveland, 2007)

About the history of coloured cotton in the Americas

Coloured cotton agriculture began around 2700 BC in India/Pakistan, Egypt, Mexico and Peru. It was then common for cotton to grow in a variety of colors.

The Mochica indians in Peru developed an extraordinary palette of natural cotton fiber colors, ranging from white, grey, cream, beige, brown, and reddish-brown to chocolate, green, yellow and mauve. (Musso 2001, Musso 2007).

Chocolate brown fibers, unique to Gossypium. barbadense, have been unearthed at the most ancient levels of Huaca Prieta, a settlement on the northern Peruvian coast that was occupied between 3100 and 1300 BC. This chocolate brown fiber and a light-brown one can be seen in many of the fabrics made by Andean weavers, which have survived for millennia because of the arid coastal soils of northern Peru. It appears that these colors were intentionally differentiated and bred by ancient Peruvian fisher folk, who made nets and lines from the darker shades because they were less visible to fish
Small villages kept the coloured strains alive and growing through the past several hundred years. Documents indicate that when the first Spaniards crossed the Peruvian desert in 1531 they marveled at the extensive fields of cotton growing in a range of colors unlike anything they had seen. Naturally colored cotton fabrics were among the first items collected as tribute and sold or shipped to Spanish court, and those Indian textiles were more technically sophisticated than anything woven on European looms at the end of the 15th century.

Many scientists and explorers have been intrigued by the singular beauty and value of Peruvian cotton, including the naturalists Darwin and von Humboldt.
The oldest archaeological evidence in Mexico comes from the site of Tehuacan, near Oaxaca in Mexico and was produced sometime around 2300 BC.
Besides, natural coloured cotton was grown from Oaxaca to the south about 5,000 years ago.Pigmented cotton was used as tribute. Sixteenth-century Mexican documents, for instance, reveal that brown cotton constituted a principal form of payment from the lowlands peoples to the Aztecs.

Colored plants were marginalized, surviving only in seed banks kept by some agricultural departments here and there around the world and in small, traditional communities in a handful of places, including Mexico, Guatemala and Peru.

Development of natural coloured cotton

All the colored cotton plants we see in the West use commercially and interbreed today come from pre-Colombian stocks created by the indigenous peoples of Central and South America. Small villages kept the coloured strains alive and growing through the past several hundred years. Today descendants of ancient Peruvian cultures still harvest, gin and spin by hand the naturally coloured cottons on the northern coast of Peru. Mauve colored cotton was found growing in a few places on Peru's north coast. The plant which had been carefully cultivated and maintained over millennia is now producing naturally coloured cotton for commercial uses. Naturally coloured cotton suddenly reappeared as environmentally friendly cotton in the early 1990's. (Musso 2008).

James M. Vreeland, Jr. worked several years at Chan Chan, Peru, with Victor Antonio Rodrigues Suy Suy, a professor of anthropology at the National University of Trujillo and a descendant of the Mochic ethnic group. He informed him that there was such a thing as naturally coloured cotton. People who taught him the most were the Mochica indians, who,

some 2,000 years ago, cultivated cottons of many hues and who had quietly maintained some of these cultivars. (Vreeland 1981) *(Figure 1)*

1- Native Coloured Cotton Peru

This led him to create in 1982 the Native Cotton Project with the support of the Ministries of Labor and Tourism. The Company Arequipa Textile was interested in selling products made from this cotton. Thence the birth of the brand Pakucho, cotton brown in the language of the Incas. The Center for Technology Innovation in the Sipan city is working with native coloured cotton that was used at the time of the Lord of Sipan, red, brown, white rose, for use on handlooms. (Vreeland 1993, Vreeland 1999). Peru Naturtex Partners from 1997 is producing yarn and woven natural cotton with the Pakucho brand in cream, beige, brown, rust, chocolate, green, mauve colors certified by Skal, German organization. Peru Naturtex Partners is one organization involved in this trade: a contract manufacturing organization, vertically integrating organic fiber production, including both carded and combed natural coloured cotton. (Peru Naturtex Partners 1997). *(Figure 2) (Figure 3)*

2-Green Colour Pakucho, Peru

3- Others colours Pakucho, Peru

The Native Cotton Project of Peru, with the support of the Peruvian Government, UNESCO and private institutions has recovered a wide range of naturally coloured cotton

fiber, including cream, beige, brown, rust, chocolate, mauve, avocado and other earthy tones.(Rodriguez 2008)

While spending time in the Gambia, West Africa, the American Sally Fox observed the indiscriminate use of pesticides, which chimed with her concern for the environment and encouraged her to develop safer methods of pest management. She was introduced to coloured cotton while working for a cotton breeder, whose focus was developing pest-resistant strains of cotton. She rediscovered a small amount of brown cotton seeds in 1982. The peoples of Central and South America had spun these strains for centuries. Here was Sally Fox's opportunity to combine her concern for the environment, work in her field of entomology, and practice her favorite pastime, spinning and weaving. She took on the challenge of improving an ancient agricultural art, spending several years crossbreeding coloured cotton plants to produce commercially viable long-fiber coloured cotton. Sally Fox's motto was 'No dyes, no pesticides, just pure cotton. (Davidson 2005). After only three years of plant breeding, she realized that the brown colour was actually hiding green, red, and pink. These unexpected cotton lint were given to hand spinner study groups who helped her to discover other qualities. The task was not only improving the fiber quality, but also increasing the colour spectrum. Experimental machine processing by John Price at the International Centre for Textile Research and Development first demonstrated the improvements that had been made. It takes seven to ten years of selective crossbreeding before a new variety develops, i.e. a line of plants whose seeds always produce plants identical to the parent but distinctly different from others of the same species.

Sally Fox has been successful in increasing the average length of coloured cotton fibres from about 1 cm to over 2.5 cm, more than adequate for commercial spinning. In 1993, Fox produced about 2000 tonnes of naturally coloured cotton, grown on about 4000 hectares, She registered the trade name Foxfibre in six distinct shades: Coyote and New Brown, both of which are reddish-browns, milk-chocolate-coloured Buffalo, sage-coloured Palo Verde, Green Fox Fibre, and a dark forest New Green (*Figure 4, Figure 5)*.

4- Colours Fox Fiber, U.S.A


5- Other colours Fox Fiber, U.S.A

The raw colours of the cotton yarns may display only a hint of the colours to come once "developed" by washing and/or boiling. Some of the techniques to develop the colour before weaving take into account the ph of the water. The higher the ph of the water used to wash or boil the cotton, the darker the colours will become. The more minerals in the water, the brighter your colours may be. The colours darken in warm or hot water and when dried with as much heat as possible. It is the heat and the moisture that bring the colour out. These colours do not wash out, but they do fade with sun exposure. (Inventors, 2007, Fox Fibre, 2011)

BC Cotton Inc. of Bakersfield, California, founded in 1992, was competing with Sally Fox in the development of coloured cotton for commercial use. According with Company spokesman, Raymond Bird, BC Cotton has developed red, brown, ivory and green varieties. They obtained seed samples from germplasm collections held by the university and government gene bank collections, including Texas A&M University, University of California and USDA's Shafer Research Station. Free samples of 25 seed are made available to breeders who request them. (RAFI, 1993)

In Mexico, the communities of Jamiltepec district, the cotton area Oaxaca, are still producing colored cotton. Artisan weaver's communities that are producing color cotton for now in this area of Oaxaca are Santa María Huazolotitlán, Santa Catarina Mechoacan, San Andres Huaxpaltepec, San Juan Colorado, communities of the Jamiltepec district and Xochistlahuaca in the state of Guerrero.

According Flavio Aragón Cuevas, researcher at the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP)most species are on the Costa, where are used for making clothing with waist looms, especially cotton called coyuche, for their coffee colour. He points out that the Costa is among the few places where this material is still preserved. The indigenous Mixtecs of the Costa still have the tradition of planting and use coyuche cotton. In Oaxaca green cotton fiber has been found, in San Juan Colorado.In part of the west and center of the northem coast of Yucatan, on the coastal dune, was found clear brown fiber. *(Figure 10)(Figure 14).*

10- Mixtec weavers using coyuke cotton, Mexico

14- Cotton used by Mixtecs, Mexico

Luis Ignacio Velásquez revealed in 2013 that "although barely 25 years ago coyuche was without much effort found in parts of the states of Colima, Guerrero, Chiapas lowlands, Sierra Norte de Puebla, Oaxaca coast, south coast of Veracruz, Yucatan and Campeche today has been dramatically reduced, and in some cases, such as the Sierra de Puebla, is possible to ensure that it has virtually disappeared". *(Figure 11) (Figure 12)*

11- Coyuke cotton, Mexico

12- Cotton from Oaxaca, Mexico

In Guatemala, the brown, red and green cotton were cultivated and also grey and pink was growing in Huehuetenango in the past. In 1979 began the decline by the lack of research and failure to adapt to the local climate. Plantations were giving input to other products, mainly sugar cane. In 1989 the family of Horacio Villavicencio was asked by the Ixchel Museum to produce cotton to restore parts that were deteriorating. The museum itself gave them coffee seed color. They got the red and green in Totonicapán and had to acquire the green colour in a global seed bank. It is the craftsmanship that has made possible their survival up to now. *(Figure 13).*

13- Mayan Cotton, Guatemala

In Argentina, at the Experimental Station INTA Roque Sáenz Peña, Chaco, the agronomist Juan Piosson, planted in observation and testing stage the first cotton cultivar that produces dark brown fiber in the country. Its main feature is to come from a natural mutation which changed colour fiber obtained from the term of approximately 10 years.(INTI 2009) (Marino 2009).

In Brazil, jungle plants of naturally coloured cotton were found in cream and brown hues, in mixtures with cultivated white. These naturally coloured cottons were always regarded by the industry as undesirable mixtures, having just craft or ornamental use primarily in the states of Bahia and Minas Gerais. These cotton were preserved in gene banks of Embrapa Cotton in Patos- Paraíba since 1984.

The Empresa Brasileira de Pesquisa Agropecuária, EMBRAPA (Brazilian Enterprise for Agricultural Research) is a state-owned company affiliated with the Brazilian Ministry of Agriculture. Its mission is to create solutions for research, development and innovation for sustainable agriculture and become well known in the field of tropical agriculture.

EMBRAPA launched five cultivars of naturally colored cotton since 2000 to 2011 underlining its pioneering work in this field. The BRS 200 Brown was placed on the market in 2000 and seeds were multiplied in Paraiba, for about 40 small producers, and then BRS Green in 2003, BRS Safira and BRS Rubi in 2005 and BRS Topazio in 2011. All were obtained through conventional methods of genetic improvement to meet the growing demand in the market. These varieties are the result of the breeding processes started in 1996 without the use of transgenes. *(Figure 6) (Figure 7).*

6-Coloured cotton crop field in Brazil

7- Colours in Brazil

The varieties naturally coloured researched by the Embrapa Cotton don't require the use of chemical pigments, so don't pollute the environment, and still represent 70% of water economy in the finishing of the mesh process production. In addition, the naturally coloured cotton is an important source of income for about a thousand farmers in the states of Paraiba, Pernambuco, Rio Grande do Norte and Ceara, who harvest the product by hand and can get out a higher price than the conventional cotton. (Curvelo Freire 1999,Curvelo Freire 2003). The trademark "Natural Cotton Color" are accredited by Embrapa Cotton label, *(Figure 9)* that guarantees the product authenticity for the consumers. Nowadays, The authorized partners to use the trademark "Natural Cotton Color" of Embrapa are: "Algodoeiro Eco Fashion"," Casulo Arte Natural", "Coopnatural/Natural Fashion" –

Cooperative Textile Production of Cotton from Paraiba State, “Capuchos, D’Cotton”, “Entre Rios”, Francisca Gomes Vieira”, “Kairóz”, “Maria Xique”, “Rosa e Virgulino”.

9- Embrapa Cotton label, Brazil

As it is a social product and ecologically friendly, naturally coloured cotton have had increasing demand for both domestic and international markets. Nowadays, it is exported to several countries including: United States, Germany, Portugal, Spain, Italy, Switzerland, France, England, Denmark, Japan, and others. *(Figure 8)*.

8- Coloured cotton in Brazil

Advantages of naturally coloured cottons

Native cotton offers important advantages. It requires virtually no maintenance after sowing, no fertilizers, and no pesticides. It can grow in arid soils, is more fire-resistant than white cotton. In addition, the dyeing and finishing steps, so detrimental to the environment, can be eliminated. Naturally coloured cotton had a significant increase in the textile companies promoting products and services that provide environmental benefits.

Conclusion

At Heimtextil Fair in January 1993 in Frankfurt, Germany, textiles for bed and decoration not dyed, that is without chemical processes, were presented. Companies from Italy, France, U.S.A. submitted these products that used naturally coloured cotton. Consumer demand for naturally coloured cotton in the U.S., Europe and Japan has created a growing niche market. The demand for sustainable textiles becomes one of the forces that lead to innovation. More and more world brands and designers accept the challenge of environmental responsibility. (Messe Frankfurt 2011)
Organic products such as naturally coloured cotton must have accurate labeling and meet the minimum standards set for processing. The need for a general global standard to protect

the environment from chemical pollution is now recognized. Material processing and treatment must not release chemicals into the environment that can be traced in the products consumed and in turn adversely impact on the environment. These goals can only be accomplished if producers establish long-term environmental objectives and fix targets to achieve them.

Businesses are often the most capable actors to make product changes, since many adverse environmental outputs can be prevented at the product design stage. By using their position of power and through communication strategies, businesses can affect the behaviour of many people and optimize products' lifecycles beyond the manufacturing stages. Retailers too are important in helping to exert pressure on suppliers and create greener market offerings. Most importantly, they can provide easily accessible product information to consumers. Consumers in turn can take a more responsible attitude towards their purchasing decisions and lifestyles. The media itself and celebrity trendsetters can also exert strong influences.

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The author has maintained direct contact via email with Sally Fox, USA in 2006 and J. M. Vreeland, Peru in 2011.

Also with Odilon Merino, Mexico, in 2014 and. Jose Manuel Fernandez Loera, Mexico, 2013.

In addition, with Luis Paulo Carvalho, Brazil in 2011, from whom she has received samples of naturally colored cotton.

Author's interview with Patricia Marino INTI, Argentina in 2011. She received samples of brown cotton.

El Color En La Naturaleza.

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Abstract

Color is an important component of the Biotic world. Color is used in life in many functions. Many organisms use color as inter-species attraction signal, (v.g. flower and pollinators). In other cases the attraction is intra-species, indicating the health and strength condition of an organism to attract sexual partners (v.g. peacock). Color is used also to defer predation, communicating the presence of dangerous compounds in the organism, to defer predation. The Batesian mimicry, is a strategy in which non-poisonous snakes imitate the colors of poisonous snakes to cheat the predators. They avoid being predated without investing energy to develop poison.

Color is used also as camouflage, to be unseen in their context and avoid predation, but also to stay hidden and surprise their prey. There exist also strategies of dynamic coloration, where the color changes according to the context. The chameleon can mimic their context adjusting their color to some particular context. Some fishes change color and geometrical patterns in their skin according to local environmental conditions. In the lecture there will be presented some ways by which Color is created in Nature: from pigments, to the use of symbiotic associations and the Structural Color, strategy which use reflection and refraction in micro- and nanostructures (uncolored) that reflect particular gammas of the light spectrum. The colors produced are very bright, colorful, and in some cases may change (v.g. Morpho butterfly).

It will be explored how these color strategies can be mimicked for human use instead of toxic pigments The lecture will present biomimicry case studies, like Mirasol as ultra-low consumption display Chromaflair (color changing paint), Morphotex (color-changing fibers for textiles), showing how Nature can inspire our new technology in color creation, for innovation and reduction of environmental negative impact associated to color.

Introducción:

El color en la naturaleza

Uno de los primeros lugares en donde cualquier persona percibe el valor del color en la naturaleza son las flores. Efectivamente, el color las hace saltar por encima de su contexto

y se hacen notar. Es un signo de comunicación que alerta a otras especies de su presencia y en algunas ocasiones de su edad y madurez y motiva a otras especies a la acción, por ejemplo con la polinización.

Signo de comunicación.

El color se utiliza como signo en un proceso de comunicación. Aunque es un proceso muy obvio en muchos casos, ayuda a definir secuencias muy particulares en muchos procesos. Un ejemplo muy claro es el de los frutos.

Dentro de los retos de la vida, una vez que un organismo obtiene los recursos necesarios para poder mantener su vida, mantener su metabolismo, el reto más relevante es pasar su información genética a la siguiente generación a través de la reproducción. No es casual que flores y frutos, que son los elementos donde se da este pase genético a la siguiente generación, sean donde el color aparece con mayor diversidad.

Comunicación para Atraer.

Las flores son las encargadas de la reproducción sexual de las plantas. Buscan que se conjuguen las células sexuales de ambos géneros para poder crear el nuevo código de la planta descendiente. Para lograrlo muchas plantas simplemente dependen del viento. En muchos de esos casos las flores son muy pequeñas, poco llamativas y a veces son verdes como el resto de la planta o de algún café muy discreto como en los pastos de espigas.

Pero hay plantas que se han adaptado a utilizar como medios de polinización a aves o insectos. Y en este caso, la planta que llame más la atención de los polinizadores será la que más posibilidades tenga de reproducirse. Las plantas invierten una gran cantidad de energía en desarrollar los más variados diseños y colores para mandar su señal a grandes distancias y ser distinguidas por los polinizadores. Adaptaciones que buscan mandar la señal más efectiva para el tipo de polinizadores preferidos, existen en diversos grados en la naturaleza. Hay atracción genérica para cualquier polinizador, donde la clave es hacerse notar lo más posible, pero también hay adaptaciones específicas para crear una relación de mutua dependencia entre, por ejemplo, un ave y una flor en particular, y las especies se asocian con una gran dependencia entre ellas, pero la polinización es segura y específica.

Karl von Frisch realizó los experimentos desde 1915 sobre la percepción del color en los insectos, en una época donde se decía que no podían percibir el color. Para von Frisch, esto implicaba que no tenía sentido biológico el que las flores generaran color. A través de sistemáticos, pero sencillos experimentos realizados con tarjetas de color, logró obtener evidencia de la percepción del color por estos insectos. Anteriormente había desarrollado estudios con los que demostró que también los peces perciben el color. Su trabajo completo fue premiado junto con otros célebres científicos del comportamiento y la comunicación animal, Konrad Lorenz y Nikolaas Timbergen, con el Premio Nobel en 1973.

Además de la flor, el fruto es uno de las máximas inversiones energéticas de una planta. Una vez fecundadas, se generadas las semillas y se envuelven en tejido vegetal que en

muchos casos tiene un gran contenido energético almacenado en enlaces químicos que se usa para atraer animales que dispersen la semilla al comer el fruto y también para apoyar el desarrollo de la semilla joven, con un entorno rico en energía.

Atracción oportuna en el tiempo.

Aquí el tiempo se vuelve crítico. Un consumo demasiado temprano del fruto, cuando la semilla todavía no está madura, generará que todo el esfuerzo de la planta se pierda. Es por ello que es importante asegurar que el fruto será consumido en un tiempo adecuado. Para ello las plantas utilizan el color. Por ejemplo, cambiando a desarrollar frutos coloridos como moras, manzanas, plátano salvaje, etc. Cuando no están maduros son por completo verdes, difíciles de distinguir de las hojas a los animales que están buscando alimento. El cambio de color a amarillo, rojo, morado, naranja, en cambio los hace sobresalir claramente y asegura que serán consumidos en el momento oportuno, y sus semillas maduras dispersadas. En este ejemplo, el color es parte de los criterios sencillos con las cuales operan ecosistemas complejos.

Aquí es importante mencionar que el estímulo en muchos casos está específicamente adaptado a su destinatario y a veces esto implica usar otras gamas del espectro electromagnético incluso diferentes de la luz visible. Flores como la Driada de ocho pétalos (Dryada Octopetala) o el Árnica alpina (Arnica alpina), tienen un color visible amarillo, pero en la visión ultravioleta de los insectos, ellos ven otra coloración y sobre todos líneas y venas más oscuras que indican el centro de la flor y la posición del néctar. (Rees, 1992). [i]Las flores que tienen documentada alguna señal ultravioleta son muchísimas y se pueden explorar en el sitio del fotógrafo Bjørn Rørslett.[ii]

La atracción a través de manifestar estados internos óptimos.

La función del color en el reino animal tiene entre sus funciones las de atracción y repulsión. En muchos casos es un atractor que muestra externamente un buen estado de nutrición y de salud y tiene un importante rol en la selección de pareja para el apareamiento. Los ejemplos son muchísimos, pero se revisarán algunos ejemplos representativos.

Uno de los ejemplos más conocidos y llamativos para mucha gente es el magnífico colorido de la cola del pavorreal macho. Compuesta por plumas largas, iridiscentes, que presentan estructuras multicolores denominadas como “ojos”. Una de las presiones selectivas es la selección por parte de la hembra, del de su pareja para el apareamiento. Las hembras del pavorreal, que no son tan coloridas, utilizan como medio de comparación el tamaño y el iridiscente colorido de los machos. Una de las hipótesis más comunes de esto es porque expresan externamente la condición interna de salud y fortaleza del macho: muestran una alta inversión en energía, y también, dado que el colorido los hace más visibles, los machos han enfrentado más ataques de predadores y han sobrevivido: combinación de fuerza interna y destreza en su comportamiento, muy atractivos para la hembra para heredar a sus crías, e incrementa las posibilidades que el macho provea un mejor protección hacia las crías y les herede una genética saludable. El color se usa

entonces para comunicar la mejor adaptación y ser seleccionado en la lucha por heredar la propia carga genética. (Audesirk, 2008)[iii]

Una variación de esta estrategia es aquella usada por los flamencos. Los carotenos que consumen en su dieta, de pequeños invertebrados, se convierten con su metabolismo en componentes grasos con color naranja o rosa, y se muestran en el color del organismo, un efecto similar al cambio de color que experimentan los camarones al ser cocidos en casa. Esto es una radiografía de su estado nutricional y como en el caso del flamenco, es utilizado para atraer pareja. Se ha detectado incluso un uso intencional del color, ya que de acuerdo a un equipo español de investigación, existe un uso cosméticos deliberado por estas aves, para comunicar su calidad a otros miembros de la especie, particularmente a las parejas. Se ha documentado la presencia de carotenos similares a los de las plumas en los aceites de acicalamiento producidos por la glándula uropígea, y que añadida a las plumas incrementan su colorido, haciendo un efecto de amplificación de la señal. Su uso con fines cosméticos se incrementa cuando se reúnen en grandes grupos y se infiere que es para atraer a la pareja. Se ha documentado que los individuos más coloridos inician su anidamiento primero. (Amat, 2010)[iv]

Los despliegues de este tipo de atracciones pueden ser los más variados, incluyen desde luego a los quetzales, los colibríes con sus vibrantes colores y estructuras, entre otros muchos organismos.

El color como signo de comunicación del estado hormonal/sexual.

En otros casos, el color se utiliza para comunicar no la salud o estado físico del organismo, sino su particular momento en el ciclo reproductivo. Uno de los ejemplos conocidos hace ya varios años es el del pez espinoso (Gasterosteus aculeatus). Este pez mantiene una coloración neutra similar a la arena del fondo marino donde vive, de manera que está camuflado. Cuando el macho selecciona un territorio para su reproducción, cambia su coloración con un tono rojo en la parte fronto-ventral. Esto comunica a las hembras que está listo, pero también a otros machos que está listo para defender su territorio y es más agresivo. Tras construir su nido haciendo una concavidad y cubriéndola con restos de algas, secretando un líquido pegajoso que consolida el nido. En ese momento mantiene su sección ventral roja, pero toda su parte dorsal muestra un blanco azuloso, que le sirve para atraer a su pareja. El rojo utiliza pigmentos llamados carotenos provenientes de la alimentación, ya que los pueden producir si no los consumen. Entre más rojo y brillante se ve, la hembra sabe que el macho es más hábil para encontrar alimento y está en mejor condición física. Tras el nacimiento de los alevines, el macho continúa mostrando su color agresivo hasta que tienen edad para vivir solos y vuelve a su color arena convencional. En este caso se utiliza el color como signo de comunicación entre miembros de la misma especie. (Tinberger, 1965; et al)[v] [vi]

El color como señal que brinda protección.

Uno de los primeros comportamientos detectados entre ciertas aves es que, a modo de proteger a la pareja y a la descendencia, los machos son más coloridos, para hacerlos más

visibles a los predadores y evitar que ataquen a quienes aseguran la supervivencia de la especie. (Tinbergen, 1965)[vii]

En otros casos como en los casos de polillas y orugas, tanto el color como la disposición les permite mostrar unos grandes "ojos" falsos de gran tamaño y que permiten confundir al predador, que se intimida y suelta a la presa o evita el ataque. (Tinbergen, 1965).[viii] Incluso hay algunas palomillas cuyas alas reproducen la cabeza de un búho y evitan ser atacadas. Un camuflaje por confusión.

Dentro de las posibilidades que da el color y los patrones geométricos en la Naturaleza está incluido el tema completo del camuflaje. El camuflaje puede ser para no ser atacado o para no ser visto cuando se va a atacar. (Ejemplo de los peces, sepias y pulpos que cambian de color). Percepción y cambio de patrón, en camaleón y en peces.

El color como señal para evitar ataques.

Una función adicional del color, como signo de comunicación, es la tendencia a utilizar colores brillantes y vivos de los organismos que son venenosos o cuya ingestión tiene sustancias que pueden ser tóxicas o peligrosas para el predador. No es algo usado por la mayoría de los organismos venenosos o tóxicos en general, pero si es una estrategia muy repetida, de manera que constituye un patrón utilizado comúnmente por diferentes especies, entre las que están serpientes, ranas y mariposas. Este fenómeno designado científicamente como Aposematismo[ix], es lo contrario del camuflaje. En lugar de pretender no ser visto para atacar o no ser atacado, el propósito del organismo es hacerse notar. Aunque no es el único el color y los patrones de color de alto contraste es uno de las señales más comúnmente usadas para esta función. La rana de la flecha venenosa (Dendrobatidae), cuyo nombre viene de la extracción de la toxina para envenenar flechas de los primeros pobladores en la América tropical, son ranas de muy pequeño tamaño pero que combinan colores tanto azul intenso como azul y rojo y en algunas ocasiones con puntos negros para contrastar, que muestran que si son ingeridas la reacción adversa en el predador será tal que incluso puede correr peligro su vida. En algunos casos la cantidad de veneno alojada en ellas puede ser suficiente para matar 10 humanos adultos.[x]

Esta estrategia que presenta beneficios mutuos, ente la especie que evita la predación, la presa que no es atacada es tan eficaz, que una tercera especie ha desarrollado una forma de verse beneficiada. Así, organismos que no producen veneno, imitan las coloraciones de los que si lo tienen para evitar la predación, con la ventaja de que no requieren hacer el gasto energético y evolutivo de desarrollar el veneno. Éste fenómeno se llama Imitación Batesiana (Batesian mimicry), donde un organismo no venenoso se muestra igual que el venenoso para evitar ser predado. Hay otra imitación también muy interesante llamada Imitación Mulleriana, donde dos especies las dos venenosas se imitan en sus alertas cromáticas para facilitar el aprendizaje del predador y nuevamente, las tres especies resultan beneficiadas. En todas estas estrategias el uso del espectro electromagnéticos visible que llamamos color y los altos contrastes juegan un papel crucial a la hora del proceso "didáctico" del organismo hacia los predadores.

El color como fuente de regulación térmica.

Algunos organismos utilizan el color y cambios en su coloración como forma de realizar

un balance térmico. El camaleón del desierto utiliza esta estrategia para absorber calor en las frías mañanas y luego reflejar lo más posible durante el caluroso día. Incluso llegan a mostrar a media mañana una zona del cuerpo clara para reflejar el sol mientras que la parte sombreada conserva su color oscuro. El tener un color claro es incrementar la reflectividad del organismo, rebotando gran parte de la gama del espectro electromagnético lo que se traduce en menor absorción de calor. El presentar una coloración oscura permite absorber esa energía, incrementando la temperatura, algo crítico para el inicio metabólico de un reptil (dado que no genera calor interno, pierde todo el calor necesario durante la noche). Se ha especulado, pero todavía no se tiene evidencia suficiente, que en el caso de animales con patrones alternados como la cebra, se utiliza el patrón en color blanco y negro para generar un diferencial térmico en la superficie que genera micro-corrientes de aire entre las zonas que se calientan y las que no, lo cual favorece la evaporación apoyando a la regulación térmica del organismo.

¿Cómo se genera el color en la Naturaleza?

En la naturaleza, muchos de los colores son la consecuencia directa de la físico-química que ocurre dentro de los organismos. Es decir, nuestro tono de piel refleja en parte lo que alcanza a traslucirse de nuestros tejidos llenos de sangre. Las plantas son verdes porque el compuesto principal de la fotosíntesis tiene ese color, la clorofila.

Sin embargo cuando se requiere producir color por alguna función en particular se utilizan tres estrategias principales: Pigmentación, color estructural y bioluminiscencia (Sun, 2013)[xi]. La pigmentación, utilizar compuestos como si fueran tintas, que aportan cierto color, como la melanina en nuestra piel y cabello, los carotenos en los vegetales rojos o amarillos, etc. Los pigmentos utilizados en estas coloraciones, son de origen orgánico, y son fácilmente descompuestos en componentes benignos, sin involucrar la generación de productos o sub-productos tóxicos para la vida.

Una de las características más increíbles del manejo del color en la naturaleza es el llamado color estructural. El color estructural es un tipo de coloración no proveniente de compuestos químicos o pigmentos, sino de fenómenos físicos como la reflexión de la luz. Casi siempre opera a nivel de superficies entre microscópicas y nanoscópicos que a través de una estructura de capas, reflejan de manera diferenciada la luz. Existen varias estrategias, como interferencia por películas, dispersión coherente o incoherente de la luz, redes de difracción, cristales fotónicos y otros mecanismos todavía en estudio. El color se deriva principalmente de interferencia por películas, que incluye interferencia de la luz por películas delgadas y/o múltiples.

Por ejemplo, en las plumas del ya mencionado pavorreal, están dotadas de un pigmento café oscuro, sin embargo a través de su micro-estructura pueden verse verdes, azules o iridiscentes. (Hooke)[xii]

Muchos tipos de mariposas utilizan estructuras que interaccionan con la luz a través de ciertas escamas en sus plumas para producir color. La parte superior de las escamas de estas mariposas se componen de estructuras transparentes de tamaño nanoscópico que tienen una

sustancia de capas múltiples de quitina y de aire. En lugar de absorber ciertas longitudes de onda de manera estática y reflejar algún color en particular como hacen los pigmentos, estas estructuras selectivamente cancelan ciertos colores a través de interferir su longitud de onda, que viene de la estructura de la escama, pero también de la distancia entre las diferentes capas, y se puede ajustar dinámicamente modificando esta última variable, cambiando el color, lo que las mariposas utilizan para camuflaje, termorregulación y comunicación. Uno de los ejemplos más llamativos de esta propiedad es la mariposa Morpheus, que exhibe uno de los más vibrantes e iridiscentes azules del mundo natural. (AskNature, 2014) [xiii]

¿Cómo estos estudios pueden aportar innovación en la industria del color?

El estudio de esta creación de color en la Naturaleza está revolucionando nuestra tecnología de pantallas.

Esta forma de crear los colores a través de micro y nano estructuras que en la naturaleza se ha mostrado muy eficiente, y de bajo consumo energético, está inspirando a través de procesos de Biomimesis a diferentes innovadores para mejorar y hacer menos dependiente de la energía las pantallas que utilizamos. La empresa Qualcomm ha desarrollado una pantalla llamasa Mirasol, que para generar el color aplica una tecnología inspirada en las alas de las mariposas. Al estudiar y emular estas formas y procesos de la naturaleza, los ingenieros de Qualcomm han podido desarrollar esta pantalla con la nueva tecnología llamada IMOD. Esto permite que las pantallas sean de ultra-bajo consumo.

Se han desarrollado otras aplicaciones como pinturas que cambian de color o son iridiscentes, o simplemente la facultad de producir color sin requerir pigmentos, lo cual puede mejorar significativamente el desempeño ambiental de la industria relacionada con el color, al reducir sus residuos y sub-productos tóxicos o flamables.

Conclusión

El color es de gran interés dentro del estudio del mundo natural, con muchas funciones asociadas a el, desde la comunicación, la atracción, la protección, la selección de pareja. Ante la posibilidad de utilizar el color, la Naturaleza ha desarrollado una serie de estrategias basadas en pigmentos de origen orgánico y fácilmente biodegradables pero también ha desarrollado el color estructural, donde a través de micro- y nanoestructuras y procesos físicos como dispersión, reflexión y selección e interferencias de ciertas longitudes de onda le permite a materiales transparentes o pardos, mostrar un color a través de un fenómeno físico de muy poco consumo energético. Es importante estudiar más a fondo estas estrategias, ya que pueden influir positivamente en la creación de pantallas de ultra-bajo consumo, y tintas no basadas en químicos sino en procesos físicos microscópicos, que permiten no solo crear color sino cambiarlo a voluntad como reacción a factores externos. Esto puede apoyar en el mejoramiento ambiental de la industria relacionada con el color, a través de la imitación de la Naturaleza.

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Changing Fashion Preferences Of Bridal Wear In India: A Cultural Shift

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Abstract

Universally, dresses have been known to indicate one's cultural identity. The most illustrious and expressive dresses are wedding garments. Weddings today are almost of the scale of an event and symbolise pride and prestige, displaying one's ethnicity, economic wealth and social standing. As diverse are India's culture, equally diverse are its numerous wedding traditions; each community having its own tradition and unique bridal attires. Over time this tradition led segment has evolved and witnessed a radical shift not only in the perception of fashion change but also in the larger purview of the meaning attached to it to keep pace with the current values of the society and so has the bride's attire. Prevalent trends are indicative of a constantly evolving society; reflecting the motivation that drives the brides to alter their traditional dress; reflecting their understanding of world view, changing goals, preferences and values of a society against the previous assumption of customs being static in a traditional setting. This study attempts to analyse macro and micro information on fashion change with specific reference to bridal wear. Established models of fashion adoption and change are employed to establish the cultural shifts observed in India towards preferences and emergence of new thematic categories in bridal wear hence mapping the essence and language of traditional in today's pretext.

***Keywords*:** Fashion change, Indian bridal wear, Fashion adoption, Conspicuous consumption, Hindi cinema.

Introduction

Dress is one of the most important makers of cultural belonging, wedding dresses being the most telling and visible mediums that reflect one's identity, culture, and taste. Dress has been the most rejoiced and well documented prop of society. Prestige, wealth and status are reciprocated through wedding dresses. Weddings in India are by far the most important part of one's culture, heritage and traditions.

Foster and Johnson perhaps are a few researchers who have written and illustrated numerous wedding traditions through wedding dresses from around the world. Their essays also confirm that while the traditional dress is under the threat of global communication, modern ideologies, loss of certain traditions is perhaps evident and becomes obvious in a certain sense. It simultaneously reveals that these wedding dresses are carriers of the spirit

of the times and evolving traditions. Wedding dresses are highly adaptable and deeply cherish transitional traditions of the community and society in its larger purview. Traditions are thereby defined as a term used to honour the spirit (Blumer, 1968) of the norms and rather than a single style of dress worn in the past.

In many societies and even in Indian subcontinent, women do dress in their native attire that originated in a remote past in order to meet cultural hopes and expectations (Foster and Johnson, 2003). However, these older styles have no relation to the current context of traditions and fashions. To honour both the past times and present understanding, brides often alter their traditional attire and make changes according to the present day context which result in a seemingly traditional dress but with the motivations and aspirations reflecting through the changes made. The motivations reflect personal taste and society values and the present day understanding of traditions. Sometimes the bride is left with no choice and has to follow what the family has to offer. In India especially in some Hindu communities, the bridal dress is given to her as a *shagun*[1] or a good omen by her mother- in law. In this case the bride is left with very little or no choice of her own. But there are some who step out and experiment with the tradition. The contrast between what the bride wishes to wear and what the community is reflected through her fashion adoption process.

The conspicuous consumptions of an Indian wedding are not a hidden fact any more (Bloch et. all, 2002, and 2004). The Bridal and the Wedding wear market stands tall worth $150 million (Forbes India, 2011). The impact of globalism, consumerism, plastic money, popular Indian cinema and media is reflected through conspicuous consumption and immediate gratification, clearly visible in wedding; with wedding being a true unit of measure of evaluating lifestyle and status (Bristol- Rhys, 2007; Bloch et. all, 2004; and Kapur, 2009).

Documentation and research with respect to region wise descriptions of Indian traditional wedding dresses is scarce (Kumar, 1999; Foster and Johnson, 2003 and Jones and Ramdass, 2004). There exists a need to document the evolving traditions and practices of these diverse communities. The wedding wear industry is estimated to grow to a $2.23 billion net worth by 2020 (Mampatta 2009), this itself makes it vital to document the driving force that is causing – change in the larger purview of fashion, hence leading to the growth of this segment of Women's Wear in India. This study attempts to analyse macro and micro information on fashion change with specific reference to bridal wear.

Nature of Weddings

Any discussion on Indian cultural practices is incomplete without the mention of weddings and vice-versa. Today, in the fast pace of life, weddings have achieved an order of a space where rituals and traditions can be practised. Economic aspects of a wedding, conspicuous consumption and wedding planning have been given more importance by researchers and authors worldwide. Sociology, culture and fashion based implications have been given little importance. In order to do understand why and diagnose better analysis, it is necessary to take into account several perspectives (sociology, psychology, anthropology, demographics, economics, culture and history) of study (Lowe, 1987).

The expenditure and extravaganza of weddings has increased at a progressive pace. The weddings today are mostly designed and organised by professionals who deliver according to the requirements and budget, as opposed to the traditional method of family members organising and conducting the ceremonies. The Indian consumption engine is the only contender worldwide to give competition to the USA wedding market segment, or perhaps even partake it. Mampatta (2009) in his article quotes several experts from the industry and puts forth statistics which define the due course of this trillion dollar industry. Wedding sector is the fourth largest contributor, contributing 12% to the GDP of India after service, manufacturing and agriculture.

Linsen, Kempen and Kraaykamp, (2010), reflect on Bourdieu's works on consumer culture to suggest that conspicuous consumption is essentially a social differentiating mechanism. It is through the differences in taste preferences, by means of which distinction from and relatedness towards social groups can be estimated.

Conspicuous consumption reflects and individual's standing in the social hierarchy and is synonymous to phenomenon of weddings. Owing to the discretionary and disposable income, a global market as platform of choice, improved products, highly organised and designed services, the competition and pressure from the community and society and above all customization has paved the way into a conspicuous consumption society. Bloch, Rao and Desai (2004) in their study analysed how the conspicuous consumption practice has not even spared the rural population.

After scanning through different media and observations, four broad segments of consumption were categorised, namely: Ceremony, Aspiration and attire, travel and food. These segments have been synonymous to weddings as illustrated by Russell (1923). It is evident that the segments do not function in isolation rather have cause and effect relationships between each other. Aspirations define and cater the conduct of the bride and the groom. The look, trousseau, bridal attire is highly influenced by the mass media, cinema, fashion awareness and bridal wear designers. Travel is rather nascent segment added to the Indian Scenario with destination weddings and honeymoon design packages (Foster and Johnson, 2003; Forbes, 2011).

Rao (2001) describes that Weddings are of the biggest festival any family encounters. The number of guests, the scale of event, the food, dress and the total expenditure are humble indicators of the families standing and status in the society. The worth of gifts received in a wedding are described as a unit measure of one's social standing, respect and good will in the immediate community and society at large.

Figure 1, An example of a Wedding Venue, Photograph by Vijay Eesam (Adopted with permission from: Vijay Eesam Wedding Photography, Bangalore, India)

Indian bridal wear: Establishing the traditional

Woodward (2007) suggests that the tension between conformity and individuality can be a motor for change at the level of the fashion system (Simmel, 1971) and a means for women to create an innovative look from their wardrobes. How women manage and construct their appearances involves the consideration of specific social situations, as well as the wider social and cultural context (Kaiser, 2003, P-58).

The broad context of social expectations are refracted through individual style preferences, social networks and women's unique biographies. The factors women deal with when they assemble their appearance are multiple and wide ranging. Dhamija (Berg, 2010) describes that "women's traditional basic dress forms as the draped and wrapped sari, sarong, and *dupatta* (veil), in addition to stitched garments including the *choli* (tight-fitting blouse), *ghagra* (gathered skirt), *kurti* (short shirt), and the long *kamiz* worn over the *salwar* (gathered loose fit pant) or tight *churidar pajamas* (gathered at ankle; ankle length fitted pant)."

Martand Singh in the preface of Royal Costumes and Textiles of India confirms that, Kumar's compilations in the book (1999), is the only updated visual confirmation and reference India has to establish what was traditional. Mukherjee's book on Royal Mughal Ladies and Their Costumes (2001) is the only comprehensive documentation sans visuals that concentrates on the costumes of the Mughal ladies. This study basis it's pretext on the comprehensive work and compilations by Kumar and Mukherjee.

Traditional and royal are taken to be synonyms and harbingers of culture, as they were essentially passed down through generations. Royal costumes from the Hindu courts and Kingdoms as well as from the Mughal Harems (in particular: for this study is in reference to Bridal wear only) are the only source of understanding what was considered to be traditional and how it evolved over the ages. India's glorious history is an amalgamation of various cultural influences from its long list of invaders and rulers. What is truly Indian and what is clearly foreign influence is difficult to distil (Kumar, 1999). What one knows is that India's traditions have been greatly influenced by various cultural practices from across

the globe from Greece to Europe. The more prominent of these influences and impacts were from the Mughal traditions and British rule.

Kumar (1999) and Mukherjee (2001) suggest that, the *ghaghra, choli* and *dupatta* were the main day to day costume in the Western provinces of Rajasthan and Gujarat. The Northern provinces of Punjab, Jammu and Kashmir, Himachal, and Parts of Avadh, wore either the *Farshi paijama* (long flared floor length pant), *kameez* (Long shirt or kurta), *dupatta*, some of them opted for the *salwar*. The sari was considered to be worn on special occasions. It was only when the purdah was abolished that sari became a daily wear garment as opposed to the *ghaghra, choli, dupatta* and *farshi paijama, kameez and dupatta*, which were now kept for special occasions such as weddings and festivals. The royal wedding dresses were pieces of art, sometimes passed down 5 generations. On other occasions the wedding dresses were made by a collective effort of royal patrons, craftsmen, embroiders and weavers from across the country.

With the elite and the royals travelling to other countries and cultures for work and otherwise resulted in influence and infestation of foreign cultures into the traditional. Kumar suggests that Women's garments were not dramatically affected as that of the men by European and British cultures, slight change in silhouettes, more practical silhouettes resulted, colour selection changed to a more European taste. While fabric was greatly affected, rich fabrics such as silk and pure cotton were replaced by cheap cottons and other machine made fabrics.

Kumar argues that the changes that happen in Indian fashion and aesthetics are primarily based on what preceded them. She says that the native population has absorbed, selected, and assimilated external influence but have always anchored themselves onto their cultural identities. Johnson's study on the traditional *Panetar* and *Gharcholu* (2003) saris is perhaps the only few studies which have taken into consideration the transitions that have occurred in the language of our traditional garments over the ages.

However, sometimes changes are brought about in traditions and customs for the greater good of the society. Edward (2003) also describes the symbolic meaning behind the typical Muslim embroideries that existed. He says that the Muslim embroideries reflected the Quranic prescriptions and floral motifs rather than the figurative embroidery motifs used by their Hindu counter parts. The use of floral, geometric motifs and interlacing stitches made the surface glitter in light. Edward (2003) suggests that this was perhaps because of the Indo- Persian philosophy that the divine light is a visible manifestation of God, and the Muslim women literally filled their attires with the light making their garments auspicious in a true sense. Edward's description is in agreement with Kapur's (2009) description of Muslim influences in depiction of Hindu garments in Cinema. It wouldn't be wrong to say at this juncture that what was being defined as traditional bridal garments at mass level in India was-is highly influenced by Indo- Perisan and Muslim styles of silhouette and ornamentation techniques.

Nevertheless, Fashion today is ruled by media. Kumar's concerns are evident through the advancements in communications and increase in the average travel has caused the geographical boundaries to dissolve which has resulted in "cross- pollination" of

regional styles and practices resulting in the emergent new design vocabularies. With increase in travel, working brides, fast access to fashion information from across the world and globalisation there is an influx of influences from around the world and across the country. Today every designer has his/ her own theme and styles catering to specific client profiles, resulting in the evolution of various thematic categories depicting the attitude and nature of the bride. “Princes bride”, “Neo bride”, “Modern bride”, “Traditional bride”, “Demure bride”, “Classic bride” are some examples of categories defining the attitude and conduct of the bride (Vogue, 2009; Vogue, 2010, Wedding Affair, 2011, Asiana, 2011; Designer Mode, 2008; Delhi Times, 2012). These emergent vocabularies are powered by the mass productions and new manifestations of the traditional.

Influence of Hindi Cinema on Indian Weddings

Cinema is known to be an engine of creating and trending conspicuous consumption (Deshpande, 2007). The effect of cinema is not only on the material expenditure rather its expanse is far into the psyche, aspirations, transitional fashions, identity and social structure. Cinema has effectively and silently created identities. Indian cinema has been dominated by the upwardly mobile elite of India’s middle class. Fashion depicted through the medium was highly western centric and glorified the access to the West (Deshpande, 2007).

Muslim culture portrayal in commercial Hindi cinema has been communal and evident to the extent that it popularised Muslim cultural fashion and dress etiquette. Deshpande highlights that there was a phase when everyone wore sherwan2 highly known for its Muslim connotation. It is also evident that in depiction of wedding scenes in cinema, the Mughal and the Muslim style of wedding attire has been given the position of traditional and hence fashionable as opposed to the conservative sari which is taken to be non-fashionable (Kumar,1999).

It is common in the wedding and bridal retail market that certain styles from the movies are sold with the name of the movies attached to them as an identity. This widely known fact in sparsely documented rather under documented academically and even in reportage from a fashion perspective. Considering the above, it would be unfair to ignore such a powerful source of influence and inspiration in analysing Bridal Wear.

Magazines dictating identities

Magazine and magazine covers are one of the medium for communicating the trends and new developments in all the four conspicuous consumption segments which lead to new and greater aspirations further adding onto the cycle of consumption.

Magazine covers from a range of fashion, lifestyle and travel magazines and have a high readership in India (Infobharti India, 2011; India readership survey, 2010). All of the above are highly illustrious and self-explanatory of the consumption trends and new emergent thematic categories in weddings. This powerful medium is the one most approachable vehicle and creates aspirations among the brides to be and their families.

Magazines have been the prominent fuel to this conspicuous consumption society since long. Their introduction in India is rather nascent in comparison to West. Williams (2004), in her PhD- dissertation thesis on Need for a Multicultural Magazine in the US market, brings forth that the South – Asian or the Indian Wedding and Indian Bride are a much sought and fast selling trend in the West. Williams argues that in a globalised world, there is now a need for a multicultural Magazine for a more aware and global bride, so that she is benefitted by an all – in – one cultural information source which provides wedding trends and bridal looks from around the world. In the internet age, websites, blogs are also proved to be a better and effective medium, as a result of which print and television media also have resorted to the internet as an addition or an extension of them for consumers to be able to engage with them at a virtual platform also. Documenting all the other vehicles of communication which also play a great role in creating desires and aspirations amongst the consumers is beyond the scope of this study.
Due to the expansive nature of Weddings and the nuances involved, even Foster and Johnson (2003) have acknowledged that no single academic approach or study can claim wedding attire as its exclusive purview.

The Bridal Wear in the Present context

Srivastava (2008, Pp.- 18), begins her article on the latest bridal trends by saying that "Times are a changing' and bridal wear goes on experimental mode, wrapping western influences in its fold. Neckline plunge and corsets and halter necks replace the traditional choli". This statement by Srivastava clearly reveals the present of the Bridal attire as opposed to its past. Srivastava further puts forth that traditionally Indian women wore a bridal *sari* on her wedding day, due to the information influx and western influences the trousseaus have evolved to include *lehenga choli, salwar kameez* with the sari being last in the preferences list.

The wedding wear and bridal wear industry has existed in the form of bridal retail stores, since decades now, to the extent that markets like Chandni Chowk and Karol Bagh (New Delhi, India) to name a few have almost become synonymous to bridal wear. The formation of FDCI2 in 2000 has led to development of a niche Bridal wear industry with Designer – Bridal couture weeks and an organised bridal retail segment. Prior to the formation of FDCI, designers showcased their bridal collection through private shows or exhibitions, while retail stores preferred to reach their target audience through the print media, especially magazines.

With the retail boom and formation of FDCI in 2000, the scenario of Indian garment industry in the larger context went through a dramatic sea change (Sethi, 2008, Editorial page, Designer Mode). Now there are two parallel running industries in the Bridal and wedding wear segment, the Couture and the Retail, both of which are the bread and butter of the Industry as a whole (Sethi, 2008).

Tarun Tahiliani, Srivastava (2008) mentions of him as one of the most influential designers in the Bridal couture segment. In an interview with Vogue India Magazine (Vogue India, July 2010, Pp- 80), Tahiliani, reflected on the state and status of the Bridal couture segment, He mentioned that the couture pieces are handcrafted and take time to

shape into perfection that the customer demands. He described his 2011 collection to be reflecting a Modern India with an old world charm but with a modern twist. He argues that today Bridal wear has to provide an experience not just the costume; It is the holistic experience that he delivers. Further he suggested that "the biggest trend is a mix of Indian fabrics and western silhouettes…impeccable tailoring… Indian techniques…" (Tahiliani, as quoted by Khanna, Vogue, July 2010, Pp-80). He made an important claim that till date Indian craft has been the major component of the bridal couture as embellishment was still of high importance. In contrast to couture bridal wear, Srivastava (2008), in her article Budget Bride, makes it out rightly clear of the present day aspirations. She says it is the look that is important to a bride today (Mass Market Theory: Katz and Lazarsfeld, 1955 cited in Sproles, 1981; Kings,1963 cited in Sproles, 1981).

Today designers are making efforts to bring Indian couture at par of world fashion and make India one of the Fashion capitals. It is important to bring to light the difference in opinions regarding Indian Couture. A recent article "Fashion designer Manish Arora feels Indian couture is just bridal wear" (Times of India, August, 2012), clearly explains the two opinion camps. The article quotes one of it as "Times View" referring to the journalists' panel view and the other as the "Counter View". The Times view describes Indian couture to have steered away from the previous notion of creating bridal lehangas to presenting a range of creative silhouettes, exploring new textures, themes and influences from the around the world clearly stating that wedding and bridal wear are just one part of the industry and not the whole phenomenon. While the counter view quotes Srijana Mitra Das, who is in agreement with designer Manish Arora that Indian couture is still all about bridal and wedding wear. He says that India's couture revolves around one event that is wedding when people spend lavish amounts on clothing. He suggests that one should accept this fact and maximise this USP as it is the bread and butter of the fashion industry. Das says that India is at its early stages of high end fashions and to reach artistic maturity to go cutting-edge and financial stability will take some more time.

Fashion Adoption leading to Fashion Change: inter –relationship

Lynch and Strauss (2002, p.1) say that "It is out of uneasy relationships that fashion change emerges, and understanding it becomes a route for understanding human life in the twenty first century". They go on to suggest that Fashion change theory looks different in the twenty- first century hence a one point perspective would be void.

Sproles identified that Consumer Behaviour is a propagator of Change. He identifies consumers as the primary and the most important initiator of change. It is the consumer that decides the faith of a product to be fashionable or not. Four theories were put forth by Sproles (1981) based on consumer decision, of the four theories, Mass Market and Collective selection theories work on similar principles and nature of the Bridal Wear and the Bridal wear Industry.

Bridal Wear as a means of demonstrating Fashion Change

Royal and Traditional bridal dresses had a character to them. Today the bridal wear is about experience, it is about creating a different look every time a bride decides her attire.

With the changing techniques of embellishments, cross- pollination of influences across the globe both at micro and macro levels to the extent of the bridal wear losing out on its visual belonging. Earlier bridal attires could be visually differentiated, but it is a difficult to do so today with the retail market and designers selling bridal wear which are not categorised according to region or religion. Perhaps only jewellery could have been a possible parameter for telling, but due to the overwhelming mix and match artificial jewellery options, which are sometimes selected over original jewellery, has made the task of visually differentiating even more difficult.

Focus: Why a Socio- cultural perspective

Lowe (1993), suggested that to improve our understanding of fashion and the ability to predict was to focus more on a quantitative aspects of external factors that influence fashion change. Probable approach of qualitative to a quantitative analysis would prove to add dimensions of existing knowledge. Lowe further asserts that fashion is not only a kind of cultural change, it reflects and gives meaning to transformations in a much broad cultural mix and that researchers now need to inquire why changes happen. Also that more exploratory approach perhaps directed towards experimenting with indicators of fashion change and termination made more relevance and context in today's society (Sproles' 1981).

Socio- Cultural Factor: Indicators and Subjective Well being

Diener & Suh (1997) argued that social indicators and subjective well-being measures were necessary to evaluate a society. According to Diener and Suh, off late two new scientific approaches of measuring quality of life are being used primarily: "objective" or social indicators, and subjective well-being (SWB). The social indicators movement focuses its attention on measuring. Subjective well-being research, in contrast, is concerned with individuals' subjective experience of life. Social indicators and subjective well-being measures are highly complementary approaches.
Indicators are transformed by individuals to produce what is perceived by people as desirable or undesirable. Subjective well-being measures assess people's actual reactions that are involved in transactional process.

Methodology

This study follows a mix method approach of research. Grounded theory was applied to gain maximum from the data collected and to be able to maintain a balance between the qualitative and quantitative research. The research strategy included: Observation, Personal Interview, Interview guideline, Photo- elicitation method.

Through the comparison and analysis of existing studies and research, the concepts and characteristics, fashion change and transitions in bridal wear could be explained. It was confirmed that it was necessary to map the changes in bridal fashion of the Hindu Business community of Delhi – NCR as a subject of enquiry due to lack of study in the area of Bridal fashions and perceptions in India.

The primary research of this study can be studied along the linear relationship of the empirical work which involved four phases; each phase making use of different categories of methods to achieve the aim. Preliminary Observation was undertaken to assess the actual premise of Bridal wear in India, further on in the Business community, in order to establish the current status, conduct, scale and placement thereof in the society. This stage crystallised the fact that Bridal wear has evolved over a period of time in the Hindu community at large and that perceptions, understanding of Bridal fashion has evolved into new vocabularies.

The second phase was divided into two timelines: Time line A – year 1980-1999 and Time line B – year 2000-2012. Time line A implemented case studies to establish what was primarily taken as traditional Bridal wear in the Business Community throughout this the time line. Time line B undertook in- depth interviews with the Business Community brides to understand their individual adoption cycles and their perception of Bridal fashion today. Time line B was focused at evaluating reasons for transitions if any. The third phase was confirmation of information collected from Time line B respondents by analysing their wedding photographs to gain details of what was actually adopted and which of them were most prevalent. Triangulation of all three phases led to analysing results from all three phases further into a combined analysis of results. The results were then interpreted into identifying socio- cultural factors or reasons that affect the community's choice of adoption leading to fashion change at large.

Table 1 : Preliminary observation process

	Observation 1	**Observation 2**	**Observation 3**
Type	Non- participant	Non- participant	Participant
Subject	Reportage+ Magazines+ Television shows on wedding events and Bridal wear in general in Delhi and Business community as well	Direct + Indirect insights from books, journals, articles on fashion and bridal fashion other perspectives contributing to the study	Weddings : their conduct scale and the Bride's attire
Condition	Neutral	Neutral	Neutral
No. of Subjects	-	-	2
Date	-	-	January- February 2012
Recording	Narrative	Narrative	Narrative

Interpretations from Observations

- The scale at which weddings are conducted today has definitely changed over the years.
- Conspicuous consumption has led to the growth and initiation of several parallel and sub- industries.
- Aspirations and motivations are highly directed by cinema and media.

- The weddings are vulnerable to numerous thematic influences and are highly designed and choreographed by an organised industry set up.

Case Study 1: A socio-cultural perspective of fashion change demonstrated through bridal wear of the Business/Merchant community of Delhi- NCR, India.

In India, communities are largely identified by religion. The Hindu Community is the largest of all the communities in India constituting 80.5 % of the total Indian population according to the census of 2001 (Das, 2004). This study is focused on one of the four Hindu communities; the Vaishya community, which is said to constitute the Jains, Marwaris, Guajaratis and the Baniyas according to Bhattacharya, (1896), In *the impact of religion and reputation in the organization of Indian merchant communities*, Iyer (1999, pp.16-17) states that 'Baniya community' as term is derogatory in its connotation. In the more contemporary context this community is now defined as the 'The Indian Business Community' or 'The Indian Merchant Community' (Iyer, 1999, Lamb, 1995, Spodek, 1969, Elliot (1871) as cited by Russells, 1923).

Reportage has asserted that this community is the most spendthrift community in terms of conspicuous consumption depicted through the conduct and scale their weddings. Some suggest that it has par taken the Punjabi community which was considered to be spending maximum and overwhelming amounts at their weddings. The Business community has perhaps changed the context and conduct of weddings altogether (Wedding Affair, 2011, Verve, 2008, Vivah, 2011, Designer Mode, 2008, Iyer, 1999, Lamb, 1995). The Baniya is one of the strictest castes and considered amongst the high castes and enjoy a high social status. They have a very distinctive character, from a very early age they engaged in the matters of business, money making tactics and accounting (Russells 1923; Spodek, 1969; Iyer,1999). This is very nature makes it a primary reason to investigate the conduct of this community in the society.

Time line A implemented six interviews with Business Community women who got married during the years 1980-1999 to find out what was considered to be traditional bridal wear in their families and in the community at the time of their wedding. The interview guideline questions were asked posed to establish all the eight parameters for this time line as well. The respondents wedding albums were consulted to further understand the conduct of their bridal attires. Through the case studies an insight of perception of bridal attires was found out that were prevalent during the time period from year 1980 to 1999.

The third phase was confirmation of information collected from Time line B respondents by analysing their wedding photographs to gain details of what was actually adopted and which of them were most prevalent visually through categorical sorting. Banks (2007) suggests that photo- elicitation method is a straight forward method to understand but difficult to utilize. Banks further elaborates the process by asserting that "specific examples of social relations and cultural form depicted in the photographs can become basis for a discussion of broader abstractions and generalities; conversely, vague memories can be given sharper focus, unleashing flood of details" (Banks, 2007, pp- 65).

Table 2 : Time Line A process details

Interview: Time Line A	
Method	Face- to face in depth interview sessions, telephonic conversations, recordings
Time line	Year 1980-1999
Target	Business Community Married Women
Sampling Method	Convenient Sampling
Number of Samples	6
Questions Posed	Same as designed in the Interview Guideline
Period	March- April 2012
Duration	20-30 minutes

Time line B undertook 50 in- depth interviews with the Business Community brides to understand their individual adoption cycles and their perception of Bridal fashion today. Time line B was focused at evaluating reasons for transitions if any.

Table 3 : Time Line B process and Details

Personal Interviews : Time Line B	
Method	Face- to face in depth interview sessions, recordings of the sessions
Time line	Year 2000-2012
Target	Business Community Married Women
Sampling Method	Snowball Sampling
Number of Samples	50
Questions Posed	Same as designed in the Interview Guideline
Period	March- April 2012
Duration	20-60 minutes

Triangulation of all three phases led to analysing results from all three phases further into a combined analysis of results. The results were then interpreted into identifying socio- cultural factors or reasons that affect the community's choice of adoption leading to fashion change at large.

Interpretations and analysis from Time line A

- In 8o's and 90's only source of fashion or bridal information was through word of mouth and other weddings in the community.
- The brides (1980- 1999) then did not have many options to experiment with and were true following what was prescribed by the then set norms.
- The traditional bridal attire for the Business Community was a *benarasi sari* (saris from Banaras) with golden or silver work. Red and maroon were considered to be traditional and auspicious colours of a bride signifying femininity and fertility. *Gota kinnari* (edge finish) was of specifically high importance and was attached to the *sari pallu* (draped section of sari from falling down from shoulder), only to be removed later.

- The *Charchanch*i (traditional sari) sari was only mentioned by one respondent who is of a Rajput – Marwari decent, essentially hailing from Rajasthan. With no other respondents mentioning about this particular sari, it can only be presumed that this particular tradition was adopted from the Marwari Business communities settled in Rajasthan and Gujarat. The *charchanchi* has visual resemblance to the *gharcholu* sari of Gujarat.
- Figure 2, establishes what was considered to be traditional with key elements drawn from the case studies.

Figure 2: Traditional bridal attire during 1980-1999

Interpretations and Analysis from Time line B

Understanding what the respondents perceived of the larger idea of weddings was important as it brought about insights to the study, of what weddings actually meant to the people of the community.

- Perception of meaning of Indian Weddings: depicts that 33% respondents agreed that weddings were a depiction of their communities' cultures and traditions. 24 % respondents claimed it to a display of social standing and status. Only 12 % agreed of weddings being a display of economic and financial wealth as opposed to 24 % who totally disagreed to any display of financial wealth.
- Importance of Wedding wear: bridal wear**:** 57% of the respondents asserted that the bride's attire was very important in a wedding. The most common reason sighted by 68 % respondents was that in a wedding, people, relatives make judgements of the family by looking at what the bride was wearing. The attire becomes a measure or a unit of family status in the society.
- Knowledge of the traditional attire and Details of community: 76 % of the brides were well aware of their traditional attires and norms. 14 % of them were unsure of what exactly was prescribed by the community. And 10 % were totally not aware of any such criteria.

- Selection Ideology: It was important to investigate the cost of the respondents attire to assess the quality and type of work. 26% respondents claimed to have spent more than 90,000 Rs. on their bridal wear alone. 37 % said that they spent around 60,000-80,000 Rs. on their attire. While 35 % spent 30,000- 50,000 and only 2% respondent spent below 20,000 Rs on their attire. The amount spent is directly proportional to the type, quality and design of the attire.
- The Marwari bridal attire was the most aspired for with 31 % respondents showing their preference. The Christian bridal gown was also appealing to the respondents and 23 % of them liked it, followed by Rajasthani and Gujarati bridal wear also being popular amongst the respondents. The Punjabi culture only lured 9% of the brides.
- Fashion Information / knowledge : Only 41 % of the respondents resort to magazines for fashion information. Out of which 18 % preferred Hindi magazines and 41 % read English fashion magazines. Femina was most read amongst the English magazines. While *Griha Shobha*[43] found maximum readership.
- Inspiration and aspirations: Movies were found to be inspirational by 56 % brides and that they got ideas and aspirations from characters and bridal attires depicted in movies, followed by magazine advertisements with 13 % respondents suggesting that magazine advertisements depicted inspirational moods and themes. 11% referred that travelling experiences to other countries and even from travelling within India brought afore many inspirational wedding ideas. Respondent number SR3's relative was spotted wearing the famous *Hum apke hain kaun* sari version which she had specially got made for the wedding.
- To find: the actual fashion adoption and implementation: 80 % brides bought their bridal attires from bridal retail stores, While 18 % got them customised from designers. This is indicative of the huge potential of the bridal retail market. Look played a major role in deciding their attire. Colour was also of high importance while selecting, followed by Embroidery and silhouette
- Maximum number of respondents opted for red colour. 14 % wore maroon to their weddings. 10 % preferred green colour, followed by pink, magenta, orange, white and blue. Gold and silver were used in combinations with other colours. SR 6 gave insights of the colours that were considered auspicious: red, maroon, green and yellow. New colour experimentations were prominent.
- Maximum number of respondents related their look to be similar to the traditional thematic board followed by bling.
- 49 respondents wore Lehnga, choli and dupatta while only one respondent wore a sari.
- Make up was sighted as a USP by 22 % brides, followed by 19 % brides who mentioned colour to be the USP of their attire. Embroidery and look was sighted by 9 % and 8 % brides respectively. Nath and original jewellery was also mentioned to be a USP in the attire.
- Also it was the measure of weight or how heavy the attire was which the second was most sighted unique feature of their attire with 19 %responses from brides.
- Most of the brides said that they never thought about their dream bridal look at the time of selection. Movies were cited by maximum brides and defined their dream bridal look.

The Visual boards were investigated on the basis on visual assessment with no co-relation to details provided by the respondents. This was done to avoid biases at any levels. Also the photo elicitation was brought on discussion with the respondent only after the interview guideline was completed**.**

- The category of look was assessed against the pre-designed thematic boards. In some cases the looks tend to overlap into two categories, hence they were counted in both the overlapping categories. Number of boards that were bling in their look was prominent (39 on frequency count).
- The prominent silhouette was flared and variations of it were found. The maximum prominence of flared (voluminous flared= 6 on frequency and flared/ trumpet = 22 on frequency count) silhouettes highlights that the average Indian women body figure has a heavy abdomen. A flared silhouette hides all the flaws of the body; hence its prominence on the boards is clearly visible.
- Maximum number of respondents (49 respondents) were adorned in *Lehnga, choli and duppatta*, only SR2 (code given to respondent), was sporting a multi-coloured sari, but this could also be probably due to the fact that her marriage took place in early months of the year 2000; hence the use of sari continued from as that of time line A. The visible use of the *charchanchi* was spotted 6 times.
- Colour was the most difficult parameter to assess. With the use of multiple colours in single attire it was difficult to sort them under individual colour categories; instead combinations of colour categories were prominent and reoccurring. The categorical sorting of colour revealed that red was the most prominent colour and was used in several combinations. The combination of red + gold+ purple/ maroon was the most prominent with 15 counts of frequency. Almost all colour combinations had the use of gold or silver as zari, or metallic wires, coiled wires, sequins etc. Several new colour experimentations were also visible; the use of colours: turquoise, bright orange and olive green were the most striking.
- Relationship Matrix between the quality of work and the look was evident. The more original quality of work was used, the more traditional and simple the look was. While if the quality of work was compromised on; water dropped versions resulted a bling looks.
- It was observed that when artificial jewellery was used the surface was denser and when original jewellery was worn the surface was less dense and finer in terms of quality and design.
- A perception relationship was observed that with respect to the weight of the attire: the heavier the attire the richer it was in its look and feel while the lighter versions were supposedly simple and less ornate.
- The more aware the brides were in terms of fashion and trend information the more experimental they were with their looks. While those who were less aware and kept no track of trends highly relied on retailers for ideas and options.
- It was observed that the "Bling Look" is now synonymous to traditional or is "New Traditional". Two bling looks were created from the photographs of the bride to better classify as to what refers to traditional today.

On the basis of the interpretations and analysis the following socio- cultural factors were derived:

Table 4: Identified Socio- Cultural Factors

SOCIO-CULTURAL FACTOR	TYPE	DETAILS	SUPPORT SOURCE STUDY
Body Image	Human Capital: SWB	Maximum voluminous and flared silhouettes to hide flaws of the body; Indian body type distinctive heavy abdomen	Body-image evaluation and body-image investment among adolescents: a test of sociocultural and social comparison theories: Todd G. Morrison, Rudolf Kalin, Melanie A. Morrison
Attitude towards future	Cultural Capital :Objective Indicator	Quality of work, interest in new themes, evolving cultural values and decision making, price of original jewellery	Socio-cultural factors driving innovation: understanding the "four capitals" in a sectoral context: Technopolis, Reid
Attitude towards other cultures	Cultural Capital : Objective Indicator	Integration of different cultural practices, dress elements, colours and etiquettes	Socio-cultural factors driving innovation: understanding the "four capitals" in a sectoral context: Technopolis, Reid, A.
Fashion Awareness :	Cultural Capital : Objective Indicator	Readership, blogs, mass dissemination, new themes, wedding planners, bridal retail	Consumer Culture and Purchase Intentions towards Fashion Apparel: Rajagopal : EGADE Business School
Bonding between couples	Human Capital : SWB	Involvement, bonding, free –open minded relations, active decisions, matching attires,	Socio-cultural factors driving innovation: understanding the "four capitals" in a sectoral context: Technopolis, Reid,
Sources of Information	Social capital: SWB	Travel, immigration, western, foreign bridal ideas, trickle across fashions, bridal couture shows	Consumer Culture and Purchase Intentions towards Fashion Apparel: Rajagopal : EGADE Business School
Individualism v/s uniqueness	Social capital: SWB	Dangerous similarities between brides across culturs, similar surface	Consumer Culture and Purchase Intentions towards Fashion

		ornamentation patterns, bridal retail selling similar patterns with different styling creating numerous looks	Apparel: Rajagopal : EGADE Business School
Beauty :Artificial	Social capital: SWB	Make up, accessories, packages , artificial jewellery	Socio-cultural factors driving innovation: understanding the "four capitals" in a sectoral context: Technopolis, Reid, A.
Look	Human Capital: SWB	Attitude portrayed by brides depicted through over all look; belonging; perception and aspirations reflected; new language of understanding evolving traditions	Socio-cultural factors driving innovation: understanding the "four capitals" in a sectoral context: Technopolis, Reid, A.
Skills and knowledge:	Technology Capital :Objective	Lack of trained skill artisans, lack of patrons, mass produced customization; origin of artisan	Kumar,1999; Bristol-Rhys- 2003
Status Ambivalence : Identity	Social Capital : SWB: Objective Indicator	Identity confusion, New identity terms: business community	Iyer, 1999

Results And Conclusion

The study investigated bride's conduct of attire to analyse and synthesise the effective reasons into socio cultural factors that have been the driving the evident changes in fashion. The identified the socio- cultural factors drive the Community at large to make prevalent changes in their fashion adoption cycles.

The identified changes in preferences illustrate the values and perception of the present society. It would not be wrong to say that the society is now open to new trends. A delicate balance is always required to be maintained in order to respect the old cultural practices while at the same time experimenting with the new traditions; only then does a trend result in becoming fashion. Today, India requires such changes and cultural shifts across genres while maintaining the Indian identity and not blindly aping external influences to be able to attain the status of a fashion capital and deliver Indian couture in its true sense.

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Multisensory Environments of Light and Colour: The Permanent and the Ephemeral

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Abstract

In the current technological and cultural condition, almost all areas of human and social activity are being (or will be) affected. The growing concern with the "image", the instant persuasion and the acceleration and fragmentation of experiments have been limiting procedures that interfere with the thinking and doing, changing the nature of the project act in its representation and relationship with the human being.

Before the velocity of change in space / time, individual / materiality relations, emerges the need of awareness to create new forms of expression and interaction of light and colour. In this context, we propose to analyze the methodology, in particular, *Steven Holl Architects*, *Carlo Ratti Associati* and *FoAM et al* considering the characteristics and fundamental relationships established in the process of creating effects that appeal to feelings and encourage the development of the imagination.

Among many aspects, we question the relationship between built and lived and the loss of sensitivity of some authors toward human being and space, enunciating as a new paradigm, the necessity of change the glance of science and further approximation of several areas of knowledge. A discussion which circumscribes, in particular, the senses, the place, the time, the materiality, the colour and the light and, proposes the transformation of the human environment and its surroundings making the space protagonist of a system of relations that rediscover and redefine the physical, social and emotional dimension.

The space announced the intensity of the form in a rescue relationship between colour, light and matter. It stands out the idea of material and immaterial, permanent and ephemeral representation, sprouting the metaphor between composition and time, principle and technique, effect and poetic. The development of such potentialities enables to create principles that contribute to the interdisciplinary relationship between the design, the construction and the experience.

Keywords: multisensory environments, light, colour, permanent, ephemeral

Body and Space: perception, interpretation and sensation

The acts of embodiment and shelter have close meanings. On the one hand, architecture is an extension of the human body. It can be considered a skin that works as

an interface between us and the world. On the other hand, the body, like architecture, is a house of souls and dreams.

(Silva & Azevedo, 2011: 105)

As an initial assumption in the understanding of the complex architecture's character, must be consider the importance of the experience of the body in space. The space is perceived as a reflection of human existence, structuring their reality, covering their experiences and accompanied its evolution. Existing in a variety of scales to which the individual learns to be sensitive, their expressiveness becomes a reunion and discovery of metaphysical, sensible, spiritual or philosophical realities and stands out as an essential element of the body's perception, interpretation and sensation.

More over, those realities are experienced by the body through the sensory system of the individual, and processed and reconstructed in his mind, being this reconstitution related to the experiences and memories, as well as, the imaginary. In this context, Merleau-Ponty (1945 [2002: 145]) mencioned that, body does not represent "(…) the simple result of associations established during the experience, but an outlet on global awareness of my posture in the intersensorial world". Space and body are inseparable in the discovery of inhabit and shelter of the human being.

Throughout history, as mentioned Teyssot (2010: 259) "appear to be irrefutable the historical, direct and continuous connections between the architecture and the body, established either analogically or in reality". Comprising different areas of knowledge, the body interacts, simultaneously, with the conception of environment and the notion of architecture. Those circumstances may express the body as source of geometry and measuring; the body as image and multimedia tool contributing to the process of dematerialization of space and the sensorial body, which marks the bodily experience to the underestimated materiality.

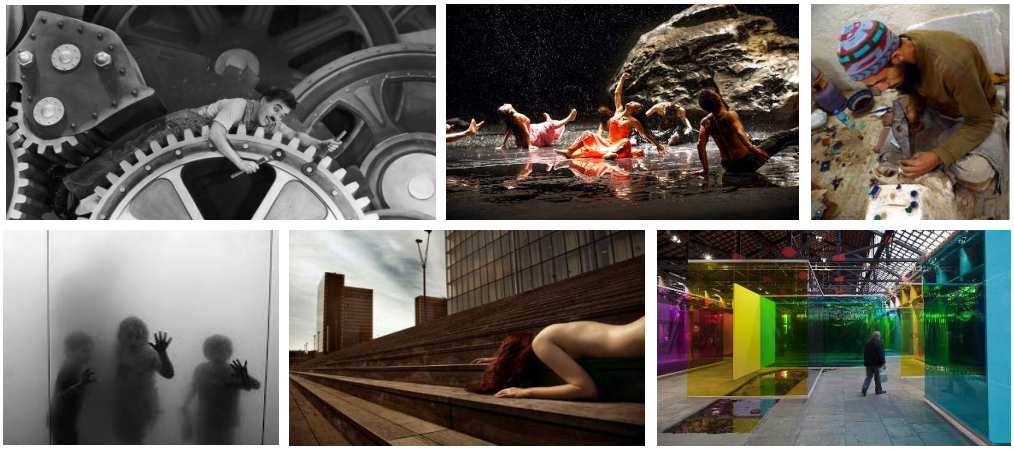

Figure 1: Charlie Chaplin's movie "Modern Times", Pina Bausch's performance "Vollmond" (Full Moon), Andalus tile's technique; Antony Gormley's installation "Blind Light"; Anna di Prospero's photography "I am here"; Olafur Eliasson's installation "Your body of work" (Source: Charlie Chaplin, 1936; Laurent Philippe, 2006; Frederico Paula, 2011; Scott Roberts, 2007; Anna di Prospero, 2010; Everton Ballardin, 2011)

Presently, the interaction between body and space faces new challenges and logics of production. To face this, the creative agents tend to act in different directions and a number of considerations emerge due, on the one hand, to the existence of different transformation velocities between the modes of conceiving and building and the ways of living and desiring, on the other hand, to the existence of distinctive evolutions in the modes of conceiving, building, living and desiring. Those practices and systems of relationships enable the rediscover and reset of inherent and apparent, ephemeral and permanent, felt and suggested materiality. However, frequently, the vision and the intellect are often associated as the exclusive vehicles for the perception and orientation in space.

This fact, according to Leach (1999 [2005: 6]) creates a problem that can lead to a kind of numbness that invades the senses and obscures or hides the reality of everyday life. The instant impact and the image prevails acting over form and function. This argument particularly relevant in disciplines, such as, architecture and design reinforces the idea that will be on multisensory experience and the convergence of all the senses that the experience of space becomes richer (Pallasmaa, 2006: 30). The possibility of thinking the expression of materiality in space is fundamental to the growth of a new awareness that balances the sensual dimension of the body with the emotional dimension of the intellect.

Light and Colour: expression and interaction

Light and colour play an essential role in the relationship of the individual with the environment. Responsible elements for the animation of space, actively participate in the objective and subjective perception of it, exposing the individual to his existence. According to Mahnke (1996: 2), throughout history, scientific studies and empirical observations demonstrate that the individual's reactions in the environment are based majority on the sensory perception of light and colour.

The sensory perception is complex, it has effects that are emotional, synesthetic, associative and symbolic, and should be understood as essential in the design of spaces and objects. Even if it is not possible to include everything known, the qualification of a space through light and colour, is a search for an application related with idea of contrasts that reveal the true plasticity of forms but also of comfort and wellbeing of the individuals.

In this sense, have arisen different chromatic and luminous expressions that accompany the discovery of new materials, new pigments and new constructive means. The materials are the instruments by which the space is expressed. Regardless of the type of function that may assume, from intense light to a deep shadow is only required an adequate amount to each context, in order to obtain form, brightness, colour and texture.

Figure 2: Educational Centre in El Chaparral, Casa Barragán, Sjakket Youth Club, Stadthaus M1 (Source: Alejandro Muñoz Miranda, 2010; Stephen Silverman, 2013; PLOT = BIG + JDS, 2009, Ina Reinecke, 2013)

The effects produced by these elements are practically inexhaustible, have a characteristic crepitation, a greater or lesser intensity of contrasts, show us different aspects of regularity or irregularity whose poetry is mainly adjust to an expressive quality that, by its sensory presence, is priority for all the senses. In addition, defying conventions and opening different possibilities for interactivity or dialogue with the individual in space, these elements transform the environment, the place and enable the association to a moment, to an intimacy.

Defined by the experience whose authenticity is based on the language of construction and integrity of the senses and memories, we can not isolate light and colour from their physical context, because there is always an engaging acting on it, or the meaningful context, because the space is also built by accumulating meanings attributed to it over time. In other words, we may affirm that light and colour manifest in different ways a wide expressive capacity that takes on cultural, social and communicative values in relation to space.

> The entire visual appearance owes its existence to light and colour. The light inherent in all that is visual relation, is, in this context, previous to colour, being, therefore always present. When the light changes, the relations change and, just because the colour changes, change the message, as well as its value as a vehicle of intent; can not lose meaning, but is inevitable that change it.
>
> (Loução, 2007: 13)

It is acknowledged that the spatial characteristics created by the materiality of light and colour, reaching certain degree of complexity, goes beyond the formal aspects and become crucial in the mediation of the human actions. On the same look, different interpretative possibilities (visible and invisible) emerge. The space is revealed as the essence where the body takes a dynamic, interactive and sensory awareness.

Following this approach and through this article, we aim to research how some interventions in contemporaneity suit the conception of the body and how this can be transferred to the practice and development of a formal and spacial language designed to experience the body through matter, light and colour. Futhermore, we attempt to expand the critical discussion on tools and methods that denotates an understanding of physical

characteristics and psychological aspects of light and colour in order to provide a multisensory environments.

Even though, the empirical referents (NYU Department of Philosophy by Steven Holl Architects, Digital Water Pavilion by Carlo Ratti Associati and TxOom by FoAM et al) have different historical, cultural and spatial characteristics, the selection of them relies on the fact that both projects bring together a set of "innovative" strategies that rely on the interdisciplinary relationship between the built space (objective and material) and the lived space (subjective and immaterial).

The model of analysis was performed, in particular, across the bibliographic gathering and the exploratory observation of spaces, under a phenomenological point of view, enabling the identification of several aspects that value the sensory and perceptual relations of the individual with space through matter, colour and light.

NYU Department of Philosophy

In the early 2000s, the Steven Holl Architects studio was selected to design the interior rehabilitation of the Department of Philosophy at New York University. The building dated from 1890, is located on the corner of the Mercer Street and 5 Washington Place in the historic neighborhood of NoHo (North of Houston Street), near the Washington Square Park and within the jurisdiction of the *New York City Landmarks Preservation Commission*.

Figure 3: Ortophotomap and exterior view (Source: Gloogle Earth, 2014; Steven Holl Architects, 2007)

In this area are identifiable several forms of architectural expression and in which is recognized an urban structure with a representative period in the commerce and manufacture history of New York City, since the beginning of the 1850s decade to 1910s. As mention the Landmarks Preservation Commission (1999: 3) "(…) today, the effect is of powerful and unifying streetscapes of marble, cast-iron, limestone, brick, and terracotta facades".

Planned in 2004 and opened in 2007, the project was not intended to change the relationship of the building (cast-iron loft) established with the environment, looked only to the exterior while contextual framework, focusing on the transformation of the interior. The program fully distributed, creates an architectural solution that meets the specific issues and "(…) it is at once a tribute to the popularity of the discipline and to the excellence of NYU's philosophers that the department has over the years outgrown this ideal location; philosophers were housed in three separate locations around the campus" (Danto, 2008: 123).

Willing in six floors, the access to the building is carried out from a sandstone arch crowned by a balustrade set on the south facade. Passing the front door in glass, we are faced with a double ceiling in the lobby where are organized the public circulation of the ground floor and the controlled and private circulation of the upper floors. This space, open up to the university community and composed by some references of the original interior (iron columns, brick walls and large windows) expresses a philosophical depth in the act of thinking and making architecture that is explicit in the sensory properties of the materials and light.

On the right side, arranged on the light cork floor, several wood cubes and a bench along the south windows (designed by Brent Comber) create a place for casual seating. The porous walls wrap the new skylight and staircase that gives access to the upper floors. In front, the space leads into the reception and a curvilinear auditorium clad with cork sheet. The warmth temperature of the space is accented with the natural wood seating and the artificial light.

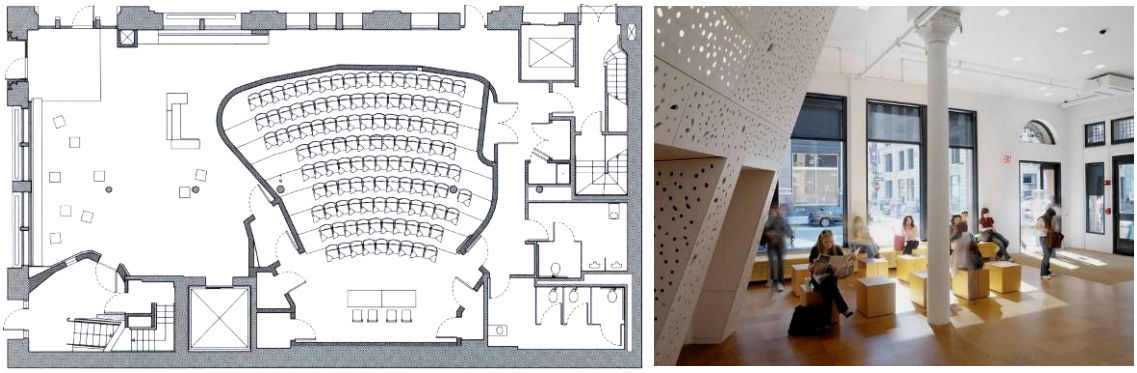

Figure 4: Ground floor plan - scale: 1/300 and entry lobby (Source: Steven Holl Architects, 2007)

The new staircase, so-called *Tower of Light*, rises with a complex geometry dictated by the position of the existing windows and the requirement of the exit in a specific direction. Similar to an atrium space, it turns around on itself nearly as a M. C. Escher drawing, so that teachers and students could casually see one another from different angles and strike up a conversation as they ascend and descend the stair. In this context, Jaynes mentions (2008: 14), the (…) "*Tower of Light* was created in sync with current academic thinking on encouraging spontaneous interaction, and was designed to provide a place where students and teachers can meet, socialize, and philosophize".

The large windows and the huge skylight, with insulated glass and wood frame painted with black, floods the space with sunlight. The staircase is set in a perforated metal shell and wrapped with an existing brick wall that is partially covered with rough patches of plaster and a sandwich plywood wall laser-cut with a different pattern on each side. To control and spread light and shadow across the space the surfaces are heavily perforated in large extensions and a little more opaque in the corners, giving the Holl's idea of porosity in architecture and appearing to a reminiscent of the Impressionism.

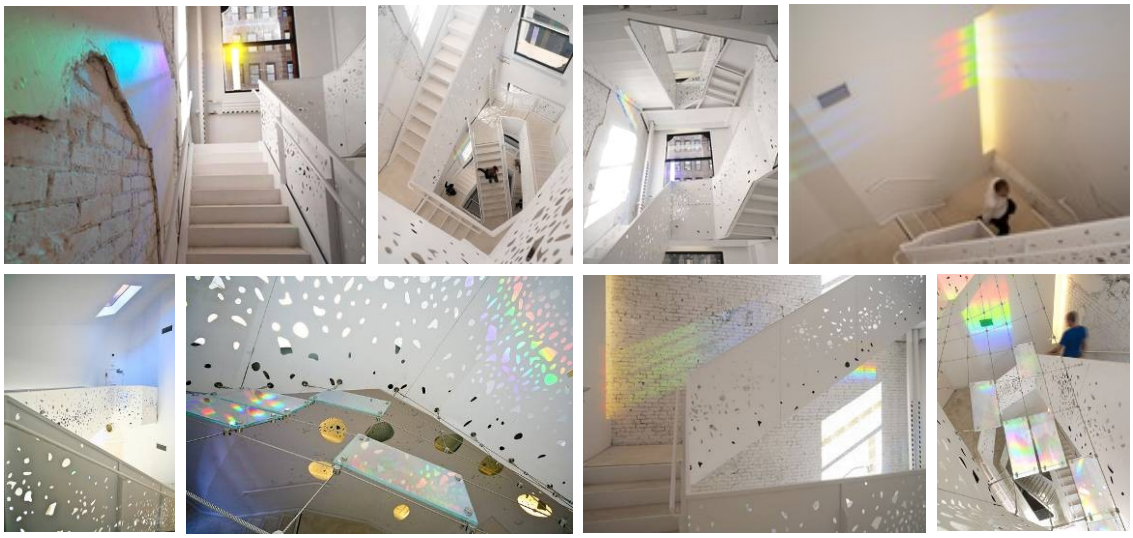

Figure 5: Tower of Light - reflection and refraction effects (Source: Steven Holl Architects, 2007)

Influenced by Wittgenstein (1977 [1996:19]), the Steven Holl Architects studio, introduced ephemeral colour by placing appling strips of prismatic film over the windows glass. As light passes through, shifting rainbow hues scatter on the entire volume with unexpected angles. As mentions Lalonde (2008, apud Mckeough 2008: 134) "it's completely low-tech. (…) during different seasons and times of day it bounces an unpredictable rainbow light effect through the space".

The organization of the upper floors is modest and includes, namely, the reception, faculty offices, graduate students offices, reading area, seminar room, library, meeting room, chairs office, lounge and kitchen. The principles of the Golden Section module are visible in the proportions and an achromatic colour scheme (black, white and grey) reinforce the Wittgenstein's idea (1977 [1996:67]) that light, people and personal possessions adds colour to the spaces. The ground floor breaks this colour scheme because the studio "(…) envisioned as a "wood and cork raft" upon which the other levels would float" (Lalonde, 2008 apud Mckeough, 2008: 136).

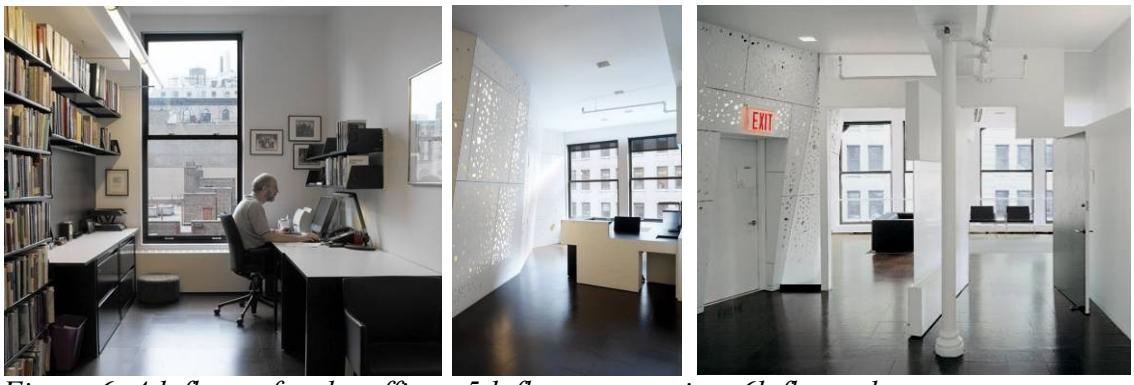

Figure 6: 4th floor - faculty offices, 5th floor - reception, 6h floor - lounge

Following this approach, the studio created a sensitive language that establish a dialogue between art and science, a perceptual experience as a field of possibilities for knowledge, invested by the plasticity and beauty of shapes, textures, light, shadow, colour and materials. This theoretical framework based on the Merleau-Ponty's Phenomenology (1945 [2002: 11]) opened up to the concept of perception, sensation and its relationship with body and movement. That is, unfolds the understanding of the body as a sensitive model in the construction of knowledge and the production of subjectivities in the space.

> Architecture holds the power to inspire and transform our day-to-day existence. The everyday act of pressing a door handle and opening into a light-washed room can become profound when experienced through sensitized consciousness. To see, to feel these physicalities is to become the subject of the senses".
>
> (Holl, 2006: 40)

Throughout the building it is visible the use of environmentally friendly methodologies and the carefully selected sustainable materials and products that upgrade the building's performance. The innovative design of elements, such as, millwork, furniture, coat hooks, door hinges, door handles and light fixtures, evoke spatial moments that create a striking aesthetic experience and solve a sociological issue, providing spaces of unique character.

This experience also afforded through the idea of hinge space - a pivoting wall that opens up so that two separate spaces merge together (similar to the Storefront for Art and Architecture Building) allow for a certain degree of fluidity materialized in an open and flexible spatial organization. Furthermore, the ratio between the height and width of the spaces, the "cutting through corners" in desks and some doors that take a "L" shape, inserted exactly where perpendicular walls meet, express a carefully study of the details, merging with the architectonic whole as a *sensitive memory*.

Figure 7: Lounge, 5th floor plan - scale: 1/300 (Source: Steven Holl Architects, 2007)

The manipulation of several values associated to the architectonic conception demonstrates that feeling and understanding are organized in the same act of signification, possible by our bodily condition and the occurrence of movement. This circumstance, as stated Heidegger (1927, apud Santos 2008: 1), through the neologism "Dasein", opens to the possibility of a rationality that emerges from the body and the biological, emotional, social, historical senses. This understanding is significant to resize the phenomenon of knowledge, relating it to the lived experience, the body and the senses.

Digital Water Pavilion

Located in the Meander Ranillas, left bank of the Ebro River and neighborhood of Rivergate in the municipality of Actur-Fernando Rey of Zaragoza, the Digital Water Pavilion (DWP) was integrated in the innovative urban-technological project "Milla Digital", and designed by Carlo Ratti Associati studio in collaboration with the MIT Senseable City Lab, for the International Exhibition "Water and Sustainable Development".

Figure 8: Ortophotomap and exterior view (Source: Gloogle Earth, 2014; Carlo Ratti Associati, 2008)

The overall concept of "Milla Digital", consists in functionally and visually connect the old city with the new, through a network of educational and community facilities, public spaces and special urban features. While the project is not yet complete, strives to achieve a successful integration of digital and physical elements, layered across the urban environment for the production of knowledge, innovation and creativity, based on the main idea of sustainable urban growth (Belloch, 2008: 9).

The first phase of the project was implemented with the exhibition, coordinated by the *Bureau International des Expositions* (BIE), held between the period of 14 June and 14 September 2008 and, tended to discuss the prospects of the future of humanity, integrating several ethical and technological aspects. That is, was designed to be an interactive and open-source gateway to citizens, institutions and companies in the future.

Marking the benning of this journey and remaining above all an outdoor structure, the design for the water pavilion grew out of a general principle which features the theme of water but it is at once a prototype for investigating the digital technologies in the public realm. An opportunity to illustrate the potential of digital architecture, inviting visitors to explore the roles that technology, science, and human spontaneity can play in balancing our environment.

In relation to and influenced by Le Courbusier (1925, apud Zuppinger 2009: 1) argument "machines à habiter", Carlo Ratti Associati studio played a critical sense about the concept of fluidity and reconfigurability in architecture by exploring its boundaries and making a building that is "fluid in the literal sense of the word. But also fluid as a reconfigurable, responsive building" (Ratti, 2008: 19).

Conceived as an extension of a wet and responsive pathway that stretches in levels between Portillo, Almozara, and Rivergate neighborhoods named the Paseo del Agua, the Pavilion enables to make, through its movable structure and colour, visual relationships at different levels with the landscape. The structure has been reduced to a minimalist configuration with four components: a reinforced concrete basement with its foundation; a reinforced concrete ground floor; two internal steel box-structures; and a moveable steel roof supported by twelve hydraulic pistons.

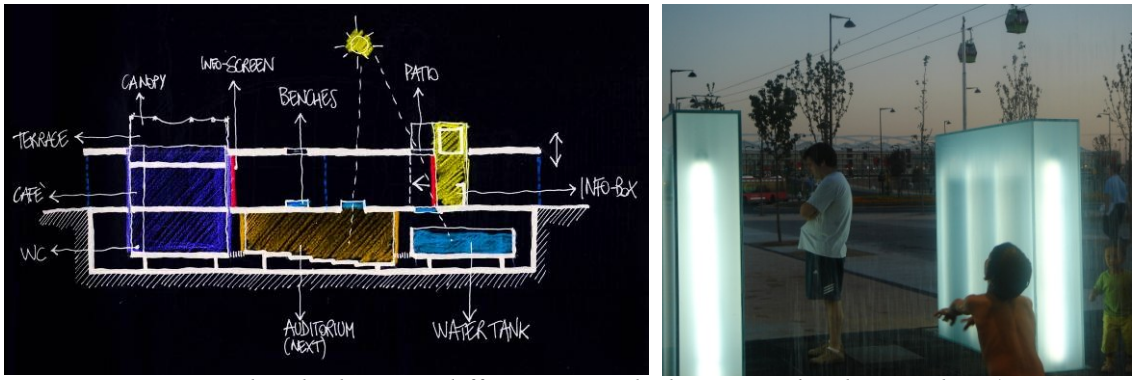

Figure 9: Design sketch showing different uses; lightness and ephemerality (Source: Carlo Ratti Associati, 2008)

The presence of water and digital technology along the perimeter and additional internal partitions creates spaces that are flexible, changeable and responsive through time. Each wall, composed of digitally controlled flow of water, can potentially become a boundary, entrance or exit, display graphics, patterns or text, connect sensors to create an interactive digital-physical environment, while the internal partitions can shift depending on the number of people inside.

Similar to an inkjet printer on a huge scale, the wall's surface is described as a one-bit-deep, 100m x 4m digital display that continuously scrolls downward. At its core, is a curtain of falling water with gaps at specific points, a pattern of pixels created from air and water in fusion with the information and the sensations.

> While the falling water conveys visual, auditory and tactile sensations and emotions its programmable character and the information it can convey demonstrate in a convincing way the possibility of blurring the distinction between the spheres of immediate sensation and mediated communication.
>
> (Picon: 2008: 34)

This approach creates flexibility and allows it to remain open to multiple interpretations through the effects of water (reflection, refraction, diffusion, and distortion) and its essential qualities (fluid, dynamic and transparent), giving a feeling of lightness and ephemerality. These effects, simultaneously: bring colour, shadow and light into the space throughout the day; encourage people to become performers on an unexpected stage and create an intimate ambience of contemplation referring us to Steiner's (1981: 12) idea, that the body experience in space involves the interaction between all senses. A sustainable idea to illustrate how buildings in the future may change their appearance from moment to moment based on necessity and use.

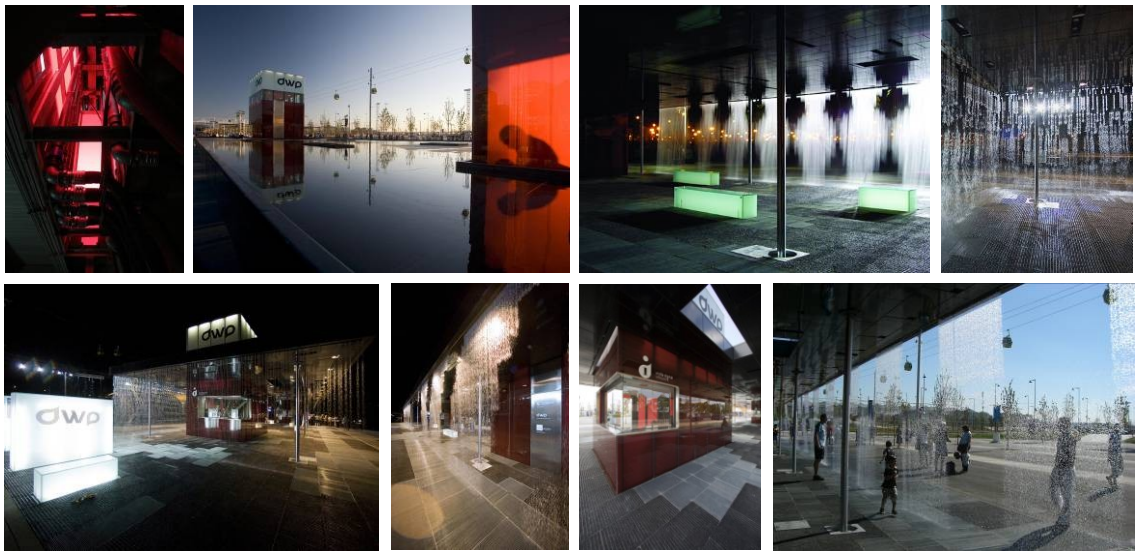

Figure 10: A sensorial experience - architecture as experience (Source: Carlo Ratti Associati, 2008)

To achieve maximum outcome with a minimum of resources, the water is recycled and managed to minimize leakage losses, while the cooling effect of the vapor eliminates the need for air conditioning. This hydrologic cycle was designed to be an open system; its technologies can be improved and developed over time. The pavilion thus contains a computer's software that process the information gathered by the sensors and transmits commands to the solenoid valves, lasers, cameras and radars. Furthermore, is linked to an internet plataform allowing to a remote interaction via software applications, text

messaging (sms) or can be extended to include lighting effects and interactive sounds systems.

Passing through the water walls, emerge two asymmetrical volumes containing the "Milla Digital" info point and the tourist office that has been transformed into a café after the Expo over. Both structurally help to stabilize the roof, define the circulation system as well as an internal-external system of spaces in reference to the Mies van der Rohe's Pavillion for the Expo of Barcelona (Cal, 2008: 69).

Figure 11: Light, shadow and colour effects (Source: Carlo Ratti Associati, 2008)

The material elements are made of coloured laminated glass and stainless steel. The chromatic colour scheme is used as a signaling system and present three basic functions in space: identification (creation of the identity of the project– DWP), sectorization (differentiation of the elements in relation to environment) and hierarchization (separation and differentiation of different types of messages on the same element). The legibility and contrast is enhanced by the material's transparency which allow the passage of natural and artificial light and creates several chromatic sensations according to the seasons, day/night or use requirements.

The exhibition area (space in between the volumes) constituted by a few glass benches and a perforated aluminum floor is another medium of additional information, displayed on interactive screens and projected videos, and in a different situations can have a wide array of spatial configurations. Furthermore, we could also describe it as a switch on-off structure where the roof plays an essencial role in the design of it. It is the source from which the digital curtains flow to the ground level playing a central role in drawing the flow of people moving through the water and through the movement.

That is, when the roof is down the building disappears and offers just a minimal space of 50 m2 of flat water that softens the light and reflects the volumes; when the roof is up (at its highest point 4.5meters), the pavillion is open and 400 m2 can be used, offering shadow and shelter (Cal, 2008: 69). Considering the structure and circulation concept, in the upper level the "Milla Digital" volume contains a meeting room and is illuminated to be seen from far away; the Café volume hosts a terrace with outdoor seating, where visitors may enjoy the view of the surrounding landscape.

Function and technical issues are paramount in the organization of the lower level, containing spaces, such as, the water tank, the technical room, the toilets and the service in

order to highlight the main purpose of the building: revealing water, while obscuring the highly complex technological features needed to draining, collecting and recycling water. Through technological achievements, the tangible and intangible properties of the space, intervenes in the affective relations between people. This intriguing experience challenges our understanding of phenomenology in the digital age and leads us to the concept of atmosphere defined by Böhme (1995: 33) as "spheres of presence", a specific experience of spatiality through texture, shadow, light, colour, air, sound and odor.

Figure 12: Composition, reconfigurability and comunication (Source: Carlo Ratti Associati, 2008)

TxOom

Under the Culture 2000 Program, FoAM with the collaboration of four European organizations (Time's Up, Kibla, Interactive Institute and Future Physical) and some independent artists was started to develop at the Hippodrome circus, between November 2002 and April 2003, a series of prototype spaces - interactive and responsive to the human body - *TxOom*.

Figure 13: Ortophotomap and exterior view (Source: Gloogle Earth, 2014; Jelltex, 2012)

The Hippodrome Circus dated from 1903, near by the seafront and surrounded by seaside entertainments and catering, represents a cultural framework in the society of Great Yarmouth City. The imaginary of young and adults is aroused by artists that bring to the circus stories of freedom, beauty, expression and overcoming. The implementation of this

project within such historic and cultural context constituted an unusual and meaningful experience in the daily life of some inhabitants.

Designed as an imaginary "eco-system" or "universe" and crossing the fields of design, architecture and sciences, this public experiment speculated on space, technology and living matter, acting as an interface between the familiar and the unknown. A figment to probe at the social and environmental impact of emerging biological and technological futures and a way to form a new creative practice on a human scale that reaches beyond specialist boundaries.

Influenced by the *TGarden* and *Sensory Circus Installations*, *TxOom* was oriented to establishing spatial situations for a limited period of time, similiar to a media performance or choreography. Modeled as particles moving on flexible surfaces, the individuals participated wearing a costume outstretched to the architecture and outfitted with basic sensing capabilities and were invited to actively participate in the growth and transformation of the space, shaping their synesthetic experiences.

In this context, the experience of *TxOom* was started in a dressing chamber with an assistant that invited the individual to choose from a set of costumes with different characteristics. Serving as phenomenological experiments: some were made of a transparent skin that clothes the individual in a heavy armor; others made of white fabric increased the individual's volume but keeped the individual's weight unchanged; and some riped as the individual walked or glued to different surfaces.

Figure 14: Costumes serve as phenomenological experiments (Source: FoAM et al., 2003)

Encapsulated in costumes that defamiliarized the body, the assistant adviced the individual to use all senses in order to discover the environment and became the ambient matter. As Kuzmanovic & Gaffney (2005:11) mentioned "these costumes contained accelerometers and cabling, woven into the materials, enabling the system to sense gesture and movement, as well as the materials' physical characteristics". To provide a comfortable setting where individuals could forget the technology wore in their costumes, the electronics were embedded ensuring aesthetic and functional integration with the structure of the garments.

The experience continued, and led to the circus arena filled with digital media (e.g. computer graphics, sound modulation and ambient lighting) and physical structures (e.g.

soft walls, active materials, pliant costumes and some objects aluding to hybrid creatures). Each body walked into the space with a finite amount of liquid heat. The heat equals light and generated a magmatic convection or ephemeral colour. Therefeore, each time the individual entered the space could find a different texture, light, colour and dynamic, while the music may be driving and percussive one time or static the next.

The media and the shapes of the materials were carved out of imaginary air-flows in a poetic allusion to the circus show. That is, the dynamics in space and the different media states were created through the individual's gestures into visual and sonic projections leaving marks and traces, in real time composition, around different surfaces, providing unexpected situations.

> The kinetic energy that players' movement generates is "recycled" into sounds, light and visual textures, rendering effects of movement visible in the space in which the movement happens. (…) Movement is not just a propelling force, but a generative force - it gives form and behaviour to the simulated life-forms in txOom's irreal eco-system.
>
> (FoAM et al., 2003: 1)

This hybrid space was defined through these signals wirelessly transmitted to a network of computers in a combination of *texture* (Tx) and *bloom* (Oom) and multiples scales of time, gesture, beat, state, session and day. Everything that was visual and auditory seemed to be made by bears aquatic kinematics or living entities and creatures of the sea. According to FoAM et al (2003:1) stated "we produced two environments which were thick, malleable and layered as a texture, elegant and responsive as a bloom".

Figure 15: Phytoplankton bloom, Jellyfish bloom and Noctiluca Scintillans (Source: Nasa, 2013, Janne Hellsten, 2009; Maria Antónia Sampayo, 2007)

The biological, social and cultural phenomenons are explored, away from the static representations of art, integrating technologies such as gestural instruments, wearable computing, permaculture, tensegrity structures and sensor networks. A biomimetic system where each costume and material were an independent organism with particular sensibilities such as: thickness, spikiness, density and bioluminescence.

Choosing them as resources and configuring them in ways that required the intersection between physical and digital effected a significant change in the customary dynamic of looking at aesthetics and usability. Tactile, luminous and sonorous, this sensory installation virtualized partial and complex effects bringing alternatives to the relations between space, time and body. Following the ethnomethodological and phenomenological approachs, respectively, of Garfinkel (1967:4) and Merleau-Ponty (1945 [2002:11] the authors created

“tension” between the real and the imaginary, the technological and the biologic, as key ingredients to socially constructed and reconstructed matter, light and colour through the process of interpretation of the individual.

In a poetic way or magical alchemie, the individual mediated the ephemeral and the permanent, the immaterial and the material. This conception of experimentation and research both empirical and theoretical produced plastic and dynamic environments, emphasizing perception, movement and responsivity in which the animation and transformation were dependent on an active and interactive body.

Figure16: TxOom - responsive environment (source: FoAM, 2002)

> In responsive environments, human participants can manipulate digital media by modulating the physical environment around them, through conscious and unconscious actions (such as bodily movement, physiological responses, speech, and social interaction). As the environment simultaneously senses and responds to these actions, the participants become immersed in media worlds whose shape and behavior react to their presence.
>
> Kuzmanovic & Gaffney (2005:9)

Accordingly, this interest in observing the processes of interaction that occur between the individuals or groups, lead us to the idea of “intersubjectivity” or “symbolic interactionism”. The social content, the psicological effect and the visual modulations were interconnected, but the content of the media and the responses of individuals to this content were diverse. They materialize the space without a defined script or a narrative. This social reality takes place through the language and a sign, therefore, the symbolism is the result of a social interaction. Although we have an individual sense, the basis for all or any senses that each one gives to his own actions, is founded on the interactions between individual, that is, on what the "I" does being regulated by the "we" socially constructed (Blumer, 1938: 2).

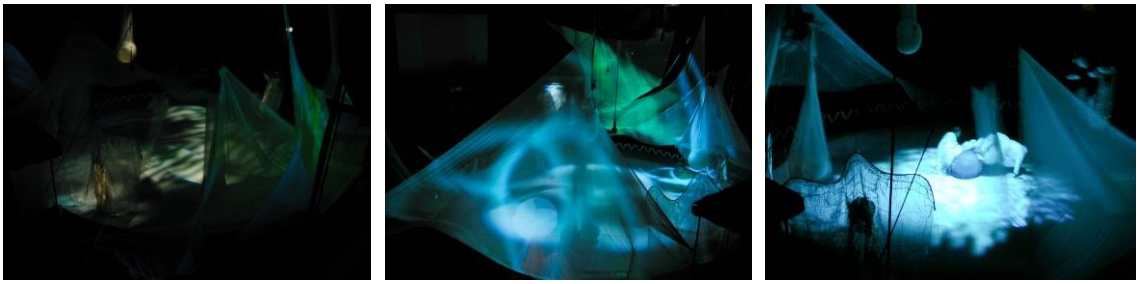

Figure 17: TxOom – experiments in space through light and colour (Source: FoAM, 2002)

Over the years, TxOom became a TRG [Transient Reality Generator], an experimeny of "mixed reality universe exploring the possibilities within virtual worlds to mutate and re-assign the laws of physics and evolution" in the spirit of an ethnographic approach (FoAM et al, 2003: 2).

Conclusions

The interdisciplinary relationship between the design, the construction and the experience is complex, dynamic and their outcomes depend upon multiple variables. It is widely assumed that some authors perceive their own processes with a unanimously conscious dilemma: the atmosphere created by the effects of colour and light can awaken all the senses, simultaneously, all the complexities of perception.

Moreover, the different flows and mutations of contemporaneity are introducing changes that break the paradigms of the relationship between object and observer, the presence of the individual in space and the embodiment of space. In this context, new notions of spatiality and plasticity are exploited by integrating flexible digital technologies in space, however, the improvement and innovation in applying light and colour, frequently, are associated with artistic and scientific achievements.

Therefore, emerges the need for understanding the different levels of interaction and the significant links created by exploiting the functional and qualitative potentialities of light and colour that determine the experience in space. Furthermore, the mediation of the decision making is fundamental during the process of design and construction in order to humanize the spaces, address ecological issues and benefit our experience, wellbeing and health.

The structure and methodology analysis was therefore appropriated as a vehicle to outline new possibilities for thought and action in the future. The analysis of the projects *NYU Department of Philosophy, Digital Water Pavilion and TxOom* bring us to the idea of architecture as an organism with various elements (organs) dependent of each other and in interaction with other organisms (human beings) who react and interact with space. Within this scope, light and colour are elements that influences the ensemble space-individual and contributes to display a phenomenological understanding of the permanent-ephemeral/visible-invisible.

Crossing several areas of knowledge, it is evident in Steven Holl Architects studio's approach the influence of the materials in the idealization of the spaces. The materiality is a source of sensations that highlight a moment in time and space. Arousing the imagination and interaction between the program, context and individuals, the plasticity of the environments are enhanced by its natural essence through texture, colour, light and shadow.

Underlining the simplicity and the unity, the studio's expresses concern with the symbolic and functional load that the "stain" acquires in space. The light becomes an autonomous element and the surfaces that appear as auxiliary elements involve the production of environments filling the subjectives variables of the individual in an elaborate process of language.

Meanwhile, Carlo Ratti Associati studio explored the potential of emerging materials through the idea of fluidity and reconfigurability, working the dissolution of boundaries between physical and digital, inside and outside, observer and object, culture and nature. This dynamic is guaranteed through mutations and flows that manifest and express the passage of time, light, shadow, transparency, chromatic phenomenons and texture.

Colour and light play both aesthetically and emotionally, for the experience of the space and place. The colours of the materials behave according to their lighting and the reflection of light offers different visualizations. The emphasis is placed on design, reviving their physical limits, in response to the local climate conditions, the energy efficiency and the architectural expression.

Foam et al invite the "nature" and the gesture of the individual to take account of the intervention, personifying the significance and the mutations that acquired in the space. Elements, such as, light, colour and shapes are unique throughout the performance, creating distinct effects and stressing the importance of time and senses emancipating their use as future tools.

This poetic response to some challenges concerning performance and responsive media technologies softens the appearance of precise and defined environments by exploring the dilution of the boundaries between interior and exterior, public and private. That is, the individual is invited to experiment through temperature, air humidity and the visual richness the meaning of life, movement, balance, thought and language.

In addition, we recognize that both authors reveal responsibility and awareness conserning the domain of space, exalting and experiencing the limits of performance of Art and Architecture and, contributing for the improvement of an interdisciplinary discussion that in the contemporaneity asserts itself as a necessity. Currently, the logic of thoughts and procedures are changing, although the individual is surrounded by technologies, the transformation of an environment do not always depend on the insertion of the "machine", of another materiality or form.

Therefore, it is pertinent to understand for which individuals the spaces are being produced and create new relationships which reflect on the theory and practice of actual

society. Such condition means revisiting the notion of representation and image of light and colour based on the body as triggering sensory-perceptual whole.

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Experimentación y aplicación contemporánea de colores textiles precolombinos de Chile.

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ABSTRACT

This research shows the experience of work about an exploration, visualization, observation, comparison, conceptualization and reflection, of a set color codes; as a representational and identity elements of our cultural heritage. The colors used have been detected in the realization of a Chilean research project, in which the researchers identify colors from parts of Pre-Columbian textiles from northern Chile, find in the Chilean Museum of Pre-Columbian Art in Santiago. To the rescue of visual memory, efficient communication and use, in different cultural spaces through contemporary technologies and processes. The experiments were performed with a collection of 35 colors of the total detected, beginning with the mathematical translation of the L*a*b* values obtained by spectrophotometer to RGB codes, in order to display and show the exact value of each hue. Based on these values, the colors are sorted by perceptual HSB color model (Hue - Saturation - Brightness) establishing them in depending of its three properties. This proof the color relations about order and amount presented between them. Were used digital 3D visualizations and infographics. Then colors are arranged in groups and worked with them looking for synaesthetic relationships, degrees of brightness and color distribution. Next we exercise visual sensitivity creating conceptual proposals, in line with the observation of chromatic atmospheres, given by the formulation of schemes, color combinations and harmonies. Finally the colors are applied in contemporary images of graphic, web and object design, using digital chromatic montage, observing brightness degrees and color hierarchy. Experimentation achieves the communication, transmit and disseminate the colorful present in Pre-Columbian Andean textiles, considering it a visual value and cultural heritage and patrimony.

Introducción

La colección textil del Museo Chileno de Arte Precolombino de Santiago, atesora piezas precolombinas del norte de Chile en un estado de conservación de calidad. Estas se han mantenido a través del paso del tiempo, debido a que permanecieron en gran parte, en tumbas funerarias en zonas climáticas desérticas propias del norte del país, lo que ha permitido mantener tanto la materialidad de las piezas, como la fidelidad los colores presentes en ellas. Aún así hay que considerar que existe deterioro y desgaste cromático propio del uso, manchas y oxidación. Sin embargo se debe destacar el profuso repertorio cromático y las armónicas combinaciones presentes en estas, en conjunto con su avanzada tecnología textil.

La riqueza cromática de los textiles precolombinos es reflejo tanto del vasto conocimiento y manejo de los colores y combinatorias por el hombre precolombino, como de la abundante materia prima tintorera disponible. Esto en conjunto con la complejidad de las técnicas textiles aplicadas en los tejidos, da por resultado una amplitud cromática, atractivas mezclas, interesantes interacciones y diversos efectos cromáticos.

Esto fue lo que indujo a un grupo de especialistas chilenas a elaborar un proyecto de investigación *"El color en los textiles de las culturas andinas precolombinas del norte de Chile: Estudio y propuesta metodológica para la clasificación y comunicación de sus códigos cromáticos como elementos representacionales e identitarios",* bajo el apoyo del Fondo Nacional de Desarrollo Científico y Tecnológico, *Fondecyt: N° 1100914.*

El objetivo del proyecto fue detectar los códigos cromáticos que identifican a los textiles, para el rescate de su memoria visual, su comunicación eficiente y utilización en diferentes espacios culturales contemporáneos mediante tecnologías y procesos adecuados. (Hoces de la Guardia, Brugnoli, Jélvez, Cox 2011 [Informe Final, *Fondecyt: N° 1100914*]).

La presente investigación muestra la experiencia de trabajo de un proceso de exploración, visualización, observación, orden, comparación, conceptualización y reflexión de estos códigos cromáticos.

Metodología de captura cromática y selección de colores.

Para medir la reflectancia de los colores de las piezas textiles, se implementa una medición instrumental con un espectrofotómetro portátil Datacolor. Decisión basada en la necesidad de contar con resultados cuantificables, confiables y sin variabilidad; y considerando que en la actualidad los avances tecnológicos han permitido que este tipo de instrumento arroje resultados de alta calidad atendiendo las condiciones antes mencionadas. Esta elección considera también la fidelidad cromática, mantenida en el traspaso de la información numérica arrojada por el espectrofotómetro hacia distintos modelos de color: RGB para visualizar las muestras de color en pantalla y CMYK para imprimir dichas muestras y realizar evaluaciones cromáticas visuales. La información colorimetría fue calculada usando el ilumínate D65 y el observador estándar suplementario de 10º recomendados por la CIE (Cárdenas 2011 [2011: 45]).

La selección a medir, del total de piezas textiles precolombinas del norte de Chile, presentes en el Museo Chileno de Arte Precolombino de Santiago, la realiza un grupo de diseñadoras textiles, expertas en el tema, con participación previa en proyectos de índole similar (*Conicyt* 207, *Fondecyt* 91-0602, 1940091, 1970110, 1010282, 1080600). Se seleccionan 42 piezas basándose en criterios visuales que abarcan desde la variedad y diferencia cromática, estado de conservación y limpieza de las superficies de las piezas, tamaño y textura uniforme de los espacios de color apropiados para la medición y finalmente la variedad de estas. En esta medición se obtiene una carta de color con 204 valores colorímetros. (Hoces de la Guardia, Brugnoli, Jelvéz, 2011 [2011: 67.92]).

Los valores se ordenan matemáticamente en el modelo de color HSB (en inglés *Hue, Saturation, Brightness*, en español matiz, saturación y luminosidad), basado en la percepción del ser humano y en las tres dimensiones del color; y se realiza una selección de matices, escogiendo aquellos que presentan una diferencia visual significativa. Se obtiene una carta de color con 73 matices.

Con el fin de comprobar el comportamiento de los colores impresos, se realiza una prueba de color e impresión en offset en una imprenta de calidad y prestigio de Chile (*Wordcolor*). En base a la cual, finalmente se realiza una última selección mediante comparación visual, escogiendo los colores de mayor diferencia entre sí, respetando las familias cromáticas y las cantidades de cada tono. Se obtiene una carta final de 35 colores, con sus respectivos valores cromáticos.

Metodología de Trabajo

La investigación se inserta como parte de la metodología de enseñanza, en modalidad de "Proyecto de Investigación", para los alumnos del curso "Materiales y Combinaciones Cromáticas en la Industria del Diseño", cátedra optativa de profundización que dicta semestralmente en la Escuela de Diseño de la Pontificia Universidad Católica de Chile, la profesora María Rosa Domper R.. Dicho proyecto se desglosa en 5 etapas las que van asociadas a los temas expuestos en clases y desarrolladas en una serie de ejercicios prácticos, donde la toma de decisiones por parte de los alumnos va en estrecha relación con los contenidos transmitidos y son respuesta de los conocimientos que van adquiriendo y de las habilidades en el manejo técnico - práctico que van obteniendo durante su ejercitación.

Los tópicos que abarca el Proyecto van asociados a las temáticas que se enseñan en la primera y segunda unidad del curso, las cuales son: interrelaciones y composición de los colores en el círculo cromático; dimensiones del color; colorimetría: medición y control del color; comprensión y utilización de modelos de color; agrupaciones o familias cromáticas; creación de armonías en esquemas cromáticos, identificación de colores dominantes, mediación y acento; construcción de paletas cromáticas y variación de intensidades y extensión de estas mediante el triángulo de Birren (1900 [1987: 212]), detección de relaciones lumínicas, composición de combinaciones y creación de proporciones; ejercitación conceptual como fuente de inspiración sugerentes para definir ambientes y atmósferas cromáticas.

El trabajo se realiza en modalidad grupal, destinando tiempo para trabajar durante las sesiones de clases y personal, en el tiempo destinado por los alumnos al desarrollo de tareas del curso. Se otorga la posibilidad de corregir avances y aclarar dudas con el profesor y/o ayudante durante el desarrollo del proyecto.

Desarrollo

Etapa 1

El trabajo comienza en base a los códigos cromáticos de la carta de 35 colores finales, seleccionados mediante la metodología antes mencionada, en el marco del desarrollo del proyecto *Fondecyt N° 1100914*.

Los códigos, están expresados en valores numéricos correspondiendo al espacio de color CIELAB (CIE 1976 L*a*b*) y acompañados de una sigla alfabética de fantasía para nombrarlos.

*Tabla 1. Extracto de la carta de 35 colores, que presenta las siglas alfabéticas de fantasía y los valores CIE L*a*b* obtenidos en la investigación.*

CÓDIGO	L*	a*	b*
GNE	16.44	0.44	0.27
F VI	26.98	3.91	4.85
AZ AG	58	-13	-9

Se entrega a los estudiantes un listado, en formato Excel de los 35 colores, con sus respectivas siglas alfabéticas y valores L*a*b*. Ellos deben convertir estos datos al modelo de color RGB, (en inglés *Red, Green, Blue*, en español rojo, verde y azul), espacio de color que es formado por los colores primarios luz. Se utiliza este lenguaje debido a que todas las etapas del proyecto se desarrollan en formato digital, siendo este espacio el adecuado para representar imágenes que serán mostradas en monitores de computador. Las imágenes RGB utilizan tres colores para reproducir en pantalla hasta 16,7 millones de colores. Las pantallas y proyectores muestran siempre los colores con el modelo RGB, esto significa que al trabajar con modos de color diferentes, como CMYK (en inglés *Cyan, Magenta, Yellow* y *Black* en español cyan, magenta, amarillo y negro), los programas computacionales convierten temporalmente los datos a RGB para su visualización.

Para convertir los valores CIELAB a distintos espacios de color, se requiere de fórmulas matemáticas complejas, hoy en día existen diferentes programas y sitios web confiables y gratuitos para realizarlo. Para este trabajo se realiza dicha conversión introduciendo los valores L*a*b* al programa *OpenRGB* de *Logicol S.r.l.,* versión 2.10.91215 (*Copyright 2008*), aplicación para *Windows* diseñada, entre otras cosas, para realizar conversiones entre los distintos modelos y estándares de color. Este programa permite introducir el tipo de iluminante estándar CIE (C, D50, D55, D65, D75, F2, F7, F11, A) y de observador estándar CIE (2° (1931) o 10° (1964)) utilizado en la obtención de los valores y el valor gama (relacionado con el *gamut* de cada pantalla de computador, siendo el 2,4 de uso estándar para la mayoría de estas), informaciones necesaria para una fidedigna conversión. Y muestra una visualización aproximada del color que se está trabajando. Como se menciona anteriormente, debido a que la medición fue realizada con iluminante D65 y observador estándar 10º, ambos datos son preestablecidos en el programa.

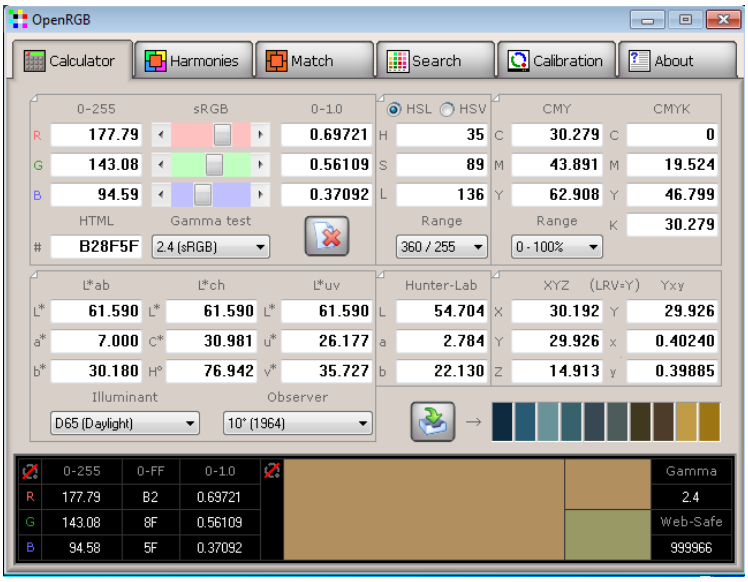

Figura 1. Visualización de la pantalla del programa OpenRGB de Logicol S.r.l., versión 2.10.91215 (Copyright 2008).

En modalidad de trabajo grupal, se obtienen los valores RGB para cada color. Con estos datos, mediante el programa de manejo gráfico Adobe Ilustrator (AI), se crea una muestra cromática en formato digital, junto a estas se coloca la sigla alfabética de fantasía para nombrarlos y los valores numéricos de RGB.

AZ AG
R 102,61
G 146,74
B 153,41

Figura 2. Muestra cromática creada digitalmente en el programa Adobe Ilustrator. Cada muestra se presenta acompañada de su respectiva sigla y de los valores de RGB.

Etapa 2

Utilizando las muestras cromáticas realizadas en Adobe Ilustrator de la etapa anterior, se busca en el programa los valores de matiz, saturación y luminosidad para cada una. Basándose en los datos obtenidos se ordenan los colores según el modelo de color perceptivo HSB y se representa gráficamente mediante infografías y/o visualización en 3D

digital. Cada gráfica debe incorporar la simbología que explica el orden y las relaciones que se establecen entre los datos.

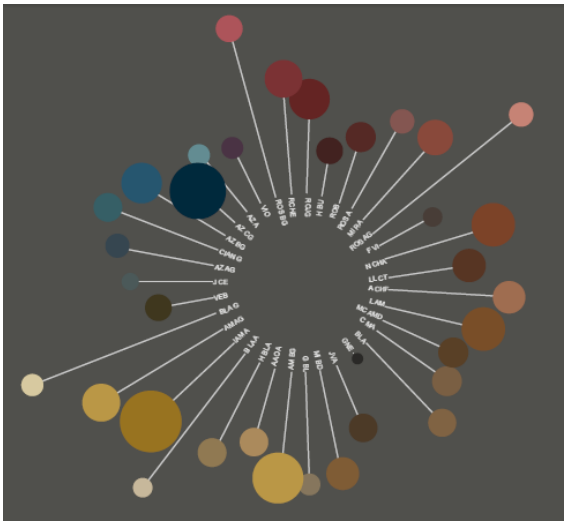

Figura 3. Detalle de infografía de orden de los colores según coordenados HSB realizado por la alumna Nadia Villota Tapia, septiembre 2014.

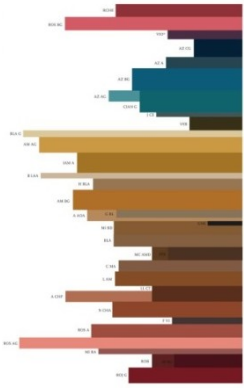

Figura 4. Detalle de infografía de orden de los colores según coordenados HSB realizado por la alumna Daniela Alarcón, 2011

Figura 5. Visualización de animación 3D, de orden de los colores según coordenados HSB realizado por el alumno Francisco Ponce, septiembre 2014.

Etapa 3

Se ordenan los 35 colores en agrupaciones o familias cromáticas basados en criterios preestablecidos por los alumnos y se colocan en el círculo cromático, manteniendo la distribución de los colores principales, secundarios y terciarios.

Se escogen matices para crear esquemas cromáticos armónicos, identificando colores dominantes, mediación y acento para los 5 tipos de armonías expuestos en clases: armonía complementara, complementaria cercana, doble complementaria, triada complementaria y gamas. Se justifica la elección cromática mediante la representación grafica esquemática de las relaciones armónicas en el círculo cromático.

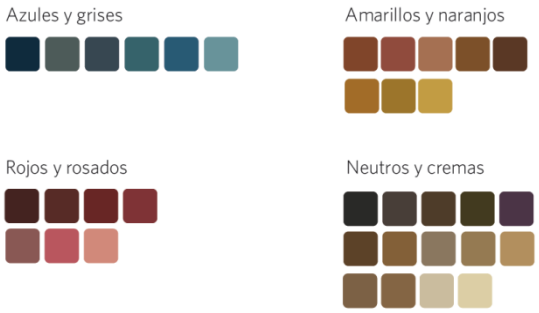

Figura 6. Familias cromáticas realizado por la alumna Francisca Valenzuela, septiembre 2014.

Figura 7. Distribución de los colores en el círculo cromático, realizado por la alumna Francisca Valenzuela, septiembre 2014.

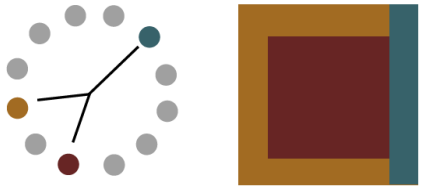

Figura 8. Armonía complementaria cercana, realizado por la alumna Valentina Sánchez, septiembre 2014.

ETAPA 4

Se realiza la construcción de paletas cromáticas de 5 matices cada una, ordenados por temperatura cromática y luminosidad; basadas en conceptos escogidos por los alumnos e inspirados en imágenes con ambientes cromáticos alusivos a la carta de color. Ejercitación de cantidades y proporciones de los colores. Propuesta de paletas complementarias, introduciendo colores adicionales, mediante manejo de luminosidad y saturación cromática. Creación de nuevos esquemas armónicos definiendo color dominante, color acento y color mediación.

Figura 9. Trabajo conceptual apoyado con imágenes, paletas cromáticas, trabajo de proporciones, colores adicionales y armonías, realizado por la alumna María José Ricci, septiembre 2014.

Figura 10. Trabajo conceptual apoyado con imágenes, paletas cromáticas, trabajo de proporciones, colores adicionales y armonías, realizado por la alumna María Jesús Álvarez, septiembre 2014.

ETAPA 5

Los alumnos deben escoger un diseño gráfico, web, objeto, publicidad, entre otros; que presenten deficiencia en su aplicación cromática, ya sea porque su propuesta de color no está de acuerdo al concepto, al público objetivo y/o a su contenido. Deben reconocer los colores acento, mediación y dominante y armar el esquema armónico correspondiente. Mediante fotomontaje digital deben reemplazar los colores presentes en el diseño, por las armonías de la etapa anterior. Se debe poner especial atención en mantener la misma distribución y disposición de los colores dominantes, mediación y acento, para así reemplazar considerando la luminosidad de los colores.

Figura 11. Fotomontaje digital, realizado por la alumna Valentina Sánchez, septiembre 2014.

Conclusiones

La visualización digital mediante infografías y representaciones en 3D, permiten observar las relaciones presentes entre los colores y a su vez ayuda a analizar sus comportamientos. Transmiten información cuantitativa respecto a la distribución de cromática, destacan grupos de matices similares, se diferencian los niveles de luminosidad y se establecen relaciones con la saturación.

El armar familias cromáticas buscando de manera libre conceptos para nombrar a los grupos, permite observar con detención los colores y buscar los apropiados que aúnen los colores respecto a un mismo criterio, ya sea por semejanza de tono, comúnmente utilizado, en grupos de rojos, azules, amarillos, tierras, grises, entre otros, como por conceptos alusivos a la propia creatividad del alumno, no necesariamente relacionados con el matiz, por ejemplo relativos a metales y minerales como, cobre, óxido, azufre, cuarzo, entre otros; conceptos que han estado presentes en los grupos creados por alumnos.

La finalidad de distribuir los colores en el círculo cromático es facilitar y hacer evidente la formación de armonías, estableciendo visualmente las relaciones naturales de los colores espectrales, la similitud de los colores adyacentes y el contraste de los opuestos. La visualización de los esquemas armónicos demuestra el comportamiento de los colores, realzando aquellas elecciones, donde el color "funciona" bien junto a otro, considerando que la sensación de armonía tiene su origen en las relaciones y en las proporciones de sus componentes cromáticos. Empleando el círculo cromático y los esquemas armónicos, se denota y se hace evidente la correcta proporción, equilibrio, nivelación visual y correspondencia entre combinaciones de colores.

La incorporación de imágenes alusivas tanto a los conceptos propuestos como al colorido trabajado, permite transportar al espectador a atmósferas cromáticas concretas, referidas a ambientes colorísticos que hacen tangible los conceptos y los refuerzan. Y a su vez permiten crear paletas de colores distintas entre sí y trabajar las proporciones según los distintos equilibrios y fuerzas cromáticas presentes en las imágenes. El proponer nuevas paletas de color, complementarias a las previamente establecidas mediante el trabajo conceptual, introduciendo colores adicionales mediante el manejo de la luminosidad y saturación cromática, permite entregar una metodología para poner a disposición riqueza y variedad cromática. Se detecta y destaca la pertinencia de presentar imágenes que transmiten sensaciones colorísticas alusivas al imaginario propio del país, relacionadas con la flora y fauna, paisajes, detalles de elementos y materiales de nuestra artesanía, entre otros.

Finalmente la aplicación de los colores en imágenes contemporáneas en montajes cromáticos digitales, observando lo grados de luminosidad y jerarquía cromática, implica poner en coordinación el sentido y relevancia que el color adquiere en una composición, entiéndase como relevancia el grado de intensidad que se le imprime a los colores seleccionados. Se obtienen imágenes que transmiten ambientes cromáticos que difieren bastamente del colorido original, denotando una sensación cromática particular característica de la Carta de Color original, de 35 colores.

Cada etapa del "Proyecto de Investigación" permite ejercitar el color de manera práctica, trabajando en concreto diferentes aspectos teóricos en la enseñanza del manejo y aplicación del color. Y complementariamente, el tema de este proyecto logra hacer visible, comunicar, transmitir y difundir el colorido presente en los textiles andinos precolombinos, considerándolo un valioso patrimonio visual y cultural y lo sitúa en el mundo contemporáneo.

Esta metodología de trabajo ha sido implementada, bajo distintas modalidades, en el curso dictado en la Escuela de Diseño en dos ocasiones anteriores (2011 y 2013), variando e incorporando nuevos ejercicios y etapas, acordes a las temáticas que se desarrollan en este. Se expone la presente, con la finalidad de compartir y debatir diversas opiniones y comentarios respecto a los contenidos y resultados y complementar la experiencia con iniciativas similares de otras partes del mundo.

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Sistematización de trabajo del color en proceso de innovación para artesanas textiles tradicionales
"Chamanteras de Doñihue", Valle del Cachapoal, Chile

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RESUMEN

Proyecto realizado en conjunto con un grupo de artesanas textiles tradicionales de la zona central de Chile, denominadas "Chamanteras de Doñihue" que producen tejidos notables desde el punto de vista cromático y de gran complejidad técnica. La pieza textil principal que tejen a telar es el "chamanto", prenda básica de la indumentaria tradicional del huaso, hombre de campo chileno, que la utiliza sólo en grandes ocasiones, festividades costumbristas o para el deporte nacional montado a caballo, llamado rodeo. Esta pieza textil, utiliza para su confección gran cantidad de hilado, de diferentes combinaciones de colores, trabajando la tejedora al menos cuatro meses continuos en ella, por lo que el producto terminado alcanza un alto precio de venta. Las tejedoras, por otra parte, dado que viven en un contexto rural aislado, tienen poco acceso a comercializar sus productos, impidiéndoles ello contar con un sustento estable. Todo lo anterior, motivó iniciar un proceso de innovación, con apoyo de las autoridades regionales, que las motive a producir otro tipo de piezas textiles, en simultáneo al tejido de chamantos, de menor complejidad y costo, sin dejar de exhibir la riqueza cromática tradicional ni las habilidades técnicas propias de su tejido, heredadas de madres a hijas por generaciones. El trabajo con la agrupación se ha desarrollado a través de una modalidad participativa entre un equipo de diseñadores, que integro como especialista en color y las tejedoras. Ha abarcado diversos aspectos productivos experimentales y de capacitación a las artesanas, entre los cuales el color ha sido un tema crucial, creando instancias de trabajo conjunto y capacitaciones en la sistematización de la elaboración de cartas de colores tradicionales y ajustes a éstas para ser aplicadas a nuevas líneas de productos. El proceso está en desarrollo y se prevé tener productos ya elaborados para presentar el proceso completo en octubre en Oaxaca.

Este proyecto se encuentra en desarrollo desde fines del año 2013 y hasta fin de 2014 y corresponde a la modalidad de proyectos financiados por el Fondo Innovación para la Competitividad Regional FIC, que provee de recursos anuales provenientes del Ministerio de Economía del Gobierno de Chile para potenciar el desarrollo económico de las regiones, mediante la ejecución de proyectos de investigación que generen conocimiento aplicable a los sectores productivos, aumentando así las oportunidades de desarrollo y calidad de vida de las personas que habitan en regiones alejadas de los centros urbanos.

En este caso concreto, se trata de innovación en la artesanía tradicional desarrollada en un pueblo llamado Doñihue, localidad situada en la zona central de Chile y donde se ha desarrollado históricamente producción de textiles de una gran calidad desde el punto de su complejidad y de su propuesta de colores: son los llamados mantas y chamantos doñihuanos.

Vista de localidad de Doñihue (imagen libro Gruzmacher citado en referencias)

Remontándose al origen de la actividad textil de esta localidad, resulta interesante recorrer el tiempo desde épocas precolombinas y luego de la llegada de europeos que traína nuevas modos de hacer, para entender el patrimonio que se conserva de esta mezcla enraizada a la cultura rural de Chile, en éste caso en la vestimenta tradicional del "huaso" o hombre campo que utiliza como prenda emblemática para grandes ocasiones el chamanto, que se constituye en un artefacto textil portador de distinciones sociales .
"El chamanto es un poncho corto, cuyas características más reconocibles son los colores fuertes, con diseños florales y campestres organizadas en listas, y una huincha ancha en todo su borde. Es usado por huasos en rodeos y celebraciones, como complemento de una vestimenta de gala, y es tejido en Doñihue, Región del Libertador Bernardo O'Higgins, Chile" (Gruzmacher [2009:9]

EL LUGAR

Doñihue es en la actualidad un pueblo con más de 16.000 habitantes situado a 22 kilómetros de la ciudad de Rancagua y a 100 kilómetros de Santiago, capital de Chile. Su nombre deriva de dos vocablos en mapudungun, lengua mapuche, *doñu* (arvejilla) y *hue* (lugar), que significa lugar de arvejillas.

La población prehispánica del lugar fue influenciada con la llegada de los españoles en el Siglo XVI, instaurándose el régimen de encomiendas. El pueblo de Doñihue existe desde 1804, como un simple caserío alrededor de una iglesia. A fines del siglo XIX existen grandes haciendas dedicadas a la cría de caballos en los campos de los alrededores del pueblo y ya en 1920 comienza la expansión de las grandes plantaciones de frutales.

EL CHAMANTO

El desarrollo de Chile se ha basado históricamente en torno al trabajo de la tierra. Este mundo agrario se organizaba en torno a la hacienda, que tenía un orden y estructura económica, social y religioso que fueron determinando su identidad. El *huaso,* o "hombre de a caballo", es un campesino mestizo, su estampa es muy reconocible, sobre todo en la zona central de Chile, donde se dedica a la agricultura y la ganadería desarrollando una cultura propia con costumbres y música particulares.

Su apero o vestimenta cotidiana del campesino chileno tiene raigambre en atuendos árabes y españoles, que son enriquecidos para las festividades tradicionales, ya sean religiosas o relacionadas a la faena agrícola, como es la fiesta del rodeo de animales.

El poncho es una prenda heredada de las vestimentas de los indígenas precolombinos y es un tejido cuadrado con una abertura central para introducir la cabeza que fue adoptado en el período de la Colonia (1598-1810) por los habitantes del país. A esta prenda original se le fueron incorporando decoraciones y remates de inspiración europea y ya los cronistas desde el siglo XVIII lo describen como una prenda distintiva del chileno, que era usado por toda la población sin distinción de clases y ocupaciones, como símbolo de amor a la patria.

El poncho corto tiene su origen en la faena ganadera, para que no dificulte el manejo de las riendas y el lazo cuando se monta a caballo, y no debe tener flecaduras que pudieran enredarse, por lo que llega apenas un poco más debajo de la cintura. También es conocida como media manta y era utilizada tanto por el peón de campo, con hilados gruesos y clores pardos, como por el hacendado que encargaba para sí un tejido con hilados finos y decoraciones inspiradas en diseños europeos y gran colorido para su uso en celebraciones.

En la cultura indígena mapuche las mujeres tejen las mantas de sus hombres, llamadas *makuñ,* y en ella colocan iconos que hablan de su posición en la sociedad. Cuando el mapuche adopta al caballo introducido por los europeos, utiliza para ello un *makuñ* pequeño, al que llama *sobremakuñ*, ya que lo coloca sobre su vestimenta. Su uso se registra a partir del siglo XIX y es una manta corta, lujosa, usada para montar a caballo en celebraciones especiales y que tiene un colorido propio: Negro, rojo, gris, verde y amarillo usados como colores secundarios.

Los chamantos muy coloridos que surgen a comienzos de 1900, reúnen el colorido e iconografía de los antiguos ponchos del siglo anterior con las técnicas del tejido del *sobremakuñ* mapuche. Este nuevo textil, tanto desde el punto de vista de su tejido como de su iconografía es de gran complejidad e implicaba tejedoras con grandes habilidades heredadas de sus antepasadas.

Este artefacto textil posee características que se mantienen hasta la actualidad, aunque sus dimensiones han cambiado, sus proporciones se han mantenido.

Es difícil datar el momento en que se inicia la actividad textil en el pueblo de Doñihue, aunque se supone que alrededor de 1920 ya se tejían "chamantos" en la localidad. Un hecho probatorio de la época es la fundación en 1911, en la ciudad de Rancagua, de la tienda "La Doñihuana", dedicada a la venta de aperos para huasos y el hecho relatado por los descendientes de su fundador, ciudadano español don Francisco Martínez, quien observó los textiles mapuches que se hacían en la zona y los encargó a las tejedoras locales cambiando los diseños por motivos extraídos de telas que traía de Europa. De ahí en adelante los chamantos serán conocidos como propios de Doñihue.

(Imagen libro Gruzmacher, citado en referencias)

EL RODEO

Esta actividad que se transformó desde una faena campesina ganadera a un deporte federado tuvo una gran influencia en la evolución de los aperos e indumentaria del huaso. A esta faena, que consistía en apartar y marcar el ganado en las grandes haciendas se le incorporó al final el lucimiento de algunos huasos que corrían animales contra una cerca, recta en un inicio, para convertirse luego en una medialuna, desde 1890 en adelante y se va transformado lentamente en un deporte, perdiendo sus características originales. Los primeros rodeos organizados como competencias entre huasos, con carreras de caballos, topeaduras y corridas de vacas ya a partir de 1912 impulsan el uso de cada vez mejores aperos, entre los que se destaca el chamanto, como prenda de lujo. Alrededor de 1950, doña María Romero Romero, proveniente de Doñihue, provoca un vuelco en la producción de chamantos, comenzando a utilizar algodón mercerizado como materia prima, dado que la lana importada comenzó a escasear, difundiendo con mucho éxito entre los compradores esta nueva modalidad, el chamanto tejido en hilo de algodón. Las chamanteras en muchos de los casos, establecen una relación personal con el huaso que le encarga el tejido de la prenda, comprendiendo que es un símbolo para quien la usa. Por lo tanto intenta satisfacer sus aspiraciones, tratando de interpretar sus ideas y traspasarlas al tejido. O sea el trabajo es colaborativo, sugiriendo ambos posibles combinaciones de colores y elección de motivos que se representarán, dentro del repertorio tradicional que conoce la tejedora.

La postura o manera en que el chamanto se usa tiene tres modalidades: Inclinado a la derecha, para dejar libre el brazo derecho, inclinado a la izquierda, para los zurdos y totalmente horizontal, usanza "a la antigua" para proteger la abertura del deterioro.

La composición visual de la superficie del chamanto, junto a las zonas labradas, hace que esta pieza se diferencie de otros ponchos o mantas que se tejen en el país. El sentido de horizontalidad está definido por la postura con la abertura de la boca casi paralela a los hombros" (Gruzmacher [2009:67]

EL TELAR

El telar en que se tejen estos complejos artefactos textiles sorprende por su simplicidad, ya que se trata de cuatro maderos estacados a una tarima, se utiliza la misma conformación pero de diferente formato, uno bajo y ancho para tejer el cuerpo del chamanto o parte central y otro idéntico pero de mayor altura para tejer la huincha. Ambos se instalan al interior del hogar de la tejedora.

Las tejedoras expertas son capaces de tejer ambas piezas, el cuerpo y la huincha, pero es común que algunas tejan sólo una parte y encarguen a otra la faltante. Incluso hay tejedoras aprendices que no saben preparar la urdimbre y la reciben armada, tarea que se realiza entre dos personas, una por cada lado del telar y a las aprendices les corresponde sólo la tarea de tejer, siguiendo las indicaciones de la maestra.

"Antes de iniciar el tejido del chamanto se planifican los colores y las labores o diseños que adornarán la pieza. Luego se calcula la cantidad de material a utilizar y se urde directamente en el telar. Por último se tejen dos piezas separadas que se cosen a mano: la parte central y la huincha que rodea todo su contorno." (Gruzmacher [2009:83]

EL TEJIDO

El tejido se estructura en base a dos urdimbres complementarias, lo que se denomina urdimbre de doble faz. Esto significa que el resultado final es un tejido que es terminado por ambas caras, pudiendo ser utilizado indistintamente por cada una de ellas.

"El chamanto se describe como un poncho corto, de colores fuertes, decorado con labores e imágenes fitomorfas que se organizan en listas, y con una huincha ancha en todo el borde. Es una prenda utilizada por huasos en celebraciones y fiestas; tejida en algodón mercerizado con un tamaño de 1 por 1.5 metros. Su tiempo de elaboración es de tres meses.

(las dos imágenes anteriores corresponden a libro Gruzmacher citado en referencias)

Las dos caras del tejido se diferencian por el color y por la claridad de la iconografía; por ejemplo en el lado derecho se presentan "labores" o dibujos de bordes pulidos y fondos y colores oscuros y se usa generalmente de día y el revés presenta dibujos de bordes irregulares y colores más claros y se usa generalmente de noche.

(imágen propia de la autora, Paz Cox)

Cada chamanto se teje en dos piezas separadas: la parte central y la huincha que rodea todo su contorno, se termina uniendo ambas piezas con una delicada costura a mano. Por lo cual el proceso total es muy cuidadoso y de gran tiempo de dedicación. Una artesana tarda a lo menos 3 meses en ello.

El proceso se inicia con la decisión del tipo de diseños que se incorporarán al tejido y los colores para calcular las cantidades de hilados necesarios. Luego la urdimbre se monta directamente sobre el telar contando las pasadas de hilo de cada color. Una vez dispuesto el urdido se colocan unas piezas de madera llamadas *"tonones"*, que son las que levantan los manojos de hilos, siendo ésta la tarea más crucial del tejido, ya que estos manojos funcionaran separando los hilos de la urdimbre para las pasadas de los hilos de la trama, formando el cruce interno de hilos que formará el tejido.


(Imagen libro Gruzmacher, citado en referencias)

El tejido se realiza con una combinación de movimientos manuales, siendo necesario llevar la cuanta de los hilos para no cometer errores, una tejedora con gran experiencia tiene en la memoria la cantidad de hilos para cada diseño y no necesita contar los hilos para moverlos.

La huincha también se teje en doble faz, una vez tejidas ambas piezas se arma el chamanto cosiendo la huinca a su alrededor de la parte central y reforzando la abertura para la cabeza con puntadas para que quede firme.

"El chamanto se describe como un poncho corto, de colores fuertes, decorado con labores e imágenes fitomorfas que se organizan en listas, y con una huincha ancha en todo el borde. Es una prenda utilizada por huasos en celebraciones y fiestas; tejida en algodón mercerizado con un tamaño de 1 por 1.5 metros. Su tiempo de elaboración es de tres meses.

LOS DISEÑOS

Desde 1900 se tejen chamantos listados y con diseños o "labores" simples, flores aisladas acompañadas de diseños a cuadros. Unos años más tarde con la influencia de las telas traídas de Europa, los diseños se hacen más intrincados y por ende más lentos y dificultosos en su tejido. Ya en 1935 aparecen diseños propios del entorno campesino de las tejedoras, como hojas de parra, flores, pájaros, uvas y otras variedades de plantas, motivos que se

masifican entre las tejedoras, coincidiendo con el cambio de material de la lana al algodón mercerizado, de mayor colorido y saturación.

Parte de la tradición de las tejedoras es no repetir los diseños, cada una aspira a tener diseños y combinaciones de colores propios y exclusivos, así como es aspiración del comprador, el huaso, de lucir una prenda única.

El chamanto se diferencia de la manta corralera, que es la que usa el huaso mientras corre el rodeo, en que estas últimas no tienen dibujos intrincados, "labores", lo que las hace más livianas y fáciles de tejer, por ende de menor costo. Constan de cuatro zonas horizontales, llamadas campos, de un solo color cada una de ellas y de tres zonas también horizontales llamadas listaduras. Los cuatro campos y las tres listaduras son rodeadas por la huincha.

LOS COLORES

Las tejedoras de chamantos en la actualidad utilizan los colores sin seguir un patrón común, ni una tradición que se pudiera determinar compartida. Ha sido incluso muy difícil lograr que expresen en las entrevistas que se han tenido con ellas, si le asignan significados específicos a cada color, salvo las referencias entre colores y objetos, como el rojo de algunas flores, el amarillo del trigo y otros. Expresan que en general ejercitan su gusto personal en la toma de decisiones de color.
Este hecho es contradictorio, si se piensa que su tradición textil posee una raíz mapuche, cultura en que cada color está cargado de un fuerte simbolismo, que en éste caso se ha perdido. La elaboración de un determinado chamanto corresponde como ya se dijo, en gran parte de los casos a un encargo, por lo que la experiencia con el color y sus combinaciones que pudiera tener la tejedora se aporta, pero la decisión final se toma en conjunto con quien solicita su confección, un huaso o cliente que trae pensada una combinación de colores, por ejemplo, dicen ellas, que la combinación de rojos y negros es muy solicitada y fácil de vender.

EL PROYECTO "INNOVANDO EN LA ARTESANIA TRADICIONAL DEL CACHAPOAL"

La Política Regional de Turismo tiene entre sus principales objetivos la *Generación de* ***un conjunto de productos*** *y servicios turísticos con un* ***alto estándar de calidad, capaz de posicionarse como una alternativa competitiva*** *frente a otros destinos, tanto nacionales como internacionales de manera innovadora y sustentable.*

Este objetivo se vincula directamente con la propuesta de desarrollo de nuevos productos a partir de la técnica textil empelada por las chamanteras. Los productos que ellas elaboran presentan una falta de promoción y posicionamiento desde el punto de vista de la artesanía tradicional y desde el reconocimiento del trabajo de las chamanteras de Doñihue. Si bien la técnica y el trabajo son de un alto estándar de calidad, no se posiciona como un producto competitivo y que represente a la localidad de Doñihue.(Tejer un buen chamanto, implica 4 meses de intenso trabajo diario y tiene un costo final de $3.500.000 pesos chilenos, (US$ 6.000 aproximadamente) precio que lo convierte en un artículo de "lujo" y de poco mercado.
En pos de aportar a esta problemática el proyecto plantea busca establecer nuevas redes productivas que enlacen la producción textil tradicional de Doñihue con otras artesanías

regionales para generar nuevos productos de mayor accesibilidad en términos económicos para llegar a nuevos públicos objetivos. Por ejemplo: Textiles de Doñihue con talabartería o con orfebrería.

En el primer caso se contactó al Centro Penitenciario (cárcel) de Rengo, localidad situada a 35 kilómetros de Doñihue para conocer las condiciones y la calidad del trabajo de talabartería que se ejecuta por parte de un grupo de los reos o internos y evaluar sus necesidades de capacitación de acuerdo a los requerimientos del proyecto.

Para el segundo caso se contactó a agrupaciones de orfebres presentes en la región con el objetivo de seleccionar artesanos con experiencia y dominio del trabajo con plata y otros metales nobles y con experiencia en el desarrollo de joyas contemporáneas que mezclen técnicas y materiales diversos.

Se planificaron y realizaron en Doñihue las capacitaciones a las chamanteras y los internos talabarteros del Centro Penitencial de Rengo, entre diciembre 2013,enero y febrero de 2014 por los profesionales que forman parte del equipo del proyecto, diseñadoras de la Escuela de Diseño de la Pontificia Universidad Católica de Chile y expertos en artesanía y comercialización. Para las capacitaciones de temáticas relativas al uso del color para ambos grupos de artesanos se solicitó la colaboración de mi persona.

CAPACITACIÓN EN TEMÁTICAS RELATIVAS AL COLOR

El proceso de definición de las actividades de capacitación se inició con el conocimiento por parte de la especialista en color de las posibilidades técnicas y visuales del tejido que tradicionalmente ha desarrollado el grupo de artesanas:

1.-Se tuvieron a la vista piezas tejidas con anterioridad por las artesanas, elaboradas con técnicas de tejido y combinaciones de colores diversas, con el objetivo de visualizar en directo, a ojo desnudo, su manufactura, sensaciones táctiles, como suavidad, grosor y peso del tejido, sensaciones visuales como brillos y texturas, así como las combinaciones y proporciones de éstas en cuanto al colorido presente en cada pieza. Se revisaron piezas con técnica de doble faz, “labores” con diversas expresiones iconográficas y también piezas más sencillas con combinaciones de colores basadas en figuras geométricas como líneas y rombos.

2. Se revisó registro fotográfico facilitado por las investigadoras del equipo de diferentes piezas tejidas por cada una de las artesanas que componen la agrupación, para tener una primera noción más amplia de combinaciones habituales y su expresión en el tejido, tanto en el caso de la técnica de doble faz, como en la expresión de tejido más simple.

3. Se solicitó muestras de hilado de los diferentes colores que utilizan las chamanteras, en conos y madejas que fueron proporcionados por el equipo de investigadoras. Este material se fotografió, cada muestra de hilado por separado, registrando el número de serie del fabricante, como dato importante para el traspaso a otro tipo de registro.

(imagen propia , tomada por autora, Paz Cox)

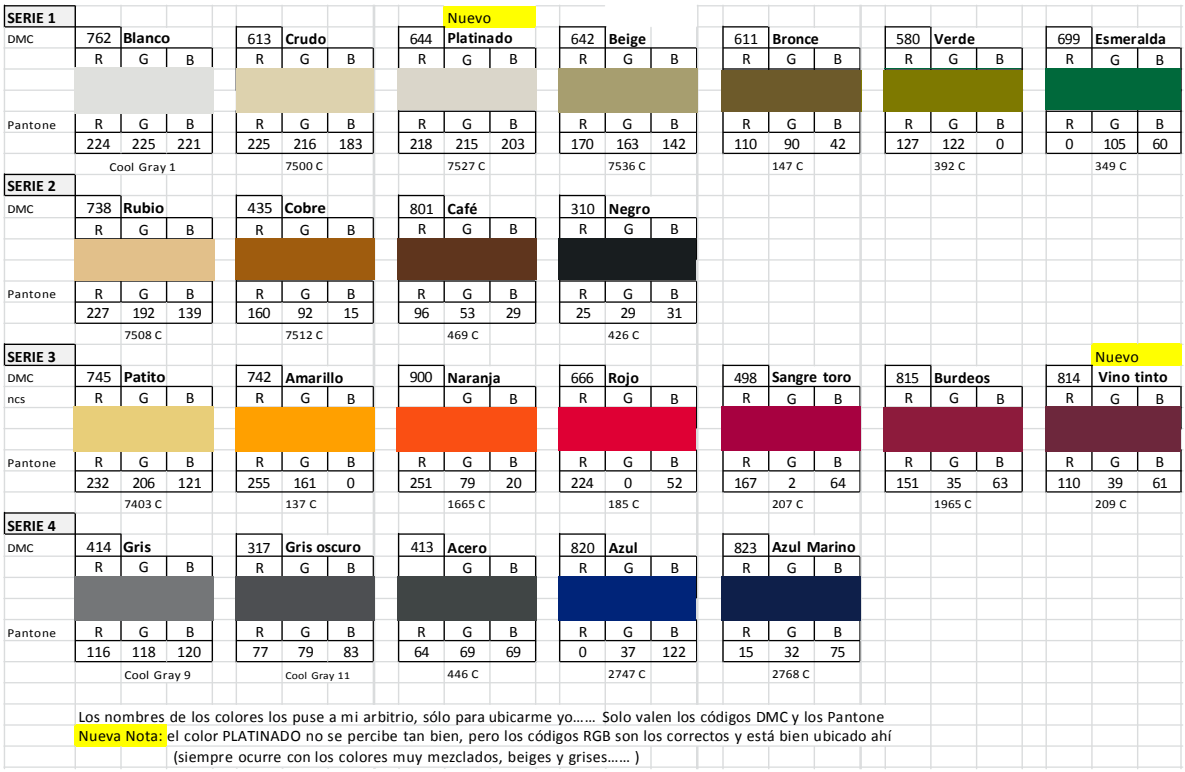
4. Se realizaron tomas fotográficas y muestras de los hilados ordenados en series de acuerdo a escalas, de las cuales se obtuvieron cuatro series:

.

- De seis colores desde el blanco al verde, pasando por tonos medios; De cuatro colores desde el beige al negro, pasando por el café; De seis colores desde el amarillo claro al burdeos, pasando por el anaranjado y el rojo y por último; De cinco colores, desde el gris al azul marino, pasando por el azul.

(imagen propia , tomada por autora, Paz Cox)

5. A través de la observación y comparación visual de las muestras de hilado, bajo condiciones lumínicas idénticas se las traspasó a códigos Pantone, utilizados en la industria productiva en Chile, en específico de la colección Color Bridge Coated, (semibrillo, como las muestras de hilo). Estos códigos Pantone, revelan la composición en RGB, (Red, Green and Blue), proporcionando los códigos para trabajar el color en formato digital, conservando siempre la codificación DMC (de la fábrica del hilado, de origen francés) como referencia. De éste modo para cada color, se obtuvo un código Pantone y su receta en RGB, para realizar las propuestas en formato digital, para que todo el grupo de artesanos accediera visualmente en simultáneo al material docente.



SERIE 1																								
DMC	762	Blanco		613	Crudo		644	Nuevo Platinado		642	Beige		611	Bronce		580	Verde		699	Esmeralda	
	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
Pantone	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
	224	225	221	225	216	183	218	215	203	170	163	142	110	90	42	127	122	0	0	105	60
	Cool Gray 1			7500 C			7527 C			7536 C			147 C			392 C			349 C		

SERIE 2												
DMC	738	Rubio		435	Cobre		801	Café		310	Negro	
	R	G	B	R	G	B	R	G	B	R	G	B
Pantone	R	G	B	R	G	B	R	G	B	R	G	B
	227	192	139	160	92	15	96	53	29	25	29	31
	7508 C			7512 C			469 C			426 C		

SERIE 3																		Nuevo		
DMC	745	Patito		742	Amarillo		900	Naranja		666	Rojo		498	Sangre toro		815	Burdeos		814	Vino tinto	
ncs	R	G	B	R	G	B		G	B	R	G	B	R	G	B	R	G	B	R	G	B
Pantone	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
	232	206	121	255	161	0	251	79	20	224	0	52	167	2	64	151	35	63	110	39	61
	7403 C			137 C			1665 C			185 C			207 C			1965 C			209 C	

SERIE 4															
DMC	414	Gris		317	Gris oscuro		413	Acero		820	Azul		823	Azul Marino	
	R	G	B	R	G	B		G	B	R	G	B	R	G	B
Pantone	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
	116	118	120	77	79	83	64	69	69	0	37	122	15	32	75
	Cool Gray 9			Cool Gray 11			446 C			2747 C			2768 C		

Los nombres de los colores los puse a mi arbitrio, sólo para ubicarme yo..... Solo valen los códigos DMC y los Pantone
Nueva Nota: el color PLATINADO no se percibe tan bien, pero los códigos RGB son los correctos y está bien ubicado ahí
(siempre ocurre con los colores muy mezclados, beiges y grises.....)

(imagen propia, archivo realizado por autora Paz Cox)

6. Con los códigos obtenidos del proceso anterior se elaboró un archivo en formato excell que exhibe las series ordenadas y en que cada color tiene su código DMC, Pantone y su fórmula RGB, agregándose un nombre de fantasía provisorio, sólo para facilitar el manejo. También se incorporó una visualización de la muestra digital de cada color, creada de acuerdo con los códigos obtenidos, pero sobre la cual se debe hacer la salvedad que no tiene constancia, ya que depende del medio de salida, computador, impresora, proyector data, el color sufre las modificaciones propias de cada uno de ellos.

Con éste conocimiento básico del material se procedió a diseñar los módulos de capacitación que se dictaron en el mes de enero del año 2014.

(Imagen propia, archivo del proyecto)

Objetivos:

- Enseñar nociones básicas del manejo del color con el objetivo de sistematizar su aplicación en las piezas textiles y en sus combinaciones con otros materiales.
- Enseñar a elaborar cartas de colores de acuerdo a las armonías habituales que han trabajado.
- Enseñar a utilizar las cartas de color para el registro de las propuestas cromáticas y hacerlas trasmisibles a otras artesanas.
- Enseñar a elaborar colecciones a través de cartas dirigidas a diferentes usuarios.
- Motivar a la innovación con propuestas cromáticas verificables sin tener que urdir y tejer.

- **Descripción de la dinámica que se desarrolló con los artesanos:**

Los módulos de capacitación se realizaron en sesiones de trabajo 6 horas cada una, en el mes de enero de 2014:

Presentación sobre algunos aspectos prácticos para el manejo del color:

-¿Qué es el color?, ¿Cómo lo vemos? ¿Por qué es difícil trabajar con él?

-Ejemplos de aplicación del color en proyectos textiles

Ejercicios desarrollados durante la sesión

-Observación de los colores utilizados exhibidos en panel en que cada color tiene un número asignado (en muestras de hilado y en papel)

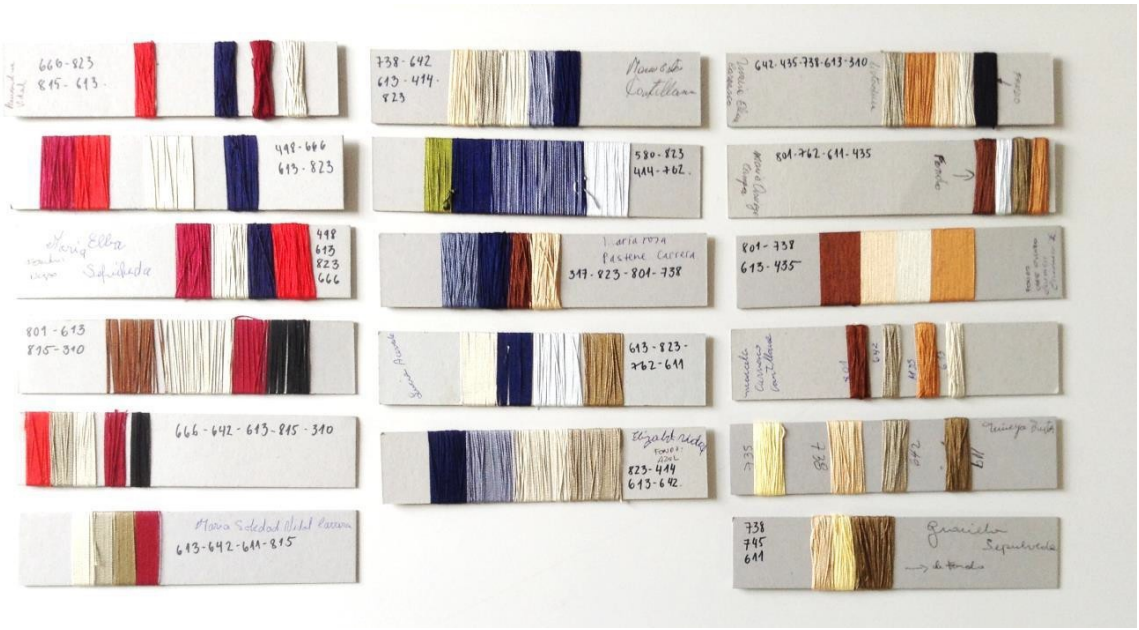
-Denominación de cada color, ¿Por qué nombre lo conoce usted? ¿Qué significado le asigna? ¿Para qué lo utiliza en sus trabajos de tejido?

Los artesanos, tejedoras y artesanos del cuero, trabajan en la observación y asignación de nombres y significados.

Encargo para la próxima sesión (a desarrollar por cada uno en su casa:Se distribuyen madejas de hilado y se les solicita reconocer las combinaciones habituales y las proporciones de los colores que utilizan en su trabajo.

Resultados:

Se lograron una serie de cartas de color, elaboradas en hilados de algodón, por cada participante del taller de capacitación, según lo solicitado.



(Imagen propia autora, Paz Cox)

Presentación sobre Sistemas para trabajar con colores

Presentación de las series y explicación de su sentido para ser aplicados en el proyecto.

-Análisis de las cartas y paletas de color desarrolladas por el grupo de artesanos como tarea en la sesión anterior

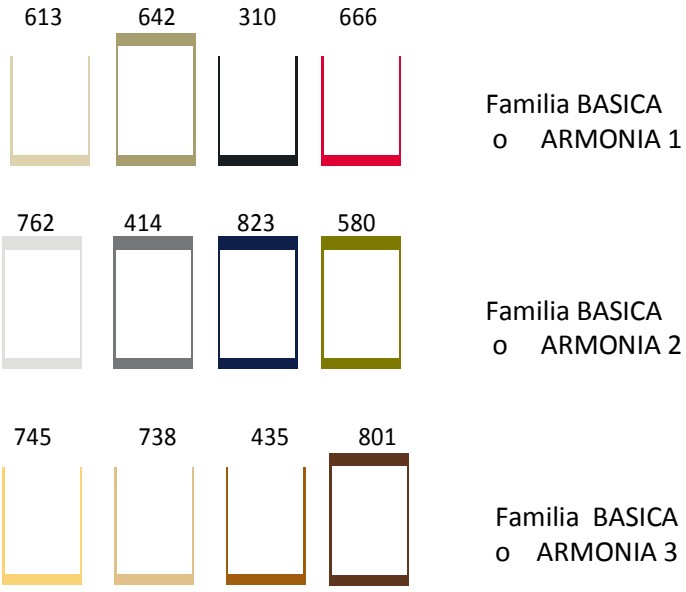
-Traspaso a cartas digitales

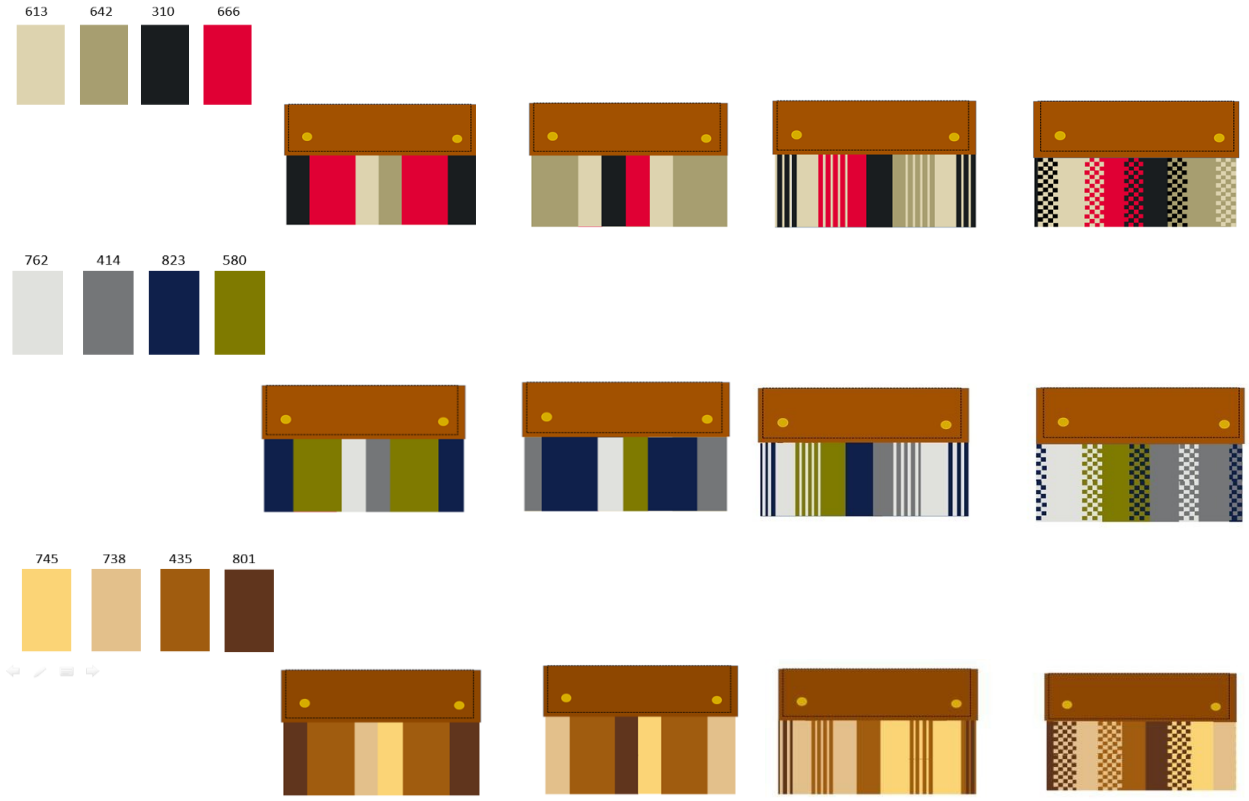
-Construcción de Armonías o Familias de colores

-Sintetización o simplificación de armonías para la construcción de tres paletas extraídas de las cartas elaboradas por los asistentes.

- Ejemplos de aplicaciones de tres paletas en colecciones de objetos.

(Imágenes propias de autora, Paz Cox)





TRABAJO POSTERIOR CON CHAMANTERAS

Como ya se dijo, el proyecto busca dar soluciones a la escasez de tejidos de las chamanteras, que éstas puedan ofrecer otras tipologías de productos para ser utilizados en contextos contemporáneos no rurales y a valores más accesibles. Sin embargo el desafío de emprender una nueva producción que se aleja de lo que han estado tejiendo por generaciones, aparecía como un riesgo considerable, por lo que se necesitaba que la agrupación de tejedoras asumiera en pleno esta posibilidad para ser desarrollada en paralelo a su quehacer tradicional, que no debe sufrir un menoscabo en su consolidada calidad.

Las elecciones, tanto de diseños como de combinaciones de colores, que realizan las tejedoras, al momento de iniciar una obra, están condicionadas a lo que espera de ella su cliente, que en la mayoría de las ocasiones trae ideas y muestras preconcebidas.

También estas elecciones están sujetas a la disponibilidad de hilados, colores determinados, a veces acotados, que van coartando muchas veces las posibilidades de nuevos emprendimientos que signifiquen innovaciones.

Es en ese contexto, donde el trabajo de los diseñadores es especialmente efectivo, para detectar oportunidades para la creatividad y el desarrollo de nuevos productos, pero con todas las consideraciones de respeto mutuo y decisión de trabajo conjunto entre diseñadores y artesanos, donde el artesano aporta su saber y experticia y el diseñador su visión de articulador hacia nuevas posibilidades y mercados.

El proceso considera la identificación de posibles usuarios, reconociendo sus necesidades e intentando conciliar en un nuevo producto estos dos mundos: el del artesano y el de los posibles usuarios de sus productos.

Otro de los objetivos importantes es lograr un mejor aprovechamiento de las materias primas y una mayor calidad en los procesos productivos que generen mejores terminaciones finales de los productos. Lo anterior implica que desde la disciplina del diseño se deben aportar nociones de control de calidad, ya sea de los materiales, formas, colores, estructuras y terminaciones.

En un tejido de la calidad reconocida, como los que se producen en Doñihue, estos parámetros se han aplicado por la experiencia, pero sólo cuando se aplican a los que mejor saben hacer, sus obras tradicionales de calidad excepcional, los chamantos. Sin embargo, la mayoría de los intentos de innovación que se han detectado, no han sido acertados y ponen de manifiesto las dificultades que han enfrentado las tejedoras cuando se las ha impulsado a intentar adaptar su quehacer hacia materialidades y formas diversas a las que manejan con maestría, siendo los productos con nuevos requerimientos de una calidad inferior y con terminaciones que evidencian esta dificultad.

Dado lo anterior se decidió trabajar por separado, para poder tener control de los procesos, el manejo de nuevas formas, los diversos tratamientos de las superficies y la relación del tejido con otros materiales. Todos los procesos anteriores estuvieron a cargo de otros integrantes del equipo del proyecto

Las combinaciones de colores que se aplican tuvieron como inicio el proceso de experimentación desarrollado durante las capacitaciones con las artesanas, que había tenido como resultado la elaboración de tres cartas de color, que podían ser aplicadas a diversos productos, orientando el esfuerzo productivo a unifica, a través de la aplicación de las mismas cartas de colores en las diversas tipologías de objetos, de manera de que se constituyeran colecciones.

El proceso de aplicación de los colores de cada carta se relacionaba íntimamente con el tamaño de la pieza tejida, por ejemplo si se trataba de una cartera, de una billetera, de un cinturón u otro de los variados objetos que se desarrollaron. Estos últimos son todos muy simples, construidos básicamente a través de pliegues, con un mínimo de cortes que complejizaran el proceso de terminación de las piezas textiles y previendo para ello el encuentro con los otros materiales, ya fuera cuero o metal que constituyen la pieza terminada.

PRIMEROS RESULTADOS

Luego de terminado el proceso anterior se definieron un grupo de objetos a desarrollar, se dimensionaron los tamaños de las piezas tejidos requeridas para cada uno de ellos, se seleccionaron de acuerdo a su voluntad, a las tejedoras que tejerían y se repartieron los hilos de los colores acordados para hacer las combinaciones con una primera colección

PALETA 1era COLECCIÓN

Serie 1																			
DMC	666	Rojo		498	Sangre toro		815	Burdeos		814	Vino tinto								
ncs	R	G	B	R	G	B	R	G	B	R	G	B							
Pantone	R	G	B	R	G	B	R	G	B	R	G	B							
	224	0	52	167	2	64	151	35	63	110	39	61							
		185 C			207 C			1965 C			209 C								
Serie 2																			
DMC	762	Blanco		414	Gris		317	Gris oscuro		413	Acero			310	Negro				
	R	G	B	R	G	B	R	G	B		G	B		R	G	B			
Pantone	R	G	B	R	G	B	R	G	B	R	G	B		R	G	B			
	224	225	221	116	118	120	77	79	83	64	69	69		25	29	31			
		Cool Gray 1			Cool Gray 9			Cool Gray 11			446 C				426 C				

(imagen de archivo realizada por autora, Paz Cox)

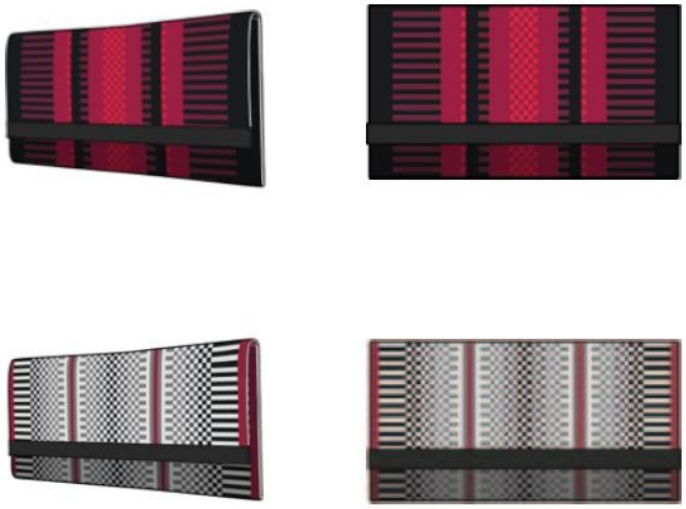
En agosto de 2014 se encontraban disponibles las primeras piezas textiles, para dar inicio al proceso de trabajo de los especialistas en trabajo del cuero, por lo que se espera adicionar imágenes de los productos finales en la presentación en AIC2014, en el mes de octubre.

A continuación se exhiben imágenes de visualizaciones de productos y fotografías de las piezas textiles ya tejidas, donde se obtuvo productos de gran calidad y con interesantes de

combinaciones basadas en la paleta anterior, en que se registran interacciones entre los colores de una enorme variedad.

Visualizaciones digitales de objetos

Monedero



Billetera

Carteras de diferentes modelos

Fotografías de las piezas tejidas

Conclusiones parciales:

Quedando aún pendiente el proceso de elaboración final de los modelos seleccionados, se concluye que las artesanas han asimilado con bastante éxito las propuestas del proyecto y se ha logrado la producción de tejidos de excelente calidad que hacen prever el cumplimiento de los objetivos, las piezas terminadas se exhibirán en AIC2014.

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MEANINGS

El Significado y el Lenguaje del Color en los Rituales Fúnebres.

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Abstract

A lo largo del tiempo, el color ha sido de gran importancia para la humanidad. Se ha utilizado como símbolo de poder, estatus social, ideologías políticas, e incluso ha sido empleado para diferenciar religiones. Por consecuencia, el lenguaje del color es variable de cultura en cultura, recordando que éste, como cualquier medio de expresión, es visualizado como un signo cromático, (significante-significado) dotado de una intrínseca versatilidad polisémica. Partiendo de esto, nuestra investigación tiene como principal objetivo: identificar el significado del color dentro de las ceremonias fúnebres en diferentes culturas y tiempos de la historia. Desde tiempos antiguos el color ha sido empleado como símbolo de vida y de muerte, dentro de la cultura fenicia, se ha destacado que los colores rojo y verde predominaban en la pintura parietal funeraria de las tumbas subterráneas en la región de Sidón. En tiempos contemporáneos dentro de la cultura occidental el color negro se asocia a la oscuridad, al miedo a lo desconocido y por ende, a la muerte, lo putrefacto y todo un amplio cúmulo de asociaciones emotivas negativas: odio, tristeza y depresión. Mientras que, en la cultura oriental como la china, el color blanco es empleado en las ceremonias fúnebres. Dentro del lenguaje del color se advierte que cada cultura y en cada tiempo se ha detectado una variedad muy amplia sobre el uso de dicho lenguaje, estos han respondido ante el reto que supone la traducción en palabras del espectro cromático con múltiples soluciones y grados muy diversos de categorización

Introducción

A lo largo de la historia, el color siempre ha sido de gran importancia para la humanidad. Se ha utilizado como símbolo de poder, estatus social, ideologías políticas, e incluso ha sido empleado para diferenciar religiones. En esta investigación se hace hincapié en los diferentes sentidos con los que se simboliza y se percibe el color en los rituales funerarios de algunas culturas, sabiendo que “el color no es sólo lo que dicen los diccionarios y los tratados científicos” (Moreno 1996:10) porque siempre que éste es retomado por alguna disciplina, se convierte en objeto de un nuevo orden, normativizándolo y categorizándolo con otra base conceptual. De ahí que, “el color no es más que invención”, (Moreno 1996:10) y, que en consecuencia, puede ser estudiado como todo un signo que conlleva a una variedad de reacciones por parte de la persona que convivan con él.

Ahora bien, si partimos de la teoría de Cabo Villaverde, (2001:363) en la que explica que el lenguaje del color se advierte que cada cultura y en cada tiempo y se ha detectado una variedad muy amplia sobre el uso de dicho lenguaje. Dice que los diferentes lenguajes o lenguas, “han respondido ante el reto que supone la traducción en palabras del espectro cromático con múltiples soluciones y grados muy diversos de categorización.” (Cabo 2001:363) por lo que nos encontramos en lo que Moreno denominaría “una nueva dimensionalidad del color, que ya

se ha transformado en colores que tienen un significado". (Moreno 1996:11), Cabo (2001), relaciona el lenguaje y la sinestesia acotando la sugestión con el color, de tal manera que a los símbolos cromáticos se les asignan nombres y adjetivos contrastantes referidos a percepciones que lo acompañan en cada cultura. Se dice que esta tendencia ya es advertida "en las asociaciones establecidas en la antigüedad clásica entre toda clase de elementos y los cuatro fundamentales –aire, tierra, fuego, agua" (Cabo 2001:373) lo cual era relacionado con su realidad y utilizado para sus actividades comunes como el vestido, pinturas rupestres y actividades religiosas como los ritos funerarios. Sin embargo, los objetos vienen siendo significativos gracias a cada aspecto de forma y color lo cual transmite mensajes o símbolos al ser humano en sus diferentes estilos de vida y son recibidos de acuerdo a su costumbre, cultura e identidad social. La importancia viene radicando en reconocer el paradigma de la cultura humana y el bienestar que color atribuye psicológica y fisiológicamente al hombre

En dicho sentido, si aceptamos que "Asociar un concepto a un color permite dotarlo de cualquier significado" (Fraser & Banks 2005:12) y que, "las asociaciones del color con determinadas cualidades están en función del entorno cultural y la personalidad de cada cual" (Fraser & Banks 2005:14), llegamos a la conclusión de que el lenguaje del color es variable de cultura en cultura, recordando que éste, como cualquier medio de expresión, es visualizado como un signo cromático, (significante- significado).

Simbolismo del color y la muerte.

El ser humano a lo largo de la historia se ha caracterizado por dotar de signos y significados la mayoría de su quehacer, ya sea social o religioso y no ha dejado atrás la inminente presencia de la muerte dándole una gran importancia. Se describe una fuerte relación entre la simbología, la historia y otros elementos como:

> la relación entre el cielo y la tierra, los puntos cardinales, las correspondencias de los diversos elementos del septenario (dioses planetarios, días de la semana) y del cuaternario (estaciones, colores, puntos cardinales, elementos) (Cirlot 1997 [2006:22]).

Así mismo, las diversas culturas han dado un lugar privilegiado a la acción de morir desde el punto de vista del sacrificio para los dioses. En varias culturas de América, sobre todo la cultura azteca quienes creían firmemente en sus dioses, les rendían culto a través de sacrificios y ofrendas, (Garagarza-Muñoz 2007:10) el hecho de morir siendo sacrificado en rituales, era un honor. Dicha significación cultural aplica del mismo modo al esoterismo, lo cual de alguna manera quien lo practica lo ve como una religión. La lectura de las cartas del Tarot por ejemplo, en la que aparece una carta llamada *El ahorcado*, completamente llena de símbolos significativos, como la posición invertida del personaje lo cual se relaciona con la idea de purificación. Los dos árboles de donde se balancea el cuerpo se representan en tonalidad verde-azul lo cual significa la naturaleza terrestre que tiende hacia el cielo, el traje del ahorcado es representado con un dualismo cromático de rojo y blanco como el águila bicéfala de los alquimistas. (Cirlot 1997 [2006:74]) Así pues los ritos religiosos relacionados con la muerte, el entierro o la cremación es mayormente relacionado con la preparación para que el hombre llegue al *más allá*.

Por lo tanto, la muerte comenzó a formar parte de la vida cotidiana y a tener cada vez mayor significado el acto del sacrificio ofrecido a los dioses, Garagarza-muñoz (2007) afirma que "podría verse como un culto a la vida más que a la muerte misma, ya que era por agradecimiento a los dioses" (Garagarza-Muñoz 2007:11), de tal manera que los aztecas veían y vivían la muerte sin miedo y a manera de festejo lo cual no es lo mismo en la cultura occidental. Por lo que se reafirma la teoría de que cada cultura vive y siente sus usos, costumbres y simbología de manera muy particular, (Cirlot 1997 [2006:140]) y (Arango 1995 [1998:285]) citan a la Dra Jolan Jacobi que al estudiar la psicología de Jung asegura que la coordinación de los colores con las funciones (psíquicas) respectivas cambia con las diferentes culturas y grupos humanos, e incluso entre los diversos individuos, más sin embargo, hay reglas generales como el simbolismo que se le da al rojo del fuego, el color de los seres vivos y ardientes, contra el verde de las plantas, la vida animal, la descomposición y la muerte.

Religiosamente hablando se entiende el simbolismo, partiendo del significado de los signos, los cuales se dividen en signos naturales y signos artificiales. Los signos naturales son aquellos que se identifican independientemente de la cultura o circunstancia, a lo que Soto-Hay (1995:10) afirma que estos pueden ser de carácter empírico, natural y hasta instintivo del ser humano. Los signos artificiales son mayormente creaciones del hombre y pueden cambiar con el tiempo, la cultura o las circunstancias. Por lo que las connotaciones de significado a algunos colores es evidentemente cambiado bajo estas realidades.

Cabe mencionar que una de estas realidades puede ser la poesía, donde algunas obras utilizan la relación entre el color y la muerte. Arango (1995 [1998:281]) analiza los símbolos y la simbología en la poesía de Federico García Lorca, alguna vez nombrado como el poeta de la muerte, bajo la teoría de la psicología de Jung[1], en donde hace diversas asociaciones entre el color y la muerte, dándole gran importancia al color verde dentro de su poesía. En la obra de la zapatera religiosa, la vecina amarilla representa el color de la muerte, la vecina verde representa la sangre, más sin embargo, el símbolo funeral se caracteriza por el color negro. En su poema llamado *El paso de la siguiriya gitana* al decir: "un arcoíris negro sobre la noche azul" y más adelante en la frase de "entre mariposas negras" (Arango 1995 [1998:109]), utiliza la noche y el negro como símbolos de muerte que se oponen al azul del cielo, mientras que en el poema *Mariana Pineda* se apoya con la dualidad negro-verde para mostrar escenas de la vida y la muerte, tomando como referencia al negro, en su calidad de negación de todos los colores, en símbolo de funeral y al verde en relación con la naturaleza y como analogía de la vida sobre la muerte (Arango 1995 [1998:285]).

Dada la necesidad del hombre de identificar objetos o sucesos por medio de los signos y sus significados, esta investigación surge del entendimiento, que en la religión, la literatura y en la cultura, entre otros, existen diversos símbolos y colores que poseen un significado propio.

El lenguaje del color en los rituales fúnebres.

Eulalio Ferrer (1999 [2007:34-54]), realiza una analogía de los diferentes colores que se utilizan en los rituales funerarios y sobre todo en las pinturas y tumbas de las diferentes

[1] La referencia de Jung se justifica dada la circunstancia de que los poetas de esta generación tuvieron influjo en Jung y Freud. (Arango 1995 [1998:283])

culturas. Cita a cuatro autores que han realizado asociaciones de colores con los puntos cardinales como referencia de las diferentes culturas, de los cuales surge la siguiente tabla:

Orientación	Giacomo Prampolini	Silvia Molina	Soustelle	Ortiz
Norte	Negro – Huang	Tortuga negra	Negro Tezcaltipoca	Amarillo
Sur	Rojo – Lang	Pájaro Rojo	Azul Huilzilopochtli	Azul
Este / Oriente	Azul – Kuei	Dragón azul	Rojo Tezcaltipoca	Blanco
Oeste / occidente	Blanco – Hu	Tigre blanco	Blanco Quetzalcoatl	Rojo
Cielo	Verde – Pi			
Tierra	Amarillo – Ts'ung			

Fig. 1 Asociación de colores con los puntos cardinales.
Elaboración propia con datos citados por Ferrer (1999 [2007:34-54])

Los estudios de Giacomo Prampolini, en los que se encierran estos códigos de colores, son relacionados con los puntos cardinales, base a las investigaciones que se han elaborado con el hecho de que en la cultura china predomine el monocolor con una sobreexplotación del rojo, considerándolo de buena suerte y como pigmento de energía y poder. Seguido de esta relación entre colores y puntos cardinales, Ferrer (1999 [2007:32-33]), cita a Silvia Molina quien enriquece estas asociaciones señalando animales que rigen los rumbos chinos y sus guerras, mismos que también les asigna un color. De la misma manera hace referencia a Jacques Soustelle, quien ha estudiado el cromatismo primitivo mexicano y lo asocia con la cultura china, así como también asocia los puntos cardinales con colores, tomando en cuenta el pensamiento cosmológico de los aztecas (Ferrer 1999 [2007:54]). Bajo la premisa de que el autor afirma que el simbolismo de los colores del occidente es invertido en el oriente, nos percatamos de la discrepancia que existe entre los colores invertidos del sur (rojo) y el oriente (azul). Por último, la Dra. Ortiz, expresa que los habitantes del Tibet creían que la tierra era una montaña con los cuatro lados de un color distinto, (Ferrer 1999 [2007:35]) los cuales se presentan en la figura 1 y se aprecian varias diferencias con los otros tres autores.

Como ya se ha hecho relato anteriormente, la simbología y el lenguaje de los colores son variados en referencia a las diferentes costumbres, a lo largo de la historia y a la diversidad cultural. Por ejemplo González (2005:286) relaciona los colores utilizados en los ministerios de la celebración cristiana de la muerte en Galicia, con los colores litúrgicos de la vestimenta del sacerdote. Indica que el verde ayuda a destacar la esperanza de la resurrección y el rojo ayuda a ver la muerte en relación al sacrificio de Jesucristo. En las celebraciones religiosas de los mártires fallecidos, la vestimenta será roja, así como en el viernes santo. Mas sin embargo y en contra posición, el blanco es usado en el aspecto pascual de la muerte de un cristiano como en la fiesta de la vigilia pascual. Ahora bien, la cultura mexicana se ha caracterizado por

ser de las pocas culturas que, desde los tiempos prehispánicos, ha tenido un especial culto. Como se ha mencionado anteriormente, el acto de morir sacrificado era un honor y hoy en día los festejos que se realizan a la muerte, para los mexiquenses, se ha convertido en una celebración de fiesta, colorido y comercialización. (Garagarza-Muñoz 2007:14)

A lo largo de la historia de nuestro país, el color ha sido un elemento que nos ha caracterizado de otras culturas, podríamos decir "que México es un país pródigo en color, que éste abunda intensamente en las formas cromáticas de su lenguaje" (Ferrer 1999 [2007:49]) Los pueblos del México prehispánico vivían en un mundo de colores,

> Los palacios y templos de las antiguas ciudades que sólo conocemos por sus muros de estuco blanco y sus tonos desvanecidos; fueron, en su época, ricamente decorados y coloreados. Gracias al trabajo de arqueólogos y conservadores sabemos que el exterior de los edificios estaba pintado con colores lisos —rojo, blanco o azul—, mientras que los dibujos más elaborados se reservaban a los interiores. Además de la pintura mural, la mayoría de las manifestaciones artísticas precolombinas, esculturas en piedra o barro, relieves de estuco y cerámicas domésticas o funerarias se distinguían por su policromía. (Dupey 2004:20)

Al hablar de color y lenguaje, no podemos dejar de lado a las culturas prehispánicas, por ejemplo, "la palabra náhuatl que significa color es tlapalli. De ella se deriva el término tlapalería, nombre que ha sobrevivido al tiempo, de los establecimientos dedicados a la venta de pinturas" (Ferrer 1999 [2007:49]) La palabra color entre los pueblos Nahuas adquiere un significado efímero, para ellos, este concepto estaba ligado directamente a un uso simbólico. Ellos relacionaban la utilización del color a las ideas adquiridas del mundo en el que vivían.

> En variantes dialectales del náhuatl actual la palabra utilizada para decir blanco es chipawak que, en el idioma antiguo, era "una cosa limpia, hermosa y clara". Además, descubrimos que en maya yucateco zac, "cosa blanca", reúne también los campos semánticos de "lo claro", "lo limpio" y "lo nuevo". Estos datos procedentes de la lengua náhuatl contemporánea y de otra cultura prehispánica comprueban que la asociación del blanco con lo limpio existe en el pensamiento mesoamericano. (Dupey 2004:26)

Por otra parte, los náhuatl asociaban directamente el color blanco con el dios Quetzalcóatl, también conocido como el *dios blanco*. Esto se debe a que a él, se le atribuyen las creaciones afortunadas sobre la tierra. Para los aztecas, el color blanco estaba relacionado a lo invisible, dicha relación estaba basada en el recorrido del sol y la dirección en que este se ocultaba (el oeste).

> De ahí que los guerreros inmolados cada día para la regeneración del sol acudieran al sacrificio con un plumón blanco, usando sandalias blancas que los aislaban del suelo en el vuelo blanco del alma. Esto explicaría por qué los dioses del panteón azteca tenían ornamentos blancos. (Ferrer 1999 [2007:55-56])

Mientras que el blanco era, para los aztecas, señal de victoria, integrador de todos los colores y símbolo de la luz; el negro era símbolo de noche y muerte. El Dios Mictlantecuhtli, señor de los muertos, estaba pintado de negro mientras que en la fiesta de la mujer blanca, Iztaccíhuatl, se acostumbraba sacrificar a una mujer vestida de verde con tiara blanca (Ferrer 1999 [2007:56]). Así mismo, en las festividades o ceremonia de fuego dedicada a Xihuitl se honraba en especial a uno de sus cuatro colores, los cuales eran: azul celeste rojo, amarillo y negro. Se trataba de prender velas del color que les correspondían en la despedida de sus muertos, como eran: velas verdes para niños, blancas para señoritas, azules para jóvenes y negras para el adulto mayor. Esta festividad se conservó hasta la llegada de los españoles en la colonización y actualmente se entierran a los niños en una ceremonia blanca (Gage 2001:61).

En la época prehispánica así como en las diferentes culturas, se han relacionado sus actividades o ritos funerarios a los Dioses que los gobernaban. Cada Dios, era el poseedor de poderes y misticismo; y las actividades de las tribus eran realizadas en su mayoría como la naturaleza se los marcaba. Es por esto que algunos dioses se han relacionado con el significado de algunos colores, los cuales en su mayoría eran extraídos de la naturaleza.

Conclusiones.

Finalmente, llegamos a la conclusión que el significado que se le da a cada color nace del inconsciente colectivo y de nuestras reacciones biológicas, modificado por la cultura, la época y el contexto en que sea empleado; aunque también es cierto que de una cultura a otra el color puede adquirir una interpretación similar. Como hemos mencionado, el color a lo largo de la historia ha sido considerado como un medio de expresión, ya que todo lo que nos rodea es color y de éste, se van a desprender un sinfín de interpretaciones.

> Hemos aprendido desde sus orígenes cómo los colores giran alrededor del hombre y de las cosas, del centro a los entornos y al revés; cortejo prodigioso en el amanecer de cada día y aun en la oscuridad de la noche. Los colores se entremezclan y juegan entre sí, marcando fronteras y borrándolas, acompañando los hábitos de la tradición y las corrientes renovadoras; sucesión constante en la que se articulan las modulaciones y las exaltaciones de un lenguaje plural y entrañable. (Ferrer 1999 [2007:14])

El color es un elemento primordial en nuestra cotidianeidad, el color está manifiesto en todas partes, dispuesto a la recepción humana, y es tan influyente en nuestras reacciones que nos lleva a una reacción inmediata, actuando de manera directa sobre las emociones. El color tiene efectos psicológicos pues es capaz de provocar emociones y sensaciones; dentro de las ceremonias y rituales fúnebres, el color blanco es asociado al comienzo y la resurrección, a diferencia del color negro que es visto como el fin y sinónimo de luto.

En nuestra cultura mexicana, la mayoría de los autores, coinciden en que el colorido en México es y ha sido muy variado, en tonos vivos y brillante, por lo tanto, no es de su excepción el uso del mismo en las festividades del día de muertos. Aunque ciertamente cada región del país lo festeja de manera diferente, podemos ver similitudes en la elaboración de

altares y arreglos de los panteones, en donde la visita a los muertos se convierte en una fiesta llena de colorido y elementos significativos.

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Provenance Of Cultural Color Meanings - Towards A Conceptual Framework

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Abstract

This paper proposes a conceptual framework for analysing the dynamic meaning- making process for cultural colour meanings in the global market place. Grounded in the cultural approach and multimodality, and based on empirical data from Sino-Finnish business encounters, the paper presents a tripartite perspective to the provenance of cultural colour meanings: persisting colour meanings, cultural colour heritage, and transforming colour meanings.

The framework acknowledges that the cultural meanings of colour originate from shared cultural experiences related to relatively persisting colour meanings or relatively transforming colour meanings. The persisting colour meanings can be related to religious colours, ideological/value-based colours, national colours, ethnic colours, linguistic colour meanings, or colours of the environment, while the transforming colour meanings can be related to colours from "other" cultures, colours of particular eras, colours of ethnic, religious, or linguistic minorities, colour expressing wealth, gender-bound colours, or colours of younger generations. Moreover, the colours related to shared experience in reference to religious, ideological or other value-bound colours form the cultural colour heritage within a cultural context. This cultural colour heritage acts as a type of filter between the other persisting colour meanings and the transforming colour meanings in the dynamic process of negotiating and re-negotiating cultural colour meanings. The framework is visualised as a globe where various cultural experiences interact. These aspects are illustrated with rich photographic data from China and from Finland.

Finally, the paper concludes that in cross-cultural context, the communicative functions of colour are ideational, interactional, textual and expressive. Communicators use resources from their particular context-specific cultural identity and experience to assign meaning for a colour. Consequently, the communicators become expressors who, intentionally or unintentionally, express their cultural experience via colours. Therefore, in a cross-cultural context the modality of colour may gain new meanings, and "meaning-making" is not in the control of the communicator/expressor.

Introduction

Cross-cultural differences in meaning-making for color have become the focus of interest of several color, online communication, and marketing researchers, among others. Meanings of colors have been suggested to vary according to cultural forces such as religion, nationality, ethnicity, and language (Belpaeme 2002, Jacobs, Keown, Worthley and Ghymn 1991, Kommonen 2011, Madden, Hewett and Roth 2000). One of the earliest scholars to advocate

the awareness of the culture-based nature of visual communication, and advertising images in particular was Scott (1994), followed by Jewitt and Oyama (2002) and Tavassoli, who has focused on color as a brand identifier (Tavassoli 2001, Tavassoli & Han 2002).

Since the beginning of this millennium, studies on the World Wide Web have been at the forefront of driving the interest on cross-cultural differences between color meanings. While the specific focus of the cross-cultural research on websites, for example, has mostly been usability rather than meaning-making as such (e.g. Shieh and Lin 2000), these studies have highlighted the significance of "culturability" (Barber and Badre 1998), that is, usability as a culturally specific feature (Chong 2004, Smith, Dunckley, French, Minochad and Chang 2004). Color has been found to be one significant aspect of culturability, because it has an impact on user experience (Fitzgerald 2004, Kondratova and Goldfarb 2006, Noiwan and Norcio 2006, Smith, Dunckley, French, Minochad and Chang 2004). Due to empirical findings exemplifying differences in cultural color meanings, MNC's have been recommended to localize the color palettes they apply for branding, product design, and website design, among others, to match cultural expectations (Fitzgerald 2004, Kommonen 2011, Kondratova and Goldfarb 2006, Noiwan and Norcio 2006).

However, while there is emergent consensus on the significance of the differences of cultural color meanings, there is a lack of insight into the origins or provenance of these differences. Moreover, previous studies have not examined whether some color meanings are more resilient than others, and why. This paper will be a first attempt to bridge that gap by systematically examining the relatively more persisting and the relatively more transformative cultural forces and their role in meaning-making for colors in Sino-Finnish business encounters. I will show how some cultural forces, such as religion, nationality, ethnicity, and language suggested by previous research, as well as two others previously less explored, ideology and the environmental setting, contribute to the more resilient or persisting color meanings, while other cultural forces, such as globalization, modernization, economic development, cultural minorities, changing gender roles, and new generations, drive the dynamics of cultural meaning-making.

To be able to better understand these interacting relations we first need to incorporate recent epistemological perspectives from two other research disciplines into our study: the socio-cultural approach to multimodality (Jewitt 2009, Ivarsson, Linderoth and Säljö 2009), and the dynamic paradigm of culture (Fang 2012). I will review the impact of these perspectives in the next section.

The theoretical framework

The theoretical framework for this paper consists of recently emergent epistemological perspectives essential for understanding the cross-cultural differences between meaning-making for colors: First, applying a socio-cultural approach to multimodality, and second, framing the concept of culture as dynamic rather than static.

Multimodal researchers Kress and van Leeuwen have taken particular interest in color as a mode (Kress and van Leeuwen 2002). In his recent textbook, van Leeuwen further demonstrates how *color meaning* has evolved, starting with symbolic meaning, followed by naturalistic and psychological color meaning, and recently increasingly coming to take on

meaning based on cultural and historical references (van Leeuwen 2011:15-16, 55). These different types of meanings can and do coexist and intertwine, because within contemporary color meanings "the local and the global exist at the same time, and interact in complex ways" (Kress and van Leeuwen 2002: 345). Kress and van Leeuwen assign two particular types of meaning potential for color: first, the distinctive features or scales of color, and second, association or *provenance*. They suggest that while any color can have many connotations, the ones actually taken up in the communicative uses of color are likely to be those that "carry significant symbolic value in the given sociocultural context" (2002: 355). Kress and van Leeuwen define provenance as follows: "Where does the color come from, where has it been culturally and historically, where have we seen it before" (2002: 355). This perspective to provenance is what I am examining in this paper.

More generally, the socio-cultural approach to multimodality sees *meaning-making as emerging from* interpretative practices in social activities related to *socio-historical and contextual resources* the communicators have access to (Jewitt 2009:169, Kress and van Leeuwen 2001:4). Meaning-making should thus be studied not only in the representations themselves, but rather in how the meanings are applied in social practices and how they interact (Ivarsson, Linderoth and Säljö 2009: 205). I will apply this socio-cultural approach for examining color meanings in Sino-Finnish business context in the empirical study in the upcoming sections to examine how the social-historical and contextual resources are applied in cultural meaning-making resulting in persisting color meanings, on the one hand, and how the interactions between different cultural color meanings induce transformative color meanings, on the other.

However, due to the parallel developments of globalization of business and the increased importance of online channels in marketing and communication mentioned in the introduction, a new perspective for understanding culture itself is emerging: *the dynamic paradigm to culture* (Fang 2012). This dynamic paradigm emerges from all three levels of interest and respective empirical studies on culture: 1) on the macro level of national cultures and cultural clusters, which are conceived to be shaped by ideology, religion, and language, among others (Inglehart and Baker 2000, Ronen and Shenkar 2013), 2) on the meso level of organizational culture, such as in the context of negotiated culture of joint ventures (Brannen and Salk 2000), and 3) on the micro level of an individual and cultural identity, such as in the context of biculturalism and multiculturalism (Benet-Martinez, Leu, Lee and Morris 2002, Hong, Morris, Chiu and Benet-Martínez, 2000). Some of the key insights from the research corpus within this dynamic paradigm include that 1) rather than being closed and static, culture is an open and transforming system, and consequently 2) culture and cultural meanings are continuously renegotiated, and that 3) one single individual can simultaneously retain multiple cultural identities (Benet-Martinez, Leu, Lee and Morris 2002, Brannen and Salk 2000, Briley, Morris and Simonson 2005, Fang 2012, Hong, Morris, Chiu and Benet-Martínez, 2000, Hong, Chao, Yang, and Rosner, 2010, Kommonen 2011). These perspectives are expected to advance post-Hofstedian research by helping scholars in acknowledging within-culture diversity as well as cultural change over time (Fang 2012, Tung 2008, Tung and Verbeke 2010).

Lastly, there is evidence of some cultural forces being more resilient against cultural change on the macro level than others. Inglehart and Baker (2000) have coined the term *cultural heritage* to describe two alternative or intertwining cultural forces that they have found as playing a crucial role in how cultures evolve: ideology and religion. They find that

the broad cultural heritage of a society - Confucian, Communist, Islamic, Orthodox, Protestant, or Roman Catholic - leaves an enduring imprint on its culture and shapes cultural clusters respectively (Inglehart and Baker 2000). Moreover, the significance of this cultural heritage is such that even globally intense transformative forces may become renegotiated. The capitalist economic system, for example, which is seen as one of the originally Western concepts that is circulated by globalization, has been found not to contrast with Communism, as thought previously, but even to be compatible with it such as in "Capitalism with Chinese characteristics" (Huang 2008, Ong 1999). Similarly, the past few decades have witnessed a significant global cultural change with the emergence of changing gender roles (Inglehart & Baker, 2000), but while emancipation of women is influencing culture on a global scale, the cultural heritage of particular areas influences the pace and form this development takes in those cultural contexts. On the micro level of an individual, Hong et al. (2000, 2010) have found that in meaning-making an individual's internalized culture may be conceived as a cultural lens, through which (s)he filters all visual stimuli. Moreover, bicultural and multicultural individuals may switch this cultural lens according to cues prompting cultural requirements within any given context (Hong, Morris, Chiu and Benet-Martínez, 2000, Hong, Chao, Yang, and Rosner, 2010). This is in line with conceptualizing culture as shared meaning (Kommonen 2011).

The empirical study

To increase our understanding on cross-cultural differences in provenance of color meaning, this study was conducted on the macro level of culture in the cross-cultural context of Sino-Finnish business encounters. The empirical materials were generated between 2007-2010. The study employed a combined emic-etic cross-cultural approach, and utilized *narrative inquiry, visual inquiry*, and *observations*, as a way to triangulate qualitative data.

Consequently, the empirical materials consist of 1) *individual and focus group narrative interviews* of color professionals, that is, people who make decisions on color choices in their work on a daily basis (e.g. fashion, graphic, interior, material, and product designers, color consultants, color and colorant marketing professionals, color and colorant researchers); 2) *visual materials* (e.g. brand guidelines, promotion materials, books, clothes, accessories and other products, store interiors, home interiors, photographs); and 3) *observation materials* for China kept in the form of an observation diary and photographs. There was no formal observation diary for Finland, because the researcher is Finnish, and found that it was not possible to observe her native culture in an ethnographic approach comparable with that for China. Therefore for Finland the researcher observed and photographed phenomena introduced by the interviewees, such as the store interiors and store personnel apparel of Marimekko (see also Kommonen 2008). The empirical materials are described in more detail in Table 1 below.

Table 1. Empirical materials of the study

Type of empirical material	**Description**	**Chinese**	**Finnish**
Individual narrative interviews, tape recorded, transcribed, and translated into English (if not conducted in English)	Color professionals with extensive experience in Finnish/Chinese business context	9	7

Focus group narrative interviews, tape and video recorded, transcribed and translated into English	Color professionals with understanding of their native cultural background	13 participants	11 + 7 participants
Visual materials (naturally occurring/provided by the interviewees)	Brochures, power-point presentations, pdf-files, images, products, web pages, media articles, store interiors, tourist attractions, films, videos, dvd covers, etc.		
Visual materials (photographed for this study)	Photographs of products, places, spaces, and phenomena that were introduced by the interviewees		
	Photographs of private homes	15 Beijing (9), Shanghai (2), Hangzhou (2), Kunshan (2)	13 Helsinki (5), Espoo (3), Turku (2), Kauniainen (1), Vihti (1), Karjalohja (1)
Observation diary and photographs	Notes from personal observations in China and in Finland Photographs from China and from Finland	**2007**: Beijing, Chengde, Hangzhou, Hong Kong, Nanjing, Shanghai, Shaoxing, Suzhou, Yu Yuan Cun, Zhuge Chang Le Cun **2008**: Hong Kong **2009**: Beijing, Shanghai, Zhouzhuang, Kunshan, Hangzhou **2010**: Shanghai	No formal observation diary for Finland

Findings: The three qualities of cultural color meanings

In this section I will systematically examine the cultural forces and their role in meaning-making for colors as they emerged in the empirical materials generated from Sino-Finnish business encounters described in the previous section. I will illustrate how some cultural forces were conceived as contributing to the 1) inherited and other 2) persisting color meanings, while other cultural forces drive the dynamics of cultural meaning-making by challenging these persisting color meanings and thus shaping 3) transformative color meanings.

In previous research, meanings of colors have been suggested to vary according to cultural factors such as religion, nationality, ethnicity, and language (Belpaeme 2002, Jacobs, Keown, Worthley & Ghymn 1991, Madden, Hewett & Roth 2000). Meanwhile, ideology,

religion, and language have been found to shape cultural clusters (e.g. Inglehart and Baker 2000, Ronen and Shenkar 2013). On the other hand, forces such as globalization, modernization, and economic development have been found to shift previous cultural boundaries (Inglehart and Baker 2000).

According to the present empirical data, the most resilient *inherited color meanings* shaping the *cultural color heritage* are based on significant shared ideological or religious experiences, while further *persisting color meanings* arise from shared experiences regarding nationality, ethnicity, language, and the environmental setting. In essence, these cultural forces orient towards sustaining the status quo of a particular culture. Conversely, there are cultural forces that specifically challenge that cultural status quo, and actively seek to transform cultural meaning-making. They induce *transformative color meanings* due to shared experiences regarding extra-cultural phenomena such as globalization, modernization, and economic development, on the one hand, and intra-cultural phenomena such as the position of religious, ethnic, and linguistic minorities, changing gender roles, and new generations.

Drawing on the empirical materials, I will next conduct a conceptual analysis of these three different qualities of cultural forces - inherited, persisting, and transformative - from the perspective of their impact on the provenance of cultural meaning-making for colors. I will link the analysis with relevant scholarly research to ground the consequent findings.

Provenance of inherited and persisting color meanings

Figure 1 below provides an initial overview of some of the persisting cultural forces that are brought to bear on meaning-making for colors, as I will elaborate in this section.

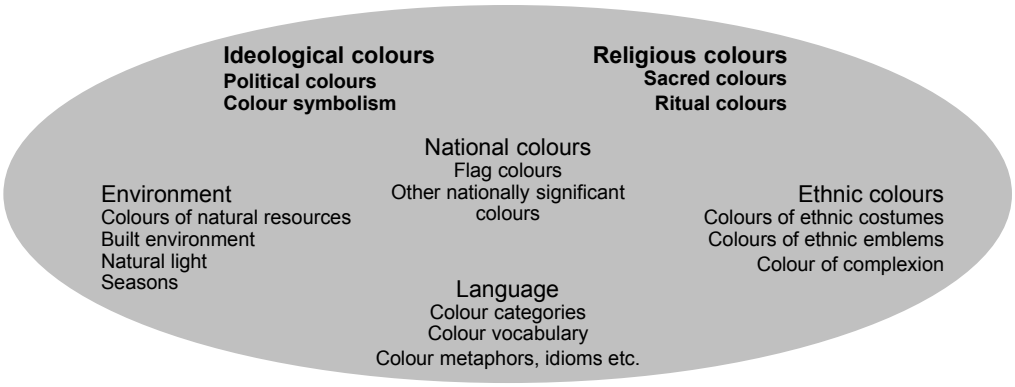

*Figure 1. Provenance of Persisting including **Inherited** color meanings*

Within persisting color meanings, *ideological* and *religious*, *national*, and *ethnic* color meanings have often become symbolic color meanings, established into culture as an historical development, and linked with customary rituals. These meanings have further become ingrained in *language*, which makes language one important source for understanding "foreign" color meanings, while sometimes linguistic color meanings may not have direct correlation with any visual color experiences. As for the effect of the *environmental* setting, it is partly symbolic and partly material.

Moreover, the present empirical materials suggest that the colors connected with shared experience associated with *cultural heritage*, that is, with ideological or religious colors, may be considered to form the cultural color heritage within a cultural context. As discussed, the socio-cultural approach to multimodality considers meaning-making of colors to occur in reference to particular culturally shared experiences. When these experiences are related to cultural heritage, the color meanings might appear extremely resilient, which became apparent in the empirical study. For example, the ideology of Communism has created both positive and negative references to a particular hue of red due to positive or negative shared experiences in Communist, non-Communist, or ex-Communist countries. Similarly, green, the sacred color of Islam, carries a strong meaning to devout Muslims, and yellow to the followers of the Hindu religion.

In contemporary Chinese culture, the color carrying cultural meaning the most is the color red. For the Chinese, red is the color of the national flag, of Communism and Mao's little red book; red is the color of the ink for seals utilized for official documents as well as by artists; red is the logo color of many state-owned enterprises; red is the color of the Spring Festival (Chinese New Year); red is employed in envelopes of gifts of money; red is the color of happiness and good luck; red is the color of the traditional bridal gown; and red is employed to ward off evil spirits, and so on. Moreover, the Confucian belief system, even if it is not considered to be an ideology or a religion as such, as well as the Chinese concept of face, both have a significant impact on persisting Chinese color meanings in general (Kommonen and Zhao 2008, Kommonen 2011).

In contrast, in Finnish culture there is no such single color that would have an ideological, religious, or value-bound significance. However, the color blue featured with white in the Finnish flag is considered an essentially Finnish color, and the poetic, romanticized connotations are constructed based on purity of Finnish nature: the blue skies and the clear blue waters of the country's tens of thousands of lakes. On the other hand, also the modest and melancholy national character of the Finns resonates with this color. Finally, blue is considered a trustworthy and reliable color, another character the Finns want to be associated with. Basically, all these aspects reflect the Lutheran ethic that still prevails in contemporary Finland in many ways, such as in considering humility a virtue. These meanings have also been found in Protestant Reformers' instructions, as black or dark clothes were meant to express humility and repentance, simplicity and functionality (van Leeuwen 2011: 3). For the Finns, expressing humility, simplicity and functionality is like a second nature, and the focus group participants considered wearing strong colors or choosing colors not based on functional motives "not typically Finnish". In particular, the context of religious rituals like the church wedding, the baptism, or the funeral, induce the Finns to honor traditions such as the white wedding gown, white dress for the baptized child, and wearing black clothes for the funeral.

When ideology or religion forms the cultural heritage, the other of the two will remain one of the persisting cultural forces. I will next examine the persisting cultural forces one by one starting with the heritage-shaping ideology and religion. I will address how they induce meaning-making for color, before proceeding to the qualities of transformative cultural forces.

First, *ideologies* and respective belief systems, philosophies, and values are linked with color systems, and often shape the cultural color heritage of a society. However, these societal

color systems may be not very explicit. Instead, they are related to implicit societal norms of "good" and "bad" behavior, derived from shared socio-cultural experience. Some of them might be disseminated by linguistic metaphors, for example, as I will illustrate later. Instead, political color symbolism is an established and explicated color system, the significance of which increases in politically active times and contexts, such as near political elections in Finland. On the other hand, the color red has a long history in Chinese context as an ideological color emphasizing power, and it has been the color of many long ruling dynasties, for example Zhou, which reigned for over 800 years (1027-221 BCE). Today, the Communist government is using the color red as their emblematic color. From cultural values point of view, Confucian ideals have prevailed in Chinese culture and, consequently, emphasis has been on expressing only the shared, socially accepted values and conforming to those, while keeping inner emotions confined. This has been visible in traditional color meanings, where muted colors have been dominating for "common" people. However, the present empirical studies show that regarding modern colors, individuality and self-expression are increasing in relative importance, especially in the singleton-generation born since 1980, who use more vivid colors (also Kommonen 2011). On the other hand, in Finnish context, it was found that the values and national character expressed by cultural color meanings are naturalness, practicality, functionality, and modesty. This translates into using natural colors, in other words, colors close to the original color of each material, such metal, wood, and textile, and similar understated colors. The Finnish focus group participants sought to rationalize their interpretations in psychological, in other words, "scientific" terms, as scientific authorities have replaced religious authorities in the reasoning in many contexts in Western culture (van Leeuwen 2011:3). Habermas (1970) has even posited that science and technology can be regarded as an ideology in Western culture and correspondingly, science might be regarded as one prevailing ideology in Finnish culture.

Second, *religious* colors are typically considered highly significant and sacred by the devoted. They often carry complex symbolic systems developed over a long period of time, and may form (part of) the cultural color heritage. Consequently, applying religious colors in, for example, marketing communication involves a high risk, because they may be associated with deep meanings without or even opposed to the intention of the communicator. According to the present empirical studies, both China and Finland appear rather secular cultures in contrast with countries with Muslim or Hindu heritage, for example. However, Finnish color meanings do remain influenced by the normative color meanings, which are apparent in many Western Protestant cultures (see e.g. van Leeuwen 2011:3). Moreover, religion and belief systems become highly visible within certain rituals related for example to birth, the wedding, and the funeral. In Finland it is customary for the bride to wear a white wedding gown, while in China white has traditionally been the color for funeral, and the wedding gown has been red. Nowadays, however, many contemporary urban Chinese brides wear both the traditional red Qipao dress and a Western style white dress; they change dresses at some point of the wedding day because they want to have a taste of both worlds (Kommonen 2011). Nevertheless, as the connotation of color red with happiness is extremely strong, focus group discussion on the topic led one Chinese color professional to wonder, "If Western people wanted to express happiness, would they also wear red?" For her, white expresses purity but cannot express happiness. To give another example from the second Finnish focus group, the religious connotation of color purple was presented as a potential explanation for why some of the male participants found the color oppressive. Likewise, color symbolism in traditional Chinese culture is often related to a metaphysical, or, as some would say, superstitious

philosophy of the *Wu Xing* or five phases, which is suggested to date back to the times of Confucius (Kommonen 2011, Kommonen and Zhao 2008, Yu 1998,). Especially in Southern parts of Mainland China and in Hong Kong, the respective color meanings verge on religious connotation.

Third, *nation states* play a resilient role through the colors of national flags, in particular, and via other colors loaded with national meanings. These colors are strongly linked with national identity, and, for example, used as corporate logo colors when the company wants to communicate national origin. Nokia's and Kone's blue logo color connotes their Finnish origin for the Finns, and similarly, many Chinese companies such as CCTV, Haier, and Huawei, use Chinese red as their logo color. Correspondingly, the national colors of neighboring countries may carry positive or negative connotations based on political relationships or history of war or conflict. The significance of national colors seems to be highlighted in certain contexts, such as during international political crises or sports events. For example, the Olympic Games are typically employed by the organizing nation state for their own brand building, and the colors of the Olympic Emblem may be put to represent culturally specific meanings. It has been indicated that in the context of the Beijing Olympic Games the purpose of using Chinese symbolic and emotive content of visual imagery and colors was to re-position China as a legitimate power (also Hagan 2008). As the present empirical studies took place just before and after the Beijing Olympic Games, they were introduced as a particular example by some of the interviewees. The head of the graphic designers on the project accounted that the six colors chosen were given particular names to link them with Chinese history and the city of Beijing: "China Red, Jade White, Chinese Scholar tree[2] Green, Great Wall Grey, Yellow of Glazing, and Porcelain Blue". The China Red was chosen because it represents the country, and Jade White was chosen because white jade is the most precious of the various jades. The green color was named after the Chinese Scholar tree, which is very important for the people of Beijing. The tone of yellow was picked from the glazed tiles of the Forbidden City, as they represent gold, and finally the blue was named after Chinese porcelain, which is internationally famous. He further explained that black was not chosen because it represents death in many areas, so it was only applied in calligraphy, and elsewhere replaced with "Great Wall Grey". These examples illustrate the significance of nationally value-laden color meanings.

Fourth, *ethnic* groups and tribes have applied colors in body-painting and clothing since early on to communicate their identity. Ethnicity remains important in cultural color meanings of indigenous peoples, in particular. Some ethnicities have further established symbolic colors for flags, such as the *Sami* people living in Lapland in the Nordic countries. The bright hues of red, blue, yellow, and green of the flag introduced in 1986 originate from the *Sami* costumes (Robinson 2002). Likewise in China, several ethnic groups still use their particular costumes and colors. In the present empirical studies, one focus group participant elaborated on her experiences from 1980's of wearing the traditional batik cloth of a minority people from her home province of Guangzhou. As a school student she bought some of this tie-dyed fabric and made herself a skirt from it, but her classmates ridiculed her "peasant style" as their ideal was "Shanghai style", more urban and modern. However, on her vacation she travelled in Shanghai, Beijing, Nanjing, and Dalian, and there her skirt was appreciated. After some time batik became into fashion in urban areas. This narrative shows how color meanings and

[2] *Sophora japonica L. (Fabaceae),* i.e. *Styphnolobium japonicum*

desirable styles are continuously negotiated, renegotiated and transformed even within a culture.

Fifth, the color vocabularies of different *languages* diverge in more than one way. Scholars have been intrigued by how languages categorize colors (e.g. Berlin and Kay 1969 [1991], Lü 1997, Roberson 2005). There is controversy in how and why even the "primary" colors (as defined by Western color conception) are named according to different principles. Comparing Mandarin Chinese, English, and Finnish, for example, there are already several differences in color vocabulary, and which areas of the "color wheel" they cover. For example, in Mandarin there is a rare color name "*cang"* (苍), which refers to a greyish blue-green (Lü 1997), very different from the *blue-green* or *turquoise* of English and Finnish (*sinivihreä, turkoosi*) languages. In contrast, there is no one specific expression or character for color "turquoise" in Chinese language, but instead, it would be called either green "*lu*" (绿); "*qing*" (青) or azure blue "*weilan*" (蔚蓝); "*zhanlan*" (湛蓝) depending on the context. Furthermore, while the colour yellow connotes gold, richness, and the Emperor, the character for yellow "*huang*" (黄) in reference to any published media, in particular, also refers to pornography. For example "*huang tu*" (黄图, "yellow picture") means pornographic pictures and graphics. Moreover, linguistic metaphors have significance in how knowledge is disseminated within a language. In Chinese language, metaphors tend to utilize body-part terms, especially internal organs, in respective metaphors and metonymies of anger, happiness, and other emotional states (Yu 1998) and in a complex system of symbolism, each organ has a relationship with one of five directions, tastes, stars, and colors (see also Kommonen 2011, Clunas 1997:134-135, Zheng 2005: 9-10). The theories of *Yin Yang* and the *Wu Xing* (five phases) of Chinese philosophy and medicine, among others, form cognitive cultural models underlying the metaphorical conceptualization (Yu 1998:50). Respectively, in Chinese language even the word for "color" is directly connected to an emotion and a body part, as the word "*yán*" (颜) means both "color" and "face", or rather, "happy glowing face" (Yu 1998: 66). In Finnish language, however, *"värittää"* ("to color") may refer to a negative connotation of embellishing the truth. In general, idioms, proverbs, and similes typically reflect what is considered significant, right or wrong in a culture. For example, the extremes of good and bad are often represented in Finnish language with colors black (for bad) and white (for good). Similarly, a saying "to wear a Green Hat" has strong connotations of shame and betrayal for the Chinese even directly connecting shame and ridicule with the green color of a hat or a scarf, because it represents the wife betraying her husband in a marriage, as several interviewees accounted.

Sixth, the local natural *environment* influences cultural color meanings due to availability of natural resources, character and amount of sunlight, seasons, and built environment, among others. The historical availability of natural resources bears contemporary significance through early color pigments, such as those produced from particular minerals (for example azurite for blue and cinnabar for red in China), plants (indigo and woad i.e. *Isatis tinctoria* for blue in India and in Europe, madder i.e. *Rubia tinctoria* for red in central Asia and later Southern Europe), lichen and fungi (utilized by Celts, Vikings and the *Sami* for yellows, reds and greens, and even blue and purple), insects (The *Cochinea* i.e. *Dactylopus coccus* for red in Mexico) and shellfish (*Murex trunculu*s or *Murex brandaris* for purple in Tyre) (Ball 2001, Gage 1999, 2005). In built environment, the custom of using certain materials for buildings, for example, have an effect on the construction and coloring of subsequent houses.

Architects talk about colorscape planning (Dong and Kong 2009), as landscape design and urban planning also take color issues as one significant topic. For example, glazed tiles are typically utilized in Portugal for walls (Lobo and Pernão 2010), and in China for roofs (Gou 2007), where the technological know-how and consequent elaborate color schemes have influenced the colorscapes, and vice versa. Similarly, in Finland and in Sweden, for example, wood was originally the most common building material. The wooden houses were painted with red and yellow paint obtained from local ochre (Fridell Antell 2005). In Finland, red was applied for the more common houses while yellow was reserved for mansions. A further issue regarding how color is experienced related to environmental setting is the amount and quality of natural light. This is affected by distance from the equator, as the direct amount of sunlight is greatest on the equator, as well as the proximity and amount of water, since water reflects light and provides it a particular character. In the present empirical studies it was suggested that in the southern parts of China the colors applied are more vivid than those in the northern parts. Differences in the amount and quality of light are also due to varying seasons in the Northern and Southern hemisphere, in other words, the quantity and quality of sunlight during the day is different in spring, summer, autumn, and winter. For example in north of Finland, there is a period of Midnight sun in the summer, during which the sun does not set, and polar night called "*kaamos"* in the winter, when the sun does not rise. The amount and quality of light – affected also by pollution in the large cities in contemporary China – influence how colors are perceived and consequently, how they are given meanings to. The interviewees emphasized this quality of natural light. Discussing color of apparel and cosmetics, among others, two interviewed managers reflected upon their personal experiences in the context of moving from one country to another. Both had noticed that the color "was not the same" at home and at the other country (Finland vs. the U.S., China vs. Finland). Recalling moving back home from China, one Finnish design manager accounted: "I opened my suitcase at home and thought this is not my suitcase, these are not my clothes! It must have been switched! Because the colors of the clothes looked so dull and ugly. In the end I could not wear most of those clothes in Finland." Not only do seasons affect the amount and quality of natural light in Northern and Southern hemispheres, but also they are directly visible in the colors of the natural environment. In all of Finland, for example, the foliage first changes color from spring to summer to autumn, and then finally falls down for the winter leaving a grey-scale of empty branches. The amount of snow in the winter, on the other hand, affects how light is experienced in the wintertime, because like water, also snow reflects light.

As in any aspect of culture and illustrated by the examples given in previous passages, many of these color meanings are not derived from one single cultural force, but they emerge as the cultural forces intertwine in complex ways. Moreover, there also exist transformative cultural forces, which confront, challenge, and mold the persisting color meanings and even the cultural color heritage. I will next examine these in more detail.

Provenance of transformative color meanings

In addition to persisting cultural forces and respective cultural heritage, there are *transformative forces,* which influence cultural meaning-making. According to the present empirical studies these are forces such as *globalization*, *modernization, economic development, minorities, changing gender roles* and *new generations*, with their particular impacts on color meanings, as well.

The main origins, in other words, the *provenance of transformative color meanings* is summarized in Figure 2 below, and expanded in subsequent sections.

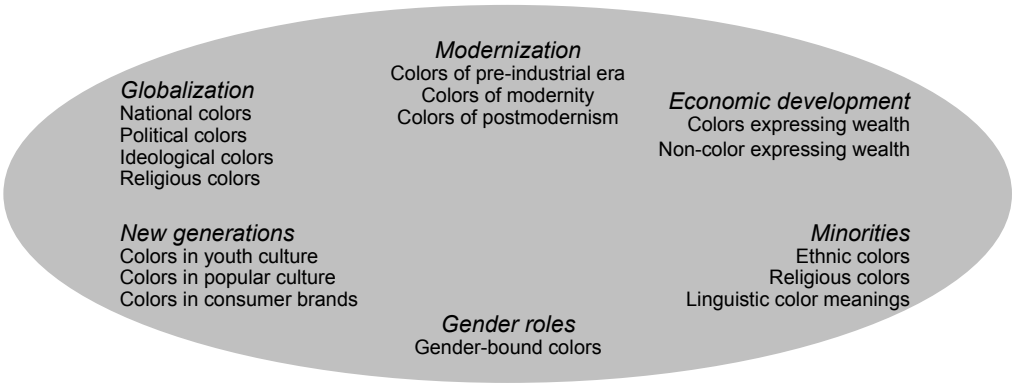

Figure 2. Provenance of Transformative color meanings.

First, within the present framework of cultural meaning-making for colors, *globalization* refers to the process where different "color cultures" or cultural color meanings such as those described above come into contact with one another. Consequently, color meanings are negotiated in processes of homogenization, hybridization, and empowerment (Kommonen 2011). Therefore, sometimes a "*global*" color meaning can be agreed upon based on either a relatively universal color association (for example blue for heaven in a particular context) or based on a globally shared standard or experience (e.g. colors of traffic lights). However, particular colors are put to serve multiple or *hybrid* meanings in one context in different cultures, for example pink in men's shirts (see Koller 2008 vs. Kommonen 2011), as will be illustrated when I discuss the color meanings connected with changing gender roles. And sometimes, a local national color meaning is so persistent, that a transcultural meaning cannot be negotiated (for example Green Hat in Sino-Finnish cross-cultural context). Particular color meanings may even be employed for the *empowerment* of national culture, as in the case of Beijing Olympic Games 2008 discussed above.

Essentially, colors have always been subject to fashions and trends, initially stemming from the limited availability and even scarcity of pigments, like in the case of purple of Tyre (Ball 2001), and consequent expression of power by the establishment. In Chinese culture the use of color was effectively regulated since imperial times continuing way into the Maoist era. For example, a certain hue of yellow color, which was considered to represent gold as a color, was reserved for the Emperor, and still today the yellow color carries this imperial connotation for the Chinese. As a matter of fact, yellow was the emblematic color of several Dynasties, for example the Han Dynasty (202 BCE-220 CE), but so where all the other color of the *Wu Xing,* each in their turn, according to the controlling cycle and later the generating cycle (Kommonen 2011), but only the color representing gold, in other words yellow, has preserved the imperial connotation to date.

Second, color started to become democratized with *modernization* and industrialization, as there were no longer differences in the prices of different hues. In Western world, this led first to a burst of colors in art, for example, creating the modernist palette of "pure" or "primary" colors. In architecture there persisted contradictions "in the positions in favor or against architectural polychromy" (Caivano 2006:356). Conversely, the postmodern era begun epitomized by "a color scheme of pale, anemic cyans and mauves" (Kress and van Leeuwen

2002: 356), a color scheme which is put to represent and express elegance; or the "international style" introducing a white and purist architecture refraining from decorations and ornaments (Caivano 2006: 356). One interviewee described the first decade of this millennium in Europe as the era of beige and grey, "the seven different Armani greys".

Third, during the pre-industrial era even the use of color as such expressed status and *wealth*, in particular, since the pigments were scarce and expensive. These pigments or substances were, in fact, some of the very first objects of international business, and consequent meaning-making for color stemmed from the very scarcity and subsequent high value of the early color substances, such as the purple of Tyre, which was "worth more than gold itself" (Ball 2001), which even led to wearing particular colors becoming subject to sumptuary laws (Clunas 2004). The democratization of color brought on by industrialization and consequent *economic development* has made color a matter of personal choice, based on cultural traditions and values, tastes, and preferences. Recently "non-color" has come to connote wealth in many contexts, such as for the unpractical choice of white for a sofa suite, which I observed in both the wealthiest Chinese and Finnish homes.

Fourth, the religious, ethnic, and linguistic *minorities* use their particular colors to express their identity within the established culture in chosen situations and contexts, while on other occasions they can choose to conform and assimilate into the dominant culture. For example, the *Sami* people of Lapland may mostly use their ethnic costumes for celebrations, but also when demonstrating against arctic mining or restrictions of their traditional livelihood, reindeer herding, in other words, when they want to influence the dominant culture and express their particular identity. At other times they may choose to blend into the urban appearance of people in Southern Finland, where most of the *Sami* people currently reside to be able to provide for their living.

Fifth, color has been employed as a *gender* and sexuality marker in many if not all cultures. In contemporary Western culture the color pink signals femininity and sexual identity with stereotypical associations of girlish characteristics, or alternative sexual orientation of men (Koller 2008). This is a relatively recent color phenomenon, because from the Medieval period until the First World War, ultramarine blue was a predominantly female color and iconic for Virgin Mary (Ball 2001, Gage 2005) while pink was reserved for little boys, as red was the masculine color of blood and fighting (Koller 2008). In China as in many Asian cultures, the colors red and pink as feminine colors are apparently even less established than in many Western cultures. For example, in ancient China "when a couple got married they got two blankets: a red one for the husband and a green one for the wife", and the color of the roof of a duplex in Hangzhou residential areas may today signal whether the family has a son (red roof) or a daughter (green roof) as their only child. In contrast, the color pink does not seem to have a specific meaning in Chinese history. The trend of menswear brands featuring pink items for the "real man" (Koller 2008) timely during the present empirical studies has taken an unexpected adaptation in China. When young Chinese men started wearing pink shirts, the bachelorettes of the singleton-generations felt empowered, because they considered this as proof that "the boys want to get the appreciation of the girls" and that "pink is the color indicating that female power in China is rising" (Kommonen 2011). In China popular boy bands such as F4 and Fahrenheit from Taiwan reinforced the trend of men wearing pink shirts, which has continued much longer in China than in many European countries. In Finland, however, the pale tones of pink and blue are to a large extent gendered at the birth of a child,

since even at some maternity hospitals boys will be clothed in pale blue and girls in pale pink, while the trend for pink shirts for men never really caught fire.

Sixth, youth culture of the *younger generations* seems to be the forum where the cultural renegotiation and transformation process is most evident. As the younger generations do not have all the lived experience of the older generations, they are perhaps less subject to experiences related to the persisting forces and, consequently, may be more amenable to new impressions. As for Western culture, the teenage rebellion against the parents and their values is even expected to some degree. In China, the fast pace of change and the singleton-generations have induced situations where many aspects of culture are currently renegotiated. As discussed above, one consequent color phenomenon is the "bachelor wearing pink" to attract the attention of girls.

Conclusions And Discussion Of The Proposed Framework

This study has been a first attempt to conceptualize the provenance of cultural color meanings to advance our understanding of meaning-making in cross-cultural contexts. To conclude, I will discuss three models or frameworks, which arise from the current empirical study: 1) the expressive function of color, which is a fundamental feature of color in meaning-making and exists within the more commonly described ideational, interactional, and textual functions. 2) Provenance of cultural color meanings conceptualized as interaction between the relatively more persisting and the relatively more transformative color meanings, while the inherited color meanings or the cultural color heritage acts as a lens filtering the interaction between the two types of cultural forces. 3) Model of color communication as expression, where the communicators are conceived as expressors of their cultural experience.

Already within the modernist research tradition, there have been numerous attempts to rationalize color and to find a scientific truth to it, a tendency that color has tenaciously resisted (Mirzoeff 1999). Based on the present study I suggest that these efforts may have failed because of two reasons: first, they have not taken into account the cultural and contextual differences in meaning-making for color, and second, they have eroded and dismissed insight on one of the most powerful qualities of color, the power to express. Here, I do not only refer to color as "expression plane" as opposed to "content plane", which has been the common distinction in multimodal studies (e.g. Fei 2004). In contrast, I propose that for example in the Chinese high-context culture, color meanings may appear as profound to even directly *express content*. Perhaps due to this very quality, "arguably color itself is metafunctional" (Kress and van Leeuwen 2002: 347). I share the view of Halliday that it is unhelpful to isolate any one function as fundamental[3], but that it may be useful to do so for certain types of inquiry (Halliday 1978: 50). Consequently, based on incorporating findings from multidisciplinary research and the current empirical data I propose that while color certainly can and does serve *ideational, interactive,* and *textual functions* (Kress and van Leeuwen 2002), in many contexts, first and foremost, *color has an expressive function*. This expressive function can be visualized as existing *within* the ideational, interactional, and textual functions, as illustrated in Figure 3 below.

[3] Halliday uses this articulation when discussing the expressive function of language.

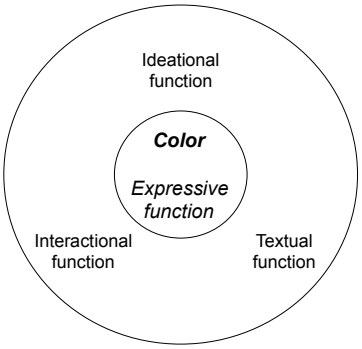

Figure 3. Functions of color: Ideational, interactional, textual, and expressive.

One could ask the question, the expression of what? Elsewhere, multimodalists have applied the wording "to express" to articulate many things with regard to color: for example, color may be considered an expression of *feelings*, a symbolic expression of *ideas and values*, an expression of *character and identity*, or *an era* (Kress and van Leeuwen 2002, van Leeuwen 2011). Already these examples support the argument that the expressive function of color may be conceived as fundamental as visualized in Figure 3 above. This expressive function of color has, in fact, been the focus of interest of art history and even the psychoanalytic approach to color, but for some reason it has not been included in the multimodal approach.

Second, as we saw earlier, color meanings are subject to dynamic cultural influences from several directions, and from several cultural and genre-specific contexts, which contribute to the dynamic nature of cultural meaning-making in general and of color meanings in particular. This may be visualized as two types of cultural forces representing interrelating qualities within a globe of cultural meaning-making, with the ideological or religious cultural heritage acting as a lens, which filters the interaction between the persisting and the transformative color meanings, as illustrated in Figure 4 below.

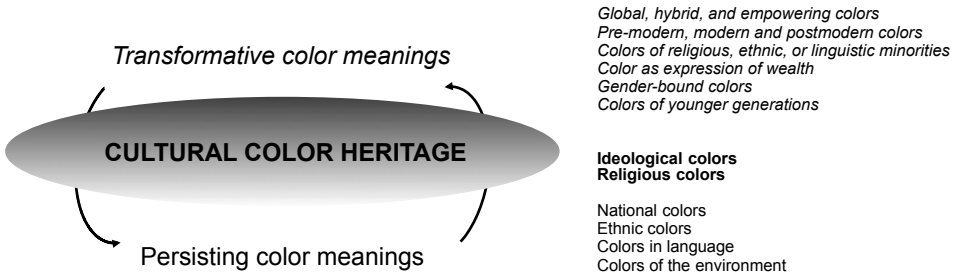

Figure 4. Provenance of cultural color meanings.

Therefore, the provenance of cultural color meanings can be conceptualized as being composed of meaning-making based on culturally shared color experiences, which are either induced by persisting color meanings, or are connected with transformative color meanings.

Associations with the two types of cultural forces shape the provenance of cultural color meanings in a particular context, with the persisting color meanings representing the traditions and the status quo, and the transformative cultural forces aiming at challenging and molding those meanings.

Moreover, when the two above introduced conclusions are combined, in other words, 1) that the salient characteristic of color is its expressive function, and 2) that meaning-making for color is based on cultural experience, a new model of color communication emerges, where the communicator is conceptualized as an *expressor* of cultural experience (see Figure 5).

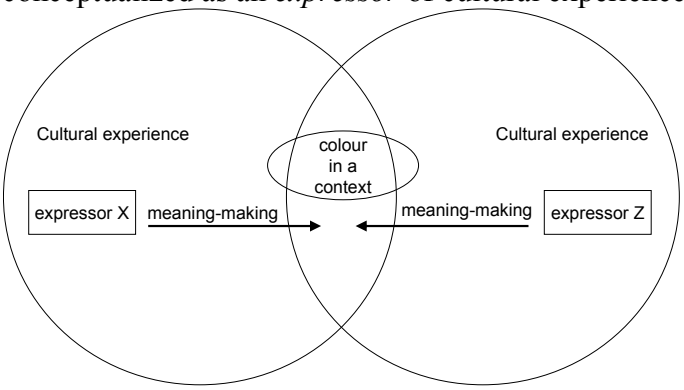

Figure 5. Model of color communication as expression of cultural experience.

In the above model, when the communicators use color they become *expressors*, since they use resources from their particular context-specific cultural identity and respective experience for meaning-making for the color. The similarity of the color meaning of expressor X and expressor Z in the Figure 5 above is dependent on the salience of shared cultural color experience related to the particular context.

To sum up, I suggest that the ideational, interactional, and textual functions, which colors are put to serve inevitably and invariably *express the cultural experience of the communicator*. Namely, without relevant cultural experience, one would not "know" the many potential cultural meanings assigned to colors. For example, without Western cultural experience, one might not "know" that pink is more feminine than masculine (Koller 2008), or that particular colors are "in harmony" with each other (e.g. Albers 1961). Similarly, without experience of Chinese culture, one would not "know" that red is the color of happiness, that green can connote shame and ridicule as a color of a hat, or that yellow can be the color of the Emperor, as well as that of pornography. When someone uses these or other colors in the "correct" way, they express their cultural experience and consequent cultural knowledge, and when they use colors in an "inappropriate" way, they reveal their inexperience with regard to the culture in question.

Limitations and implications for researchers and practitioners

This study was conducted on the macro level of national cultures in the Sino-Finnish business context, and therefore the findings are limited to that context. For example, color meanings based on social class did not emerge in the empirical materials, perhaps due to the interviewees all coming from the middle class. Moreover, some other cross-cultural context

might have surfaced further directions for the provenance of cultural color meanings, since for example Southeast Asian, African, and South American countries each have meaningful and colorful cultures.

For scholarly research, this study implies a need to incorporate and understand contexts such as the cultural context into the color studies to avoid inappropriate generalizations. Moreover, examining other cross-cultural research settings might prove valuable for our deeper understanding of the cultural meaning-making process for colors.

For business practitioners, this study implies a need to take into careful consideration the cultural color meanings, and cultural color heritage in particular, to sensitively apply global or local strategies for color usage. Since the meaning-making for any given color is not in sole control of the marketer or communicator, it is important to understand the dynamics of the cultural meaning-making in the key markets.

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Colour Preference and Colour Naming in Dichromats and Trichromats

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Abstract

Colour preferences and colour naming were investigated in Spanish participants with and without congenital colour vision deficiencies. Thirty two native dichromats (15 protanopes and 17 deuteranopes, all males) and 32 normal trichromats (15 males and 17 females) took part in the study. Participants rated their colour preference for individually presented stimuli, and afterwards were asked to name the stimuli. Stimuli consisted of light, dark and saturated version of 8 hues (Palmer & Schloss 2010). Important differences in preference appeared between trichromats and dichromats (especially for the protanope group). The most salient difference was that, compared with trichromats, dichromats had a significantly stronger preference for yellow and a weaker preference for blue. Preference for reddish and greenish hues did not differ between groups. Several potential explanations for the between groups preference differences were tested in analysis. They included the role of cone-contrast variables (Hurlbert & Ling 2007), colorimetric variables, such as chroma (C^*) and lightness (L^*), and variables related to dichromats naming performance. It was found that: (1) dichromats preferences were not related to C^* and L^* values but, there was a significant negative correlation between preferences and colour naming speed for males (normals and dichromats) but not for females.

Introduction

Colour preference is a key issue of visual perception that has influence over behaviours as different as decoration, clothing or website design. The origin of colour preferences has been a recurrent research subject. Frequently it is assumed that there are universal preferences for some colours over others (e.g. Eysenck 1941), universal sex differences (Hurlbert & Ling 2007), and universal mechanisms or dimensions that govern such differences (e.g. Palmer & Schloss 2010). On the other hand, recent research (Taylor, Clifford & Franklin 2012) emphasises that the results apparently supporting universal claims were provided from very similar populations (technologically developed).

There has been no systematic research on colour preference in red-green dichromats. Knowledge about this could be very relevant considering that: (1) Although dichromats have some residual activity in the L-M colour contrast mechanism (e.g. Scheibner & Boynton 1968; Moreira, Lillo, Álvaro & Davies 2014), their chromatic experiences are mainly determined by the S-(L+M) colour contrast mechanism (the "yellow-blue" mechanism), and this is the most relevant one for explaining colour preference in normal trichromats (they have a minimum in preference for some yellowish hues and a maximum around blue). (2) Although normal trichromats and dichromats are likely to experience different colours when responding to the same stimuli, both observer types frequently use similar Basic Colour Terms (BCTs) to name

the same stimuli, especially for saturated stimuli (Lillo, Vitini, Caballero & Moreira 2001) and for the best exemplars of each BCT (Lillo, Moreira, Álvaro & Davies 2014).

The current study evaluated colour preference in protanope and deuteranope dichromats and normal trichromats using stimuli and procedures similar to the ones used in recent studies of trichromat colour preference (Palmer & Schloss 2010; Taylor, Clifford & Franklin 2012). Analyses were conducted to establish 1.) the pattern of colour preference for dichromats and to identify similarities and differences to trichromat colour preference; 2.) to identify the predictors of dichromat colour preference (e.g., colorimetric variables) and the relationship with their colour naming. Overall the study aims to (1) further understand the perceptual experience of colour for dichromats and the underlying mechanisms of their colour perception and (2) to further understand the underlying mechanisms of colour preference.

Method

Participants

Thirty two native dichromats (15 protanopes and 17 deuteranopes, all males) and 32 normal trichromats (15 males and 17 females) took part in the study. All participants were native Spanish speakers. Their colour vision was tested with a set of psychophysical tests and if colour vision deficiencies were detected, a Rayleigh match in a Nagel anomaloscope (Tomey, AF-1). The research was conducted according to the principles expressed in the Declaration of Helsinki, and all participants gave informed consent.

Stimuli and Experimental Set up

Twenty four stimuli were close approximations of the 'saturated' (S), 'light' (L) and 'dark' (D) sets from the Berkeley Colour Project (Palmer & Schloss 2010). Each set contained 8 hues: red (R), orange (O), yellow (Y), chartreuse (H), green (G), cyan (C), blue (B), and purple (P). The stimulus chromaticity co-ordinates were verified with a Minolta CL-200 luxo-colorimeter with the required accessories. Colours were presented on a calibrated 24-in. LCD monitor (LaCie 324i; resolution of 1,920 × 1,200 pixels) as circular patches (4º diameter) in the centre of the screen and on a grey background (Y = 31.35 cd/m², x = 0.352, y = 0.351). Participants were tested in a dark room at eye-level to the centre of the monitor at a distance of 65cm.

Design and Procedure

Participants completed a colour preference task and a colour naming task, with task order counterbalanced across participants. Participants were required to move the cursor on a line rating scale from its neutral position in the middle of the scale to indicate their degree of preference for the stimuli. The stimulus remained on the screen until participant's response Preference rating and response time were recorded. In the naming task, participants were required to name aloud the colours using one of the 11 Spanish basic colour terms (*rojo*-red, *verde*-green, *azul*-blue, *amarillo*-yellow, *naranja*-orange, *rosa*-pink, *morado*-purple, *marrón*-brown, *negro*-black, *gris*-grey, *blanco*-white). Each stimulus remained on the screen for 2500

ms. Colour names and response time were registered using a unidirectional condenser microphone (Fonestar FMC-616) and a digital recorder (Olympus VN-711PC) for backup purposes. For both tasks, participants rated each stimulus twice in a pseudorandom order (without consecutive stimulus repetitions) and they were instructed to answer as quickly but precisely as possible.

Results And Discussion

Preference ratings were analysed to compare the four groups on the (1) patterns of preference (preference curves) (2) contribution of cone-contrast [L-M and S-(L+M) mechanisms] and (3) colorimetric dimensions (C^* and L^*) to colour preference and (4) the relationship of colour naming and preference.

Figure 1 gives the colour preference curves for the saturated stimulus set for normal trichromat males, females, protanopes and deuteranopes. Preference curves were obtained for all stimulus sets but for brevity we report the saturated set here.

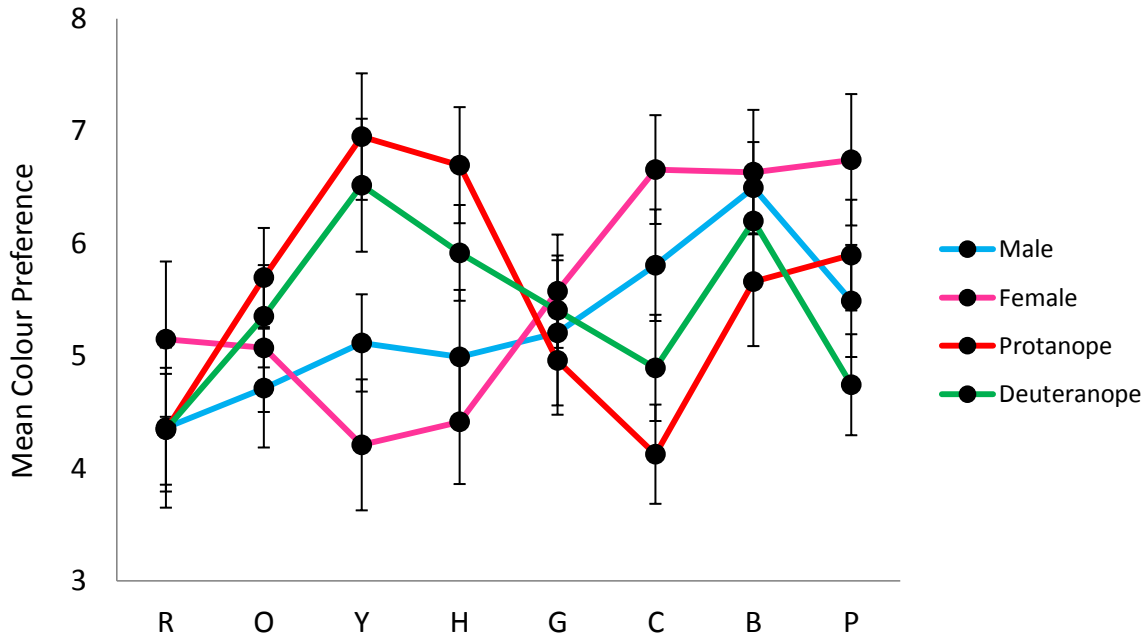

Figure 1. Mean preference ratings (±SE) for 8 colours from the "saturated" set, averaged for normal trichromatic males, females, and dichromatic protanopes and deuteranopes. The x-axis gives the hue: Red (R), Orange (O), Yellow (Y), Chartreuse (H), Green (G), Cyan (C), Blue (B) and Purple (P).

Figure 1 shows preference pattern for native Spanish normal trichromats. As it can be seen, normal trichromats colour preference for the saturated set in the current study is highly similar to that of normal trichromats from the US (Palmer & Schloss 2010) and the UK (Taylor, Clifford & Franklin 2012, Figure 3b), both for males and females. Normal trichromats showed lower preference for yellow than other hues. In contrast, protanopes and deuteranopes' preference peak was at saturated yellow. Preference for blue is weaker in dichromats than trichromats but not significantly. Surprisingly, red and green preference didn't vary between trichromats and dichromats, although red-green mechanism is almost silenced in protanopes

and deuteranopes, except by a slight residual activity (Scheibner & Boynton 1968; Moreira et al 2014).

Hurlbert and Ling (2007) analysed colour preference data taking into account cone-contrast theory: L-M axis (similar to red-green mechanism), and S-(L+M) axis (similar to yellow-blue mechanism). Mimicking such analyses, the 24 colours from the Berkley colour project were used in several regressions. We computed stimulus-background cone-contrast. Separate regressions for each group were performed with these values (independent variables) and average colour preference ratings (criterion variable). The cone-contrast model accounted for under a half of the variance in the average pattern of colour preference for males ($p < 0.01$) and females (40% and 46% respectively, $p < 0.01$), but lower levels for protanopes and deuteranopes (5% and 12%, $p > 0.05$).

Attending to colorimetric dimensions (lightness and chroma) separate least squares multiple regressions were conducted. Neither C^* or L^* were significant ($p > 0.05$) predictors of colour preferences in any group. This replicates the result obtained by Taylor, Clifford and Franklin (2012) with normal trichromats. In relation to dichromats, this is an expected result when considering that classical C^* and L^* aren't appropriate for such observers. We are currently analysing if two perceptual variables (s' and L^*_T) included in a model for predicting red-green BCTs use (Moreira et al. 2014) could predict dichromat colour preferences.

There were significant negative correlations between colour preference and naming response time for the three male groups ($p < 0.01$), but not for the female one ($p > 0.05$). The specific Pearson correlations were: Protanopes (-0.731); Deuteranopes (-0.554); Male trichromats (-0.668); Female trichromats (-0.182). This suggests a sex-linked phenomenon unaffected by dichromacy: For males, the easier the naming of the colour the more preferred the colour and vice versa. Now we're analysing this variables in relation to psychophysical specificity (Moreira et al 2014) for dichromats: the degree of compatibility (overlapping) between the range of s' and L^*_T values associated to a given BCT and stimuli belonging to others.

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Basic Colour Terms (Bcts) use by Dichromats (Protanopes and Deuteranopes) and Red-Green Mechanism's Residual Activity: Categorical, Task, and Within Group Differences

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Abstract

Two previous publications (Lillo et al. 2014; Moreira et al. 2014) described the results of three groups of people (protanopes, deuteranopes and normal trichromats) differing in their colour perception clinical status. They performed a mapping task in response to a 102 stimuli set (which of these are exemplars of X?) where X took the value of each Spanish BCT. Stimuli size was relatively big (4º) allowing the use of red-green residual activity (R-G_{res} responses). In the actual paper the relevance of this parameter was evaluated for the two dichromat groups at individual level. The main variable used in the evaluation was ΔR^2, the increase in the proportion of variance explained for each pointing task when using a previously described model (model B, Moreira et al. 2014) that includes a R-G_{res} (its only difference in relation with model A).

Important within groups differences related with R-G_{res} appeared for both dichromat types: (1) Participants better in the mapping task (less errors, more responses like the controls) had bigger ΔR^2 values (2) This variable value was especially important for the BCTs associated to higher ΔR^2 values (for example, green) in the relevant clinical group (protanope or deuteranope). (3) In the CIE L*u*v* space the most useful variable to find differences between the centroids of better and worst observers in the mapping task was u^*.

Introduction

Basic Colour Terms (BCTs) are the smallest set of terms sufficient to denote all colours in a given language. Several studies (e.g. Boynton & Olson 1987; Sturges & Whitfield 1995) have found that English has eleven BCTs and that each term has a specific colorimetric localization. English and Spanish are very similar in that every English BCT has a Spanish equivalent for naming similar positions in CIE colour spaces (Lillo, Moreira, Vitini & Martín 2007).

Two recent papers described red-green dichromats (protanopes and deuteranopes) BCTs use (Lillo, Moreira, Álvaro & Davies 2014), and two models (A and B) designed for explaining such use (Moreira, Lillo, Álvaro & Davies 2014). Both models predicted between BCTs confusions when the BCTs targets shared pseudometamers (stimuli that produce different colours in normal people but not in dichromats). Colours perceived by red-green dichromats were specified using two (L^*_T and s'; model A) or three (the other two along with R-G_{res}; model B) variables.

Transformed Lightness (L^*_T) was computed as the standard CIE 1976 lightness (L^*, see chap. 3 in Hunt & Pointer 2011) but, instead of using the standard luminance factor, transformed values were employed, for taking into account dichromats lack of a cone type (L cone for protanopes, M cone for deuteranopes). The second variable, *s'*, indicated the strength of the response in the yellow-blue mechanism. Only model B included a third variable, $R\text{-}G_{res}$ (residual activity in the R-G channel). $R\text{-}G_{res}$ is not relevant when stimuli are very different in *s'* and/or L^*_T, but it would be useful for differentiating stimuli similar in both these variables. The inclusion of $R\text{-}G_{res}$ was motivated by a series of works (e.g. Broackes 2010) that showed that, many clinically diagnosed dichromats, behave as expected for dichromats when responding to small stimuli (as the ones used in the standard Nagel anomaloscope) but as anomalous trichromats for bigger ones.

Participants in Lillo et al. (2014) performed two pointing tasks: "mapping" (which of these are exemplars of X?) and "best exemplar" (which is the best instance of X?), where X took the value of each Spanish BCT. Only results on the mapping task will be commented here. Moreira et al. (2014) computed a right response whenever a dichromat pointed a stimulus also pointed by normal observers. For some BCTs, correct answers covered a relatively big range of values for the three Model B variables (L^*_T, *s'* and $R\text{-}G_{res}$) and it was considered that such BCTs had "low psychophysical specificity". Such situation leaded to predict that dichromats perceived some stimuli belonging to other categories (e.g. some browns, greys and blacks, for the green BCT) as similar to other belonging to the target BCT (e.g. green). The more predicted similarities (the less psychophysical specificity), the more errors predicted in the mapping task.

Dichromats group's results (Lillo et al. 2014; Moreira et al. 2014) indicated that psychophysical specificity depended on the BCT (i.e. bigger for yellow than for green). They also showed that the BCT determinated $R\text{-}G_{res}$ relevance. More specifically, they revealed that for some BCTs (i.e. green and red) model B significantly explained more variance (R^2) than model A, but it didn´t happened for other BCTs (i.e. yellow and white).

This paper evaluates the relevance of the $R\text{-}G_{res}$ variable for the specific members of the dichromat groups that collaborated in our previous publications. We will use the same source of data (their responses in the mapping task), but now for analysing individual performances. The main reason for doing this supplementary analysis was that some works (e.g. Scheibner & Boynton 1968; Montag 1994) found important individual differences between the people receiving the same clinical classification (protanopia or deuteranopia). A minority, sometimes named "true dichromats" (Scheibner & Boynton 1968) behaved as dichromats no matter the stimuli size and, consequently, did not show evidence of red-green mechanism activity in response to big size stimuli (over 3º). On the other hand, evidence of such activity appeared for the other dichromats in some degree.

The relatively big size of the stimuli used in our experiment made possible red-green residual activity appearance. Such activity should correspond to changes in the $R\text{-}G_{res}$ values and to increases in the variance explained when using the model B instead of model A (ΔR^2). It was also expected that dichromats with bigger ΔR^2 values would show more right responses (similar to the ones provided by normal trichromats) in the mapping task and that this fact influenced the BCTs' centroids positions (nearer the normal trichromats' ones).

Method

Participants

Thirty-two observers participated. Normal trichromats (n=15, age range 19–24, mean age=21.4 years); Protanopes (n=8, age range 17–36, mean age=23.5 years); and Deuteranopes (n=9, age range 24–35, mean age=2.5 years). All were tested for colour vision by means of the Ishihara pseudo-isochromatic colour plates, the City University Colour Vision Test (CUCVT), the Lanthony test, and Rayleigh matches on an anomaloscope. No participant produced tritan responses. Group assignation was based on anomaloscope results. All the dichromats accepted the full range of red–green combinations in the anomaloscope.

Materials, stimuli and procedure

A set of 102 stimuli from the NCS colour atlas was chosen that included: (1) prototypes for each BCT; (2) "boundary-stimuli" between categories defined by previous use of combined terms, such as red-purple; and (3) stimuli halfway along the line in CIELUV space between a prototype and each relevant boundary colour. The set was presented on a grey background (S 5000-N, L*=50), with a small gap between adjacent stimuli. Viewed from 50 cm, each stimulus was a 4º square. Illuminance was between 225 and 250 lux with correlated colour temperature equal to 5800 K (we used incandescent lamps and Rosco corrective filters). All measurements were performed using a PR-650 SpectraScan spectrocolorimeter.

The 102 stimuli were presented simultaneously. In the mapping task, the observer indicated which stimuli were instances of a given BCT. This was done for each BCT in turn in a different random order for each observer. About half of the observers in each group performed the mapping task first followed by the best exemplar task and the remainder did so in the opposite order.

Main Results

Table 1 shows hits percentages and ΔR^2 values for both dichromat groups. It shows, for example, that one of the protanopes (P-1) got 61.14% of right responses (naming stimuli with BCTs compatible with normal trichromats responses). It also indicates that for P-1 ΔR^2 was 0.19 (R^2 was 0.73 and 0.92 for, respectively, models A and B). There were significant correlations (Pearson and Spearman; $p < 0.05$) between hit percentages and ΔR^2 values when all the dichromats were considered together ($r_{xy} = 0.77$) and for the protanope ($r_{xy} = 0.89$) and deuteranope groups alone ($r_{xy} = 0.64$).

Table 1. Individual percentages of correct responses and increments of proportion of variance (ΔR^2) when model B against model A was used.

Protanope group			**Deuteranope group**		
Participant	Hit percentages	ΔR^2	Participant	Hit percentages	ΔR^2
P-1	61.14	0.19	D-1	61.11	0.13
P-2	66.30	0.16	D-2	50.00	0.10
P-3	61.11	0.13	D-3	60.00	0.10
P-4	57.55	0.13	D-4	65.32	0.10
P-5	54.26	0.08	D-5	55.41	0.10
P-6	53.68	0.08	D-6	58.06	0.08
P-7	49.08	0.00	D-7	54.96	0.08
P-8	50.77	-0.10	D-8	51.49	0.06
			D-9	49.35	0.02

Figure 1 shows the empirical centroids for the trichromat (outermost solid line) and the deuteranope (grey triangles, dotted line) groups. It also shows the model A (circles, grey line) and model B (squares, grey line) predicted centroids for 6 chromatic categories (yellow, orange, red, pink, blue and green). Category identification labels correspond to trichromats centroids.

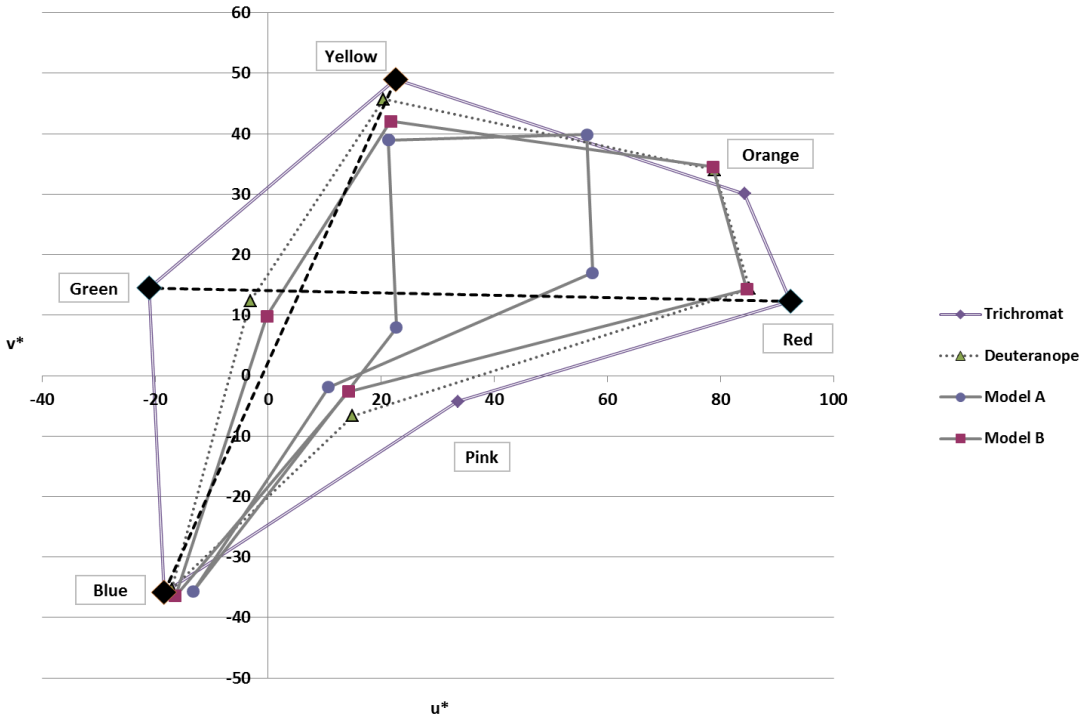

Figure 1. Empirical and predicted centroids of yellow, orange, red, pink, blue and green BCTs. Normal trichromats and protanopes empirical centroids, and model A and model B predicted centroids are shown. See text for details.

Figure 1 includes two dashed lines. The horizontal one extends from the green to the red trichromats centroids (black rhombuses). Such line is near to be parallel to the u^* axis. The other dashed line extends from the yellow to the blue centroids (black rhombuses too). The more important differences between groups and models can be described in relation with the red-green centroids distances measured along the u^* axis as follows: (1) Such distance is maximum for the trichromats and minimum for the model A predictions. (2) Intermediate and very similar distances appear for the deuteranopes and for the model B predictions. (3) There were significant correlations (Pearson and Spearman; $p < 0.05$) between, on a hand, hit percentages and, on the other hand, the differences in u^* values between the red and green centroids. Such significant differences appeared both when all the dichromats were considered together ($r_{xy} = 0.79$) and for the protanope ($r_{xy} = 0.67$) and deuteranope groups ($r_{xy} = 0.52$). No correlation between v^* and hit percentages was significant ($p > 0.05$ for all the possible comparisons).

Discussion

Important within groups $R\text{-}G_{res}$ differences appeared in both dichromat types (Table 1). This variable significantly correlated with mapping task performance. It means that some dichromats can use red-green residual activity to improve colour naming (more stimuli named with the same BCTs than normal trichromats). As Figure 1 shows, such improvement was more relevant for some BCTs (green and red) and less for others. Figure 1 also indicates that u^*, a standard colorimetric variable included in the CIELUV colour space, is very relevant for knowing which BCTs benefits more thanks to the availability of the red-green mechanism residual activity.

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Gender Differences For Colour Naming In Spanish And English

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Abstract

A colour naming experiment is being conducted via the Web at www.colournaming. com, currently with 12 languages, enabling a large number of observers from culturally and demographically diverse populations world-wide to contribute. The subject has to provide a name for each of 20 single colour patches, presented in sequence at the centre of the display screen. Any combination of words can be used. Data is gathered on the subject's age, gender, educational level, colour experience, display type and viewing conditions, as well as the response time for each sample.

This paper compares 2,960 colour names given by 148 non-colour-deficient observers (83 male and 65 female) in the Spanish language. Observers were located in Spain (53%), Argentina (15%), UK (11%), Abkhazia (8%), Colombia (3%) and 12 other countries (10%). Their ages ranged from 16 to 74, of whom 51% were graduates, 23% had a Master degree and 9% a Doctorate. The dataset in the Spanish language resulted in a total of 1,166 unique colour descriptors, of which 429 were used by females and 522 by males. The six colour names most commonly used by both genders were: rosa, azul, lila, verde, morado and violeta.

In the responses 56% consisted of a single word, 40% of two words and 4% of three or more words, with very similar rates for male and female. The eleven basic colour terms (BCTs) proposed by Berlin & Kay (1969) occurred in 26% of responses while other monolexical terms were involved in 28%. Male and female showed similar frequency of response for eight of the BCTs, but there were significant differences for amarillo, azul and rosa. The results of this experiment show that Spanish women were not faster to respond than Spanish men, and that they used fewer colour descriptors. This is quite different from English.

It is well known that the gender of the subject affects colour naming behaviour. Previous studies have shown that women tend to use more elaborate vocabularies (Rich, 1977; Swaringen *et al*, 1978), whereas men tend to use more modifiers, more compound terms and fewer elaborate names. In addition to basic colour terms (BCTs) women use significantly more elaborate terms, or BCT hyponyms, such as *mauve*, *scarlet*, *chartreuse* or *beige*. Women also offer many more 'fancy' colour terms, like *emerald green* or *cerise pink* (Nowaczyk, 1982), whereas men combine simpler colour terms together, e.g. *blue-green* (Simpson & Tarrant, 1991) and use more BCT qualifiers related to hue and saturation (Bonnardel *et al*, 2002). Women not only have larger vocabularies when talking about colours but they also have superior abilities to match and discriminate colours. For example, Perez-Carpinell *et al* (1998) found that women were more accurate for chroma and hue. In a speeded naming task, women

named colours more quickly, suggesting a faster memory retrieval of colour labels (Elias *et al*, 2003).

Such results have been reported across many cultures. In an extensive study of colour naming in English and Chinese, Lin *et al* (2001) found that female subjects used more names than male subjects in both languages. In a study in Spain, accessing colour words was found to be easier for females (Delgado & Prieto, 2003). Nepalese females were consistently able to list more colour terms than males (Thomas *et al*, 1978). In the USA Arthur *et al* (2007) found a gender dependence for the number of words used in written colour descriptions, with females tending to use more words and more tertiary terms than males, although age/educational level played a role. Additionally, females used words with a higher mean emotionality rating.

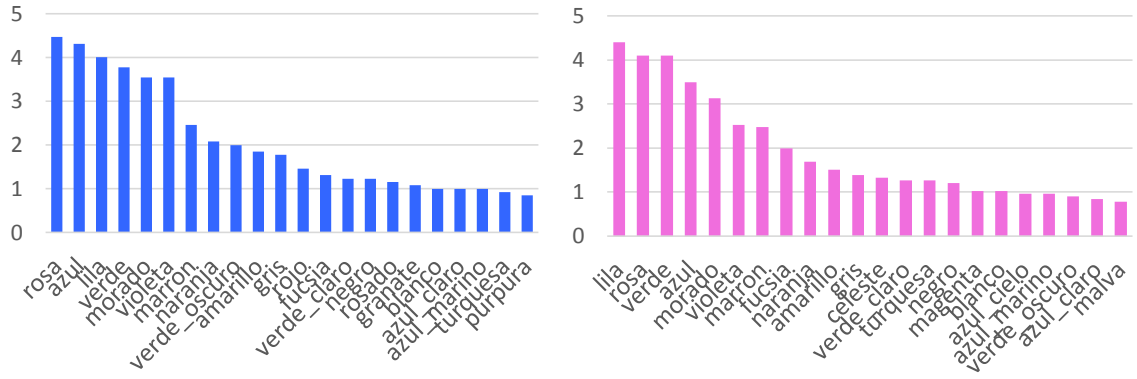

Figure 1. Occurrence (%) of 22 most commonly used Spanish words by males (left) and females (right).

A colour naming experiment is being conducted via the Web[4], currently with 12 languages, enabling a large number of observers from culturally and demographically diverse populations world-wide to contribute. The subject has to provide a name for each of 20 single colour patches, presented in sequence at the centre of the display screen on a grey background. The colour naming is unconstrained, so that any combination of words could be used. The stimuli are selected at random from 600 test samples in the Munsell Renotation Dataset and specified in the sRGB colour space. Data is gathered on the subject's age, gender, educational level, colour experience, display type and viewing conditions, as well as the response time for each sample. A simple test is included in the procedure to determine whether the subject has normal or deficient colour vision.

This paper compares 2,960 colour names given by 148 non-colour-deficient observers (65 male and 83 female) in the Spanish language. The observers were located in Spain (53%), Argentina (15%), UK (11%), Abkhazia (8%), Colombia (3%) and 12 other countries (10%). Their ages ranged from 16 to 74, of whom 51% were graduates, 23% had a Master degree and 9% a Doctorate. The refined dataset in the Spanish language resulted in a total of 1,166 unique colour descriptors, of which 522 were used by females and 429 by males. The six colour names most commonly used by both genders were: *rosa, azul, lila, verde, morado* and *violeta* (Fig. 1).

[4] www.colournaming.com

In the responses 56% consisted of a single word, 40% of two words and 4% of three or more words, with very similar rates for male and female (Table 1, left). Comparing the results with a similar dataset for the English language (Mylonas, Paramei and MacDonald, 2013), it is seen that the relative frequencies of words are similar, although there is a slight tendency for Spanish speakers to use fewer words, with only 3% using three or more words to describe a colour, compared with 6% for English speakers. Spanish females used two-word descriptors slightly more often than Spanish males.

Table 1. Frequency of words, by gender, in Spanish (left) and English (right).

	Spanish				**English**			
Number of Words	Female Occurrence	%	Male Occurrence	%	Female Occurrence	%	Male Occurrence	%
1 (basic)	423	25.49	363	27.92	939	29.61	615	27.25
1 (other)	474	28.55	372	28.62	746	23.53	498	22.07
2	718	43.25	517	39.77	1289	40.65	1003	44.45
3	38	2.29	39	3.00	166	5.23	114	5.06
4	4	0.24	6	0.46	22	0.69	20	0.89
5	3	0.18	3	0.23	4	0.13	6	0.27
6+	0	0	0	0	5	0.16	1	0.01
Total	1660	100	1300	100	3171	100	2257	100

The eleven basic colour terms (BCTs) proposed by Berlin & Kay (1969) occurred in 26% of responses while other monolexical terms were involved in 28%. Male and female showed similar frequency of response for eight of the BCTs, but there were significant differences for *amarillo, azul* and *rosa* (Fig. 2 left). This contrasts markedly with the English results (Fig. 2 right) for *yellow* and *pink*, though the gender differences are similar for *azul/blue* and *morado/purple*. *Purple* is used more in English than *morado* in Spanish and vice versa for *marron/brown*.

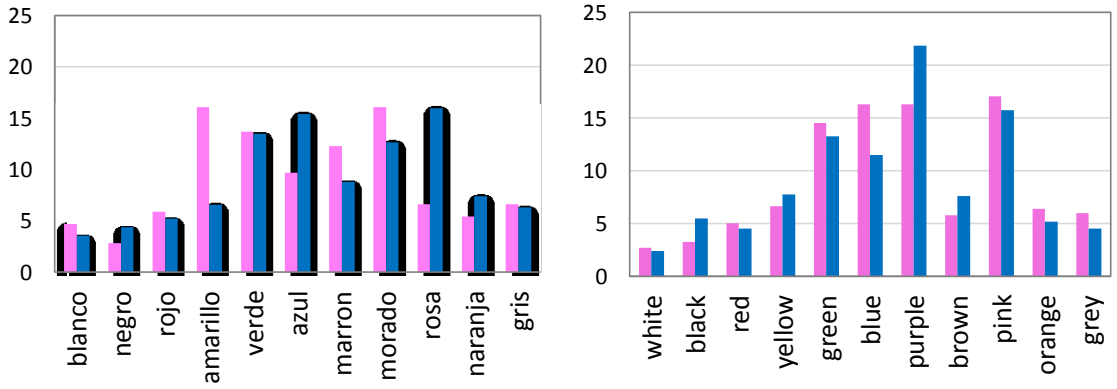

Figure 2. Frequency of basic colour terms for Spanish (left) and English (right), as used by male (blue) and female (pink) respondents.

When considering response times, in English (Fig. 3 right) females were on average 17% faster for all BCTs, but in Spanish (Fig. 3 left) there was no significant gender difference, except for *verde* where females were slightly faster on average, and for *negro* and *amarillo* where the tails of the female distributions were much longer.

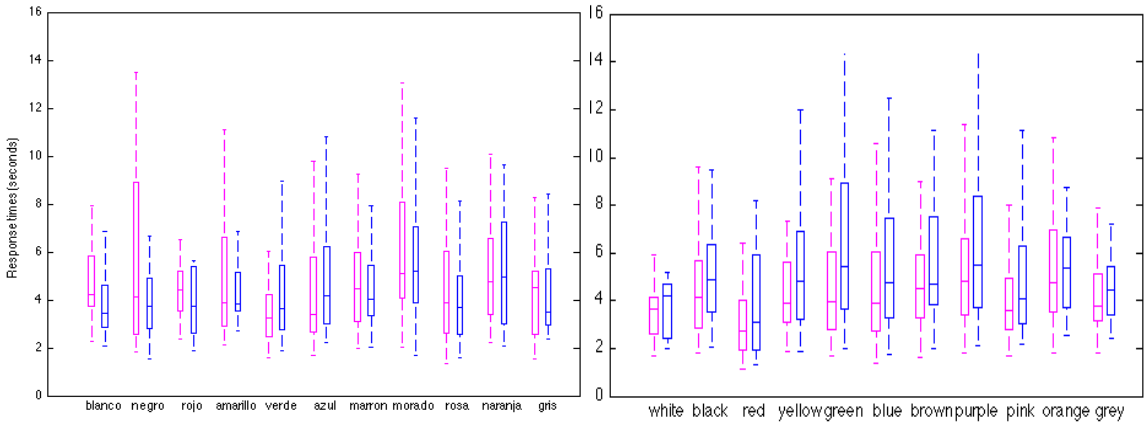

Figure 3. Comparison of response times for Spanish (left) and English (right) observers.

To visualise gender differences in colour naming, a probabilistic algorithm based on Maximum a Posteriori (MAP) was employed (for further details see Mylonas, MacDonald & Wuerger, 2010). Coordinates of the centroids of the most frequent descriptors were used to estimate the boundaries of each name category in the CIELAB image plane in both languages (Fig. 4). The visualization for Spanish shows 18 segments for females and 15 for males; females have a separate category for *azul-cielo* and males for *ocre*. In English there are 18 segments for females and 16 for males; females make fine discrimination of the warm colours *salmon, beige, tan, peach* and *salmon-pink*, whereas males differentiate *light-blue* and *cyan.* All four groups have a category for *turquesa/ turquoise*. Spanish *fucsia* is more chromatic and covers a larger area of the colour plane than English *fuchsia*. Spanish *rosa* is redder and more localised than English *pink*, and Spanish *lila* is darker than English *lilac*. The relationship of the categories with lightness is made clear by making the segmentation in the CIELAB 3D colour solid (Fig. 5).

Figure 4. Classification of the CIELAB colour plane by most frequent names: (upper) Spanish; (lower) English; (left) female; (right) male.

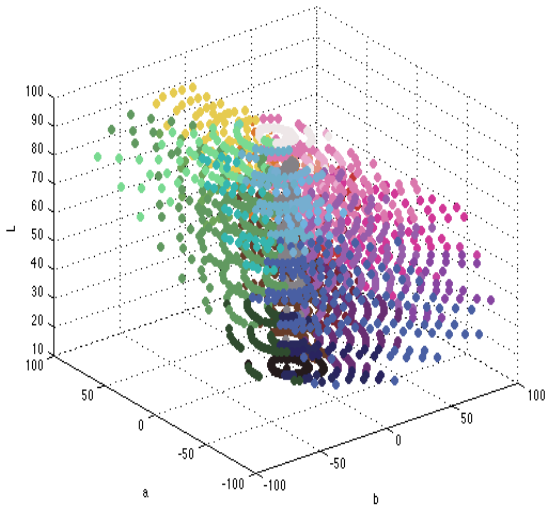

Figure 5. Classification of the CIELAB colour solid by most frequent names used by Spanish females, showing azul-cielo.

In this study we compared the Spanish colour names given by 83 female and 65 male observers to stimuli presented on a display screen. Based on our previous research in English, and on other research studies, we expected to find that women were faster and used a richer language than men. But the results of this experiment show that Spanish women were not faster to respond than Spanish men, and that their use of colour descriptors was not significantly different. The finer segmentation of the colour plane, however, suggests that women generally use more categories and thus make finer discriminations between similar colours.

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Asociación de Significados de los Colores Primarios: Variacion en Saturacion y Luminosidad, en Población Universitaria

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Resumen

Los colores primarios son tres (amarillo, rojo y azul), son aquellos que no pueden obtenerse mediante la mezcla de ningún otro por lo que se consideran absolutos. Mezclando pigmentos de éstos pueden obtenerse todos los demás.

Tres son sus dimensiones: matiz, saturación y luminosidad las cuales hacen posible organizar los sistemas del color (Arnheim, 1989[en: Prado y Ávila, 2009:89]).

También se valora desde el aspecto psicológico, el cual no es universal, existiendo variaciones transculturales, investigaciones como la de Ortiz (2011:194) sugieren que el azul se asocia con masculino y rápido, sin especificar la saturación y luminosidad.

Con el objetivo de dar a conocer el significado que se atribuyea los colores primarios se realiza la investigación variando su saturación y luminosidad.

Se encuestaron a 3,356 estudiantes de la Universidad de Guadalajara, Zona Metropolitana, ambos sexos (55.8% hombres, 44.2% mujeres). A los cuales se les presentaron 3 láminas con los 3 colores primarios (amarillo, rojo y azul) variando su saturación y luminosidad, una hoja con 59 significados pudiendo asociar de uno a tres significados a cada color.

Los resultados que se obtuvieron fueron: para el color **amarillo** claro y a**marillo naranja** le atribuyeron el significado de ***luminosidad***, **amarillo crema pasividad**. El color **rojo** en sus tres matices le atribuyeron el significado de ***amor*** esto fue el 85% de la población. Para el **azulclaro**atribuyeron el significado de ***pasividad*** en tanto que para el **azuloscuro** y **azul verde oscuro *elegancia*** no importando la variación de su saturación y luminosidad.

En este primer proceso de análisis se puede deducir que no se identifican atribuciones significativas que sean discrepantes con otras investigaciones, como en la de Prado y Ávila (2009:130), cuyos datos fueron: amarillo (luminosidad), rojo (amor) y azul (pasividad).

Palabras clave: significados del color, saturación, luminosidad, población universitaria.

1. Introducción

El color es una sensación que depende de las longitudes de las ondas luminosas reflejadas por los objetos de nuestro alrededor (Ortiz, 2011:36). Entre los científicos del color se encuentra Newton, quien es considerado como el primero y que con base en sus

observaciones del prisma de cristal reconoció siete colores: rojo, anaranjado, amarillo, verde, azul, índigo y violeta. Denominando triada primaria a los colores simples, amarillo, rojo y azul; y a sus mezclas colores complementarios o secundarios: verde, violeta y anaranjado. En donde los colores primarios son mejores que los secundarios según la armonía del color, esto parece adecuarse principalmente en el sector infantil, ya que los colores primarios son muy llamativos, según Gude (1999 [en: Prado y Ávila, 2009:107]) estudios con niños han demostrado que cuando hacen dibujos coloreados o pinturas, eligen frecuentemente el rojo, el azul y el amarillo.

Algunos autores a la combinación de estos tres colores la han llamado "balance" significando un régimen completo del espectro. Referente a esto Arnheim (1989 [en: Prado y Ávila, 2009:107]) afirma que los primarios son necesarios para el apoyo y el equilibrio completo. Si solo se presentan dos primarios reclaman la presencia del tercero, por tanto, se puede suponer que cada color por separado tiene algo de incompleto, rompiendo con el equilibrio del campo visual.

Por otra parte, todo color presenta lo que se ha denominado dimensión del color, refiriéndose a las cualidades o propiedades del color que hacen posible organizar los sistemas en una composición cromática. Estas dimensiones nos permiten diferenciar un color de otro. Son tres los elementos cromáticos:

a) Tinte, matiz o hue,
b) Saturación o intensidad,
c) Luminosidad, valor, tono o brillo.

Tinte, matiz o hue: Según Ortiz (2011:40) corresponde a la longitud de onda dominante del estímulo, es lo que define al color. Así mismo, Prado y Ávila (2009:89) mencionan que es lo que popularmente se conoce como color o croma, esto es, lo que designa el nombre que diferencia cada color

Saturación o intensidad: Es la pureza de un color respecto al gris, es la dimensión de fuerza o debilidad de un color. Es aquello que podemos identificar coloquialmente con su intensidad, con su concentración, con su capacidad de cubrir (Serra, 2011:283).

Luminosidad, valor, tono o brillo: Se refiere al grado de obscuridad o luz y al valor de gradaciones tonales. Es la cualidad clara u obscura de un color en relación con el blanco y el negro (Prado y Avila, 2009:90).

Por otra parte, Zanón (2012:01) hace mención que el color como elemento sugestivo y evocador que es, ejerce un papel muy importante en la vida cotidiana de los seres vivos, ofreciéndonos toda una serie de datos de nuestra realidad inmediata. Esto es debido a la fuerza psíquica que desprende el color y que es afectada no sólo por los propios sentidos, sino también por la mente y por el mismo cuerpo físico. Mediante el color podemos descubrir el estado de ánimo de las personas, de sus ideas, recuerdos, de sus sentimientos, incluso los más profundos y ocultos secretos.

Los datos obtenidos en éstos estudios son útiles en el diseño de infinidad de objetos y ambientes con la finalidad de adecuarlos a las diversas actividades del ser humano, para el logro de altos niveles de seguridad, eficiencia y confort en las actividades humanas.

También en el ámbito de la mercadotecnia, la importancia del color ha sido señalado. Killinger, Calkins, Umberger, Feuz y Eskridge (2011: 3288) señalan que el color es un criterio relevante en la selección del consumidor en productos a la venta.

Hasta aquí nos hemos enfocado en las aplicaciones prácticas del conocimiento acerca de las asociaciones o significados del color. Sin embargo, este conocimiento también conlleva aplicaciones teóricas. Por ejemplo, Palmer y Schloss (2010: 8878) proponen una teoría para explicar las preferencias del color, en la que la asociación afectiva positiva o negativa juega un papel preponderante en tales preferencias.

Por otro lado, es necesario considerar las diferencias transculturales al transpolar datos de otras investigaciones para aplicarlas a productos en determinado contexto. Como bien menciona Madden, Heweett y Roth (2000: 91): los efectos de la cultura en el significado asociado con claves de mercado, son criticas para los responsables del mercado internacional.

En este mismo sentido, Choi, Oehlmann, y Cottington (2008:728) expresan que se debe tomar encuenta las diferencias semánticas y contextuales entre las culturas.

Otro aspecto que ha sido discutido, es la utilización de cuadritos de colores como estímulo en los estudios para obtener significados asociados a los colore vs objetos coloreados. En este sentido,Taft (1997:48) se hizo el siguiente cuestionamiento: Los juicios de color en cuadritos de colores son representtivos de los juicios de los mismos colores contextualizados en diferentes objetos? Los resultados de su estudio mostraron una buena correspondencia entre la utilización de cuadritos de colores y los colores en los objetos. Por lo tanto, parece ser un buen material de estímulo para obtener resultados confiables en cuanto a los significados del color.

En México, no parece haber investigaciones suficientes que avalen o demuestren cuáles son los efectos de los colores sobre las personas, de manera que se puedan retomar éstos datos para el diseño adecuado a nuestra población.

Partiendo de estos postulados científicos la presente investigación tuvo la finalidad de abordar al color desde su aspecto físico variando la saturación y luminosidad, así como su aspecto psicológico en donde puede evocar emociones, sensaciones y otros aspectos semánticos, ya que el color según Serra (2011:282) posee unas implicaciones espaciales intrínsecas, de modo que cualquier pequeño cambio en sus variaciones cromática (tono, luminosidad o saturación repercute.

2. Método

2.1 Sujetos

Se encuestaron 3,356 estudiantes universitarios, hombres y mujeres, edades entre 15 y 54 años que cursaban el primer semestre en diversos Centro Universitarios de la Universidad de Guadalajara, Jalisco, México. Esto con la finalidad de evitar que tuvieran conocimientos académicos previos que pudieran tener referente a los significados del color, sobre todo en licenciaturas ligadas a las artes, diseño gráfico, entre otras. Los sujetos fueron elegidos al azar según estuvieran conformados en el grupo de estudio de la licenciatura que se imparte en cada Centro Universitario.

2.2 Materiales

La encuesta que se aplicó a los sujetos estuvo conformada por una lámina que contenía los 9 colores: amarillo claro, amarillo crema, amarillo naranja, rojo vivo, rojo seco, rojo tinto, azul claro, azul oscuro y azul verde oscuro(ver Tabla 1, código Munsell) en un rectángulo, una hoja de respuesta que contenía los datos necesarios para la descripción de la muestra, perforada en los espacios correspondientes a los 9 rectángulos de los colores seguido de tres renglones en donde ellos anotaban los significados atribuidos a cada color. Además un listado de 59 significados que emplearon para la atribución correspondiente, este listado se originó a partir de otras investigaciones (Prado, Ávila y Rosales, 2004[2009:83] ver Tabla 2).

Tabla 1. Colores incluidos en la investigación, codificación según Munsell.

Nombre común del Color Tinte, matiz o hue	Luminosidad / Saturación	Código Munsell
Amarillo claro	Luminoso/medio saturado	10 Y 9/6
Amarillo crema	Luminoso / poco saturado	5 Y 9/4
Amarillo naranja	Luminoso / medio saturado	7.5 YR 8/8
Rojo vivo	Medio luminoso / saturado	5 R 5/14
Rojo seco	Medio luminoso / medio saturado	5 R 5/12
Rojo tinto	Poco luminoso / poso saturado	5 R 4/10
Azul claro	Luminoso / medio saturado	10 B 7/6
Azul oscuro	Poco luminoso / medio saturado	5 PB 3/6
Azul verde oscuro	Poco luminoso / poso saturado	10 B 4/4

Tabla 2. Lista de significados empleados en la investigación.

Actividad	Malestar	Seriedad	Real	Sequedad
Agresividad	Desequilibrio	Sabiduría	Pasividad	Muerte
Alegría	Elegancia	Ternura	Encendido	Miedo
Amistad	Riqueza	Vacío	Alto	Naturaleza
Amor	Acogedor	Vida	Infinito	Oscuridad
Belleza	Suciedad	Conservador	Inocencia	Odio
Energía	Peligro	Fealdad	Libertad	Precaución
Equilibrio	Apagado	Femenino	Limpieza	Honestidad
Sexualidad	Tristeza	Fertilidad	Luminosidad	Indiferencia
Caliente	Vulgaridad	Frio	Masculinidad	Seguridad
Crear	Frivolidad	Fortaleza	Pobreza	Avanzar
Débil	Espera	Maldad	Religiosidad	

2.3 Procedimiento

Se proporcionó la indicación a los sujetos, así como la entrega del material, solicitándoles que colocaran la hoja de respuesta sobre la lámina que contenía los recuadros de los 9 colores, en donde debían coincidir los rectángulos con cada color. Posteriormente seles pidió que anotaran los datos generales que se solicitaban y posteriormente los significados que cada

color les evocara, mínimo uno hasta un máximo de tres, basándose en la lista de significados, con la consigna de no dejar ningún color sin responder. Se les aclaró que si algún color les evocaba algún significado que no estuviera contenido en la lista, podría incluirlo en su hoja de respuesta, no había tiempo límite para responder.

3. Resultados

3.1 Descripción de los sujetos

Los sujetos que participaron en la investigación fueron 3,356 estudiantes universitarios de ambos sexos (44.2% femenino y 55.8% masculino), edades que fluctuaban entre los 15 y 54 años, con una edad promedio de 20 años (= ± .27). La moda fue de 18 años.

En cuanto a generalidades de los sujetos como su ubicación de estudio en relación a los Centros Universitarios se obtuvo que el 10.7% correspondió al Centro Universitario de Arte, Arquitectura y Diseño, el 8.2% al Centro Universitario de Ciencias Biológicas Agropecuarias, el 26% al Centro Universitario de Ciencias Económicas Administrativas, el 31.7% al Centro Universitario de Ciencias Exactas e Ingenierías, el 15.8% al Centro Universitario de Ciencias de la Salud y el 7.6% al Centro Universitario de Ciencias Sociales y Humanidades. Referente a su situación económica, el 53.3% son sostenidos por sus padres, en tanto que el 30.1% trabajan para costear sus estudios, el resto 16.4% tiene otra forma de manutención como apoyo de tíos, abuelos y/o becas. El 50.4% residía en la Zona Metropolitana de Guadalajara y el 9.6% fuera de la ciudad. El 75.4% de los sujetos tiene o cuentan con automóvil para desplazarse, mientras que el resto no.

3.2 Asociación de significados a los colores

Al término de la aplicación de la encuesta se obtuvieron un total de 1486 significados incluido los 59 de la lista, como respuesta a los estímulos presentados (colores: amarillo, rojo y azul con sus variaciones en saturación y luminosidad). Por lo que, debido a que varios de estos significados tenían semejanza semántica se agruparon en grupos donde el significado de mayor jerarquía era encabezado por cada uno de los 59 contenidos en la lista, por ejemplo: en el significado de amor se agruparon los significados pasión, romanticismo, apasionante, cariño, amar, romántico entre otros, en el significado luminosidad se agruparon luz, luminoso, iluminación entre otros, cabe señalar que no todos los significados se agruparon (ver Tabla 3).

Tabla 3. Agrupación de significados por semejanza semántica.

Actividad	**Malestar**	**Seriedad**	**Real**	**Sequedad**
Activo	Enfermedad	Formal	Realidad	Seco
Juego	Incomodidad	Serio		Me da sed
	Molestia	Reservado		Árido
Agresividad	**Desequilibrio**	**Sabiduría**	**Pasividad**	**Muerte**
Sangre	Preocupación	Inteligencia	Tranquilidad	Infértil
Lucha	Desesperación		Pasivo	
Agresivo	Angustia		Paciencia	

Dramático Coraje	Revoltura Indefinición		Mesura Serenidad Apacible Paz Vida muy tranquila Tranquilo Lentitud Pacificidad Relajado Calmado	
Alegría Fiesta Emotivo Emoción Entusiasmo Animo Disfrutar Jovial Agradable	**Elegancia** Elegante Distinción Personalidad Sofisticación Presencia	**Ternura** Tierno Suavidad Suave Nobleza	**Encendido**	**Miedo** Misterio
Amistad Confianza Amable	**Riqueza**	**Vacío**	**Alto**	**Naturaleza** Bosque Madera Pino Arboles Mar Arena Agua Ambiente Marino Plantas Vegetación
Amor Pasión Romanticismo Apasionante Cariño Meloso Amar Romántico Cursilería Pareja Cariñoso Entrega Romántico Inspiración Amar Cursi Meloso	**Acogedor** Me agrada Calidez	**Vida** Vivo Fructífero Esperanza Respiración Vivencia	**Infinito**	**Oscuridad**

Belleza	**Suciedad**	**Conservador**	**Inocencia**	**Odio**
Llamativo	Descomposición	Decencia	Apariencia	
Bello	Mugre	Aseñorado	inocente	
Hermosura	Podredumbre			
Energía	**Peligro**	**Fealdad**	**Libertad**	**Precaución**
Enérgico	Peligrosidad	Desagradable		
Intensidad	Abismal			
Intenso				
Equilibrio	**Apagado**	**Femenino**	**Limpieza**	**Honestidad**
Neutro	Aburrido	Mujer		Sinceridad
Sexualidad	**Tristeza**	**Fertilidad**	**Luminosidad**	**Indiferencia**
Gay	Melancolía	Preñez	Luz	Me es
Cachondez	Llanto	Composta	Claro	indiferente
Sensual	Depresivo		Luminoso	Mediocridad
Intimidad			Esplendor	Indiferente
Lujuria			Iluminación	
Fogosa			Amanecer	
Libido			Claridad	
Virginidad			Día	
Placer			Encandilado	
Intimo			Resplandor	
Cachondo			Brillo	
Pasional			Brillantez	
Sexy			Iluminación	
Coquetería			Esplendor	
Tentación			Brillante	
Erotismo				
Sexo				
Excitación				
Semen				
Sensualidad				
Seducción				
Caliente	**Vulgaridad**	**Frio**	**Masculinidad**	**Seguridad**
Sol	Vulgar	Frescura	Masculino	Norma
Caliente	Algo Vulgar			Algo seguro
Fuego				
Crear	**Frivolidad**	**Fortaleza**	**Pobreza**	**Avanzar**
Creativo	Frívolo	Fuerza		
	Superficial	Fuerte		
	Soberbia	Tenacidad		
Débil	**Espera**	**Maldad**	**Religiosidad**	
Introvertido		Rencor	Cielo	
Debilidad		Hipocresía	Fé	
Marchitez			Celestial	
Timidez				
Frágil				

A continuación se expone como los sujetos atribuyeron los tres significados a cada color. Para el color amarillo claro el 23.9% de los sujetos le designaron el de luminosidad,

Para el amarillo crema el 14.4% eligió el significado de pasividad, el amarillo naranja fue atribuido como color luminoso según el 10.9%. El color rojo vivo estuvo asociado al amor por el 44.2% al igual que el rojo seco solo que este fue designado por el 26.1% del total de los sujetos, a diferencia del rojo tinto en donde los sujetos discreparon entre el significado de amor y sexualidad (ver tabla 3), el primero con un 16.6% y el segundo 2.7%. Ante esta evidencia se aplicó una Chi² para identificar la significancia en cuanto a la atribución de significados resultando ser significativa pues estadísticamente se obtuvo una Chi² =184.97, p<0.000000.

Referente al color azul claro el 31.8% de los sujetos designo el significado de pasividad, para el color azul oscuro el significado de elegancia el 17%, por ultimo para el color azul verde oscuroel 10.9% designo el significado de elegancia (ver tabla 3), en tanto que el 1.4% le atribuyo el de conservador, por tal motivo se aplicó también una Chi² para identificar la significancia en cuanto a la atribución de significados resultando ser significativa pues estadísticamente se obtuvo una Chi² =171.93, p<0.000000.

Tabla 3. Resultado de las atribuciones a los colores amarillo, rojo y azul en general.

Color	%			Significados		
	Primera Atribución	Segunda Atribución	Tercera Atribución	Primera Atribución	Segunda Atribución	Tercera Atribución
Amarillo claro	14.4	5.7	3.1	Luminosidad	Luminosidad	Luminosidad
Amarillo crema	7.4	3.4	2.0	Pasividad	Pasividad	Pasividad
Amarillo naranja	6.3	2.8	1.1	Luminosidad	Luminosidad	Luminosidad
Rojo vivo	25.0	11.6	6.1	Amor	Amor	Amor
Rojo seco	15.6	7.0	2.3	Amor	Amor	Amor
Rojo tinto	9.9	5.4	2.7	Amor	Amor	Sexualidad
Azul claro	16.4	5.1	4.6	Pasividad	Pasividad	Pasividad
Azul oscuro	9.5	4.4	2.9	Elegancia	Elegancia	Elegancia
Azul-verde oscuro	7.4	3.2	1.4	Elegancia	Elegancia	Conservador

A continuación se hace referencia a cada matiz, en donde se analizan los tres porcentajes correspondientes.

De esto se identificó que en todos los significados atribuidos en los primeros lugares estaban contenidos en la lista de los 59 significados.

AMARILLO CLARO (código Munsell 10Y 9/6)
Asociado con: Luminosidad, alegría y energía, porcentajes especificados en la Tabla 4.

Tabla 4. Porcentajes de los tres primeros significados asociados al color amarillo claro en cada evocación.

Color AMARILLO CLARO	% más alto del significado	% medio del significado	% bajo del significado
Primera evocación de significado	14.9 % Luminosidad	10.3% Alegría	7.8% Energía
Segunda evocación de significado	5.8% Luminosidad	4.5% Alegría	3.7% Energía
Tercera evocación de significado	3.2% Luminosidad	2.3% Alegría	2.0% Energía

AMARILLO CREMA (código Munsell 5Y 9/4)
Asociado con: Pasividad, débil y luminosidad, porcentajes especificados en la Tabla 5.

Tabla 5. Porcentajes de los tres primeros significados asociados al color amarillo crema en cada evocación.

Color AMARILLO CREMA	% más alto del significado	% medio del significado	% bajo del significado
Primera evocación de significado	8.5% Pasividad	7.1% Débil	4.3% Luminosidad
Segunda evocación de significado	3.8% Pasividad	2.3% Débil	2.2% Luminosidad
Tercera evocación de significado	2.1% Pasividad	1.6% Débil	1.4% Luminosidad

AMARILLO NARANJA (CÓDIGO Munsell 7.5YR 8/8)
Asociado con: Luminosidad, alegría y pasividad, porcentajes especificados en la Tabla 6.

Tabla 6. Porcentajes de los tres primeros significados asociados al color amarillo naranja en cada evocación.

Color AMARILLO NARANJA	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	6.8% Luminosidad	5.2% Alegría	4.6% Pasividad
Segunda evocación de significado	3.0% Luminosidad	2.3% Alegría	2.2% Pasividad
Tercera evocación de significado	1.1% Luminosidad	1.0% Alegría	0.9% Pasividad

ROJO VIVO (código Munsell 5R 5/14)
Asociado con: Amor, caliente y sexualidad, porcentajes especificados en la Tabla 7.

Tabla 7. Porcentajes de los tres primeros significados asociados al color rojo vivo en cada evocación.

Color ROJO VIVO	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	26.5% Amor	13.1% Caliente	11.5% Sexualidad
Segunda evocación de significado	11.6% Amor	9.6% Sexualidad	8.3% Caliente
Tercera evocación de significado	6.1% Amor	6.0% Sexualidad	5.9% Caliente

ROJO SECO (código Munsell 5R 5/12)
Asociado con: Amor, sexualidad y caliente, porcentajes especificados en la Tabla 8.

Tabla 8. Porcentajes de los tres primeros significados asociados al color rojo seco en cada evocación.

Color ROJO SECO	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	16.5% Amor	8.0% Sexualidad	7.7% Caliente
Segunda evocación de significado	7.2% Amor	5.3% Sexualidad	4.1% Caliente
Tercera evocación de significado	2.4% Amor	2.3% Caliente	2.2% Sexualidad

ROJO TINTO (código Munsell 5R 4/10)
Asociado con: Amor, sexualidad y caliente, porcentajes especificados en la Tabla 9.

Tabla 10. Porcentajes de los tres primeros significados asociados al color rojo tinto en cada evocación.

Color ROJO TINTO	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	10.8% Amor	8.8% Sexualidad	5.1% Caliente
Segunda evocación de significado	5.8% Amor	4.9% Sexualidad	3.1% Caliente
Tercera evocación de significado	2.7% Sexualidad	2.6% Amor	1.8% Caliente

AZUL CLARO (código Munsell 10B 7/6)

Asociado con: Pasividad, frío, equilibrio y honestidad, porcentajes especificados en la Tabla 10.

Tabla 10. Porcentajes de los tres primeros significados asociados al color azul claro en cada evocación.

Color AZUL CLARO	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	17.2% Pasividad	10.4% Frio	5.5% Ternura
Segunda evocación de significado	9.4% Pasividad	5.1% Frio	4.0% Equilibrio
Tercera evocación de significado	5.2% Pasividad	3.4% Frio	2.1% Honestidad

AZUL OSCURO (código Munsell 5pb 3/6)

Asociado con: Elegancia, masculino, seguridad y fortaleza, porcentajes especificados en la Tabla 11.

Tabla 11. Porcentajes de los tres primeros significados asociados al color azul oscuro en cada evocación.

Color AZUL OSCURO	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	9.6% Elegancia	10.0% Masculino	5.6% Fortaleza
Segunda evocación de significado	4.5% Elegancia	4.2% Masculino	3.3% Fortaleza
Tercera evocación de significado	2.9% Elegancia	2.3% Seguridad	2.2% Fortaleza

AZUL VERDE OSCURO (código Munsell 10B 4/4)

Asociado con: Elegancia, conservador, frío y seriedad, porcentajes especificados en la Tabla 12.

Tabla 12. Porcentajes de los tres primeros significados asociados al color azul verde oscuro en cada evocación.

Color AZUL VERDE OSCURO	*% más alto del significado*	*% medio del significado*	*% bajo del significado*
Primera evocación de significado	7.6% Elegancia	6.7% Frio	5.6% Masculino
Segunda evocación de significado	3.3% Elegancia	2.9% Seriedad	2.7% Frio
Tercera evocación de significado	1.4% Conservador	1.3% Seriedad	1.3% Frio

4. Discusión

Ya desde hace 40 años, los estudiosos del color señalaban que el rojo representaba el más alto nivel afectivo y revelaba una expresión deshinbida (Birren, 1973:13). Lo anterior coincide con los significados encontrados para todos los tipos de rojo.

Por otro lado, los azules expresan sometimiento y liberan tensión (Birren, 1973:13), equiparándose estos señalamientos con el significado de pasividad para el azul claro encontrado en la presente investigación.

En el análisis realizado en relación a la asociación de significados a los colores primarios se identificaron datos interesantes, tal es el caso del color *rojo* que, aunque se haya variado su saturación y luminosidad estuvo asociado predominantemente y constantemente con amor, caliente y sexualidad, esto es, estas asociaciones, aunque son parte de la vida cotidiana y pueden tener cierto interés, no son trascendentes si no se les encuentra una explicación más amplia y convincente, denotando que en otros estudios como el de Ortiz (2011:194,201) coinciden en denominar al rojo como excitante, caliente y sexo. Madden, Heweett y Roth (2000: 98) encontró que los significados del rojo no se unen con los de otros colores y permanecen transculturalmente, en los significados de caliente y activo en países occidentales y en asiáticos coincidió con placentero.

Por su parte, el color *amarillo* que estuvo asociado con la luminosidad, alegría y pasividad independientemente de su variación en su saturación y luminosidad, son asociaciones que

socioculturalmente se ve reforzada al constatar que el "amarillo es un color asociado con la luz, la claridad, el brillo, así como con la atracción y la fuerza" (Ortiz, 2011:113).

Resulta interesante que sólo el amarillo claro, el cuál es el que popularmente conocemos como amarillo, tuvo el significado de energía, y cómo los otros tipos de amarillos, tienen un significado completamente opuesto, como es el de pasividad. En esete sentido, energía se puede equiparar con fuerza, tal como se menciona en el párrfo precedente y con actividad, significado dado por varios países en el estudio de Madden, Heweett y Roth (2000: 96)

En un corte estadístico de este estudio referenciado por Prado, Ávila y Rosales (2011:391), reportan que el color amarillo en las mismas variaciones de saturación y luminosidad sigue prevaleciendo las asociaciones de luminosidad, pasividad, esto indica lo interesante del efecto que el color ejerce sobre quien lo percibe.

Por último, del color *azul* se menciona que si se observaron variaciones de significados según la saturación y luminosidad, pues el azul luminoso y medio saturado se asoció con pasivo y frío, en tanto los poco luminosos y poco saturados se asociaron con la elegancia y masculino; "Lüscher asocia el azul con la tranquilidad, la pasividad, la ternura y lo sensible" (Ortiz, 2011:120), por lo que probablemente si en realidad si se percibiera el color al cual se refiere Lüscher entonces se estaría refiriendo a un azul claro, luminoso y medio saturado. Aunque en otros estudios en donde no se reportan variaciones de saturación y luminosidad como el de Ortiz (1992 [2011:122]), se encontraron dos significados importantes con el frío, por su relación con el azulado oscuro del hielo y el masculino. Así mismo, Madden, Heweett y Roth (2000: 97) encontraron que el azul permanecía transculturalmente en sus significados de calmado, pacífico y suave; similar a pasivo y tierno del azul claro del presente estudio.

Las similitudes de los significados de los colores en diferentes culturas, parece indicar que existe una semántica universal, aunque con ciertas variaciones transculturales. Esto no resulta extraño ya que uno de los factores que ha sido señalado como influencia en la determinación de los significados es la asociación con eventos de la naturaleza, lo cual compartimos en todas las culturas, así como nuestro equipo biológico y psicológico.

Cabe señalar que no obstante existe carencia de estudios en relación a la asociación del color y sus significados, sobre todo variando su saturación y luminosidad, pues existe un interés por emplear al color como un medio de comunicación

5. Conclusiones

Se puede decir que la reflexión y la experiencia que se ha expuesto en la presente investigación; utilizando instrumentos que nos lleven a deducir la asociación de los tres colores primarios, amarillo, rojo y azul, variando su saturación y luminosidad, resulto que es significativo y sin discrepancia dichas asociaciones pues de manera general se designó el mismo significado para el color sin discriminar su matiz, así pues, se tiene que para el color *amarillo* (claro y naranja) le atribuyeron el significado de *luminosidad, amarillo* (crema) *pasividad*. El color *rojo* en sus tres matices le atribuyeron el significado de **amor** Para el *azul* (claro)atribuyeron el significado de *pasividad* en tanto que para el *azul* (oscuro y verde oscuro) *elegancia.*

Estos resultados tienen el interés de contribuir dentro del campo de la Educación del Diseño, especialmente indicada para que el alumno desarrolle el sentido de la percepción visual, forma y del color.Se espera que de esta manera seael interés por seguir contribuyendo a la investigación en áreas de asociaciones del color, sobre todo en variación de su tono y saturación.

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Mexican Basic Colour Terms (BCTs) and Colour Preferences

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Abstract

Three experiments were performed to analyse the relation between Mexican Basic Colour Terms (MBCTs) and colour preference. First two experiments provided, respectively, MBCTs identification and their colorimetric delimitation. Experiment one (elicited lists) recorded a list of one-word colour terms for each participant. Each term frequency (number of lists including it) and list relative position, were computed. From this information it was concluded that the Mexican version of the Spanish language includes the following BCTs (English correspondences between brackets): *amarillo* (yellow), *verde* (green), *azul* (blue), *rojo* (red) *negro* (black), *naranja* (orange), *café* (brown), *morado-violeta* (purple) *blanco* (white), *gris* (grey) and *rosa* (pink). Experiment two provided colorimetric delimitation for each of the 11 mexican BCTs from the information provided by a between categories boundary determination task. Third experiment was similar to the one described in Palmer & Schloss (2010) for measuring colour preference in the used stimuli set and in the procedure. Participants were required to evaluate the preference level for each of the 37 stimuli included in four sets (saturated, light, dark and muted). Mexican preferences were lower for the Munsell yellows than for the blues ones, as founded for the English (e.g. Palmer & Schloss, 2010). On the other hand, experiment 3 preliminary analysis indicated that BCC could play some role to explain the differences in colour preference.

Keywords: Naming, categories, color preference

Introduction

Standard colour spaces (e.g. CIELAB) and colour atlases allow the specification of between colours differences using continuous variables such as "value", "chroma", "*L**" or the "S-(L+M) colour contrast mechanism". Such kinds of variables have been used to study colour preference (e.g. Palmer & Schloss 2010; Taylor, Clifford & Franklin 2012). On the other hand, colour categorisation is focused on qualitative, and not quantitative, changes between different parts of the colour spaces. For example, red is not more colour than orange, blue or yellow, but it is just a qualitatively different colour.

Basic Colour Terms (BCTs) are the smallest set of colour terms sufficient to denote all colours in a given language (Berlin & Kay 1969; Kaiser & Boynton 1996, chapter 11; Kay, Berlin, Maffi & Merryfield 2009, chapter 1). Several studies (Boynton & Olson 1989; Sturges & Whitfield 1995) have found that English has eleven BCTs (black, white, red, green, yellow, blue, brown, purple, pink orange, and grey). Each one of these terms are used to name a specific part of the colour space and, more important now, these parts show important

differences when considered in terms of colorimetric continuous variables. For example, yellow is a category only used for naming stimuli with relatively high values in lightness (see Lillo, Moreira, Vitini & Martín 2007, Figure 5) but blue is used for naming stimuli very different in lightness (op. cit. figure 3).

English and Castilian Spanish (thereafter Castilian) have similar Basic Colour Categories. It means that every English BCT has a Spanish equivalent for naming similar positions in CIE colour spaces (Lillo et al. 2007). The main goal of our research was to obtain similar information about the Spanish spoken in México (thereafter, Mexican). Two experiments were performed in relation with such goal. The first one (elicited lists) required each participant the writing of all the one-word colour that he/she could remember during two minutes. This experiment was used to identify Mexican BCTs (words appearing in, at least, that 50% of the lists). The second experiment (one-word naming and boundary selection) presented 26 between-colour categories transitions for performing two tasks. The first one (naming ends) required the naming of the colours located at each end (i.e. green for the left and brown for the right). The second task (boundary selection) required participants to indicate the place of the transition which could be labelled with the two previously named categories indistinctly.

Third experiment evaluated colour preference in Mexican speaking population using stimuli and procedures similar to the ones used in some recent researches (Palmer & Schloss 2010; Taylor et al. 2012) to compare such preference with what previously described for English speaking populations. Colorimetric measurements provided by the experiment 2 were used to relate BCT with colour preference

Method

Experiment 1

Ninety-seven participants collaborated in Experiment 1 (57 females and 40 males). All were students of the University of Guadalajara, Mexico, with ages between 19 and 27 years. After writing their name and identification data in a white sheet of paper located opposite to them, they were asked to write (from top to bottom) all the monolexemic (one-word) colour names they could remember during 2 minutes. Participants wrote the elicited lists with their eyes closed (to avoid the influence of visual surroundings).

Experiment 2

Thirty participants collaborated in Experiment 2 (15 females, 15 males). Stimuli were presented using a 20 inches LCD screen (widescreen active matrix) with the followings primary chromatic coordinates and luminances (x, y, Y): Red (0.65; 0.34; 72 cd/m^2), Green (0.32; 0.60; 180; Blue (0.15; 0.07; 20.2). The BCTs used in the ends of the transitions presented to the observers were (English equivalence between brackets): *rojo* (red), *verde* (green), *amarillo* (yellow), *azul* (blue), *blanco* (white), *negro* (black), *naranja* (orange), *morado/violeta* (purple), *rosa* (pink), *marrón/café* (brown), *gris* (grey) and *celeste* (sky). Only the 26 transitions that pass through no other category were used (i.e: white-black transition was not used because it passes trhough grey).

Experiment 3

Fourty nine participants collaborated in Experiment 3 (25 females, 24 males). Stimuli were presented using the same screen than in experiment 2. The 32 stimuli were similar in chromatic co-ordinates and lightness (L^*) to the 'saturated' (S), 'light' (L) and 'dark' (D) sets from the Berkeley Colour Project (e.g., Palmer and Schloss 2010). Each set comprised 8 hues: red (R), orange (O), yellow (Y), chartreuse (H), green (G), cyan (C), blue (B), and purple (P).

Main Results

Experiment 1

Frequency (number of lists including a term) and relative position in each list were computed for each term. A colour term was considered a BCT if it appeared in at least 50% of the lists. Only eleven terms accomplished this requisite (their percentages inside brackets): *amarillo* (yellow, 98%), *verde* (green, 97%), *azul* (blue, 94 %), *rojo* (red, 93%), *negro* (black, 92%), *naranja* (orange, 86%), *café* (brown, 86%), *morado* (purple, 85 %), *blanco* (white, 80%), *gris* (grey, 72%), *rosado* (pink, 72%). Several statistical comparisons were performed. Their results can be synthesised as follows. Primary BCTs (yellow, green, blue, red and black) appeared significantly ($p < 0.05$) more frequently than derived BCTs (orange, brown, purple, grey and pink). For example, *amarillo*-yellow was significantly more frequent than *rosa*-pink. No significant differences appeared between different primary BCTs (e.g. between *amarillo*-yellow and *rojo*-red) nor between derived BCTs (e.g. between *naranja*-orange and *café*-brown). White behaved in a very special way. However it is usually considered a primary term, its frequency was similar to the derived ones. The only significant differences for white were in relation with the others primary terms (e.g. it was significantly less frequent than green).

For each list and BCT, the relative order (*Or*) was computed. It was computed by dividing the absolute order by the number of terms included in the list. Lower *Or* values correspond to terms at the beginning of a list. The mean *Or* value for each BCT were: *amarillo* (yellow, 0.39); *azul* (blue, 0.23); *rojo* (red, 0.27); *morado* (purple, 0.33); *verde* (green, 0,34); *negro* (black, 0.50); *rosado* (pink, 0.50); *naranja* (orange, 0.54); *blanco* (white, 0,60); *gris* (grey, 0.60) and *café* (brown, 0.61). Several statistical comparisons were performed. Their results can be synthesised as follows. In general, primary chromatic BCTs (yellow, green, blue and red) significantly ($p < 0.05$) appeared earlier in the lists than primary achromatic (black and white) and derived BCTs (pink, orange, grey and brown). Purple behaved in a very special way. However it is usually considered a derived term, its *Or* was similar to the chromatic primaries ones.

Experiment 2

Table 1 shows the CIE L^* values for the Mexican between BCT boundaries (for making its use easier, their English equivalent names are presented). For example, it indicates that the L^* for the boundary between *rojo*-red and *café*-brown is 30.93. The information about each BCTs boundaries in L^*, C^*_{ab}* and h_{ab} was used to look for equivalences with Castilian and English BCTs using the data described in Lillo et al. (2007). It was considered that two BCTs were

Table 1. L Boundaries between pairs of Mexican BCTs .*

	Red	Gre.	Yel.	Blue.	Whi.	Bla.	Brow	Pin	Oran	Pur.	Gra
Red	**						30.9	58.0	55.3	35.1	
Green		**	65.3	33.7	98.9	8.6	26.0				35.3
Yel.			**		96.8		54.2		74.7		
Blue				*	93.6	11.2				27.4	35.8
White					*			93.6			
Black						*	6.5			3.7	
Bro.							*	50.4	45.0	22.7	
Pink								*		52.8	58.6
Ora.									*		
Pur.										*	31.9

equivalents when: (1) The best representative of an alternative language (Castilian or English) was included in the portion of the colour space belonging to one Mexican BCT and (2) such portions were similar (in L^*, C^*_{ab}* and h_{ab}) in the compared languages. For example, (1) it was found that the best representatives of the Castilian BCT *marrón* and the English BCT brown were inside of the portion of the colour space corresponding to the Mexican BCT *café* (and not to any other Mexican BCT) and (2) it was found that *café*, *marrón* and brown were used to name stimuli very similar in L^* (medium-dark), C^*_{ab}* and h_{ab}. The main conclusion was that Mexican, Castilian and English are similar in BCC (Basic Colour Categories) because they all have the same number of BCTs (11) used for naming similar positions in CIE colour spaces (Lillo et al. 2007).

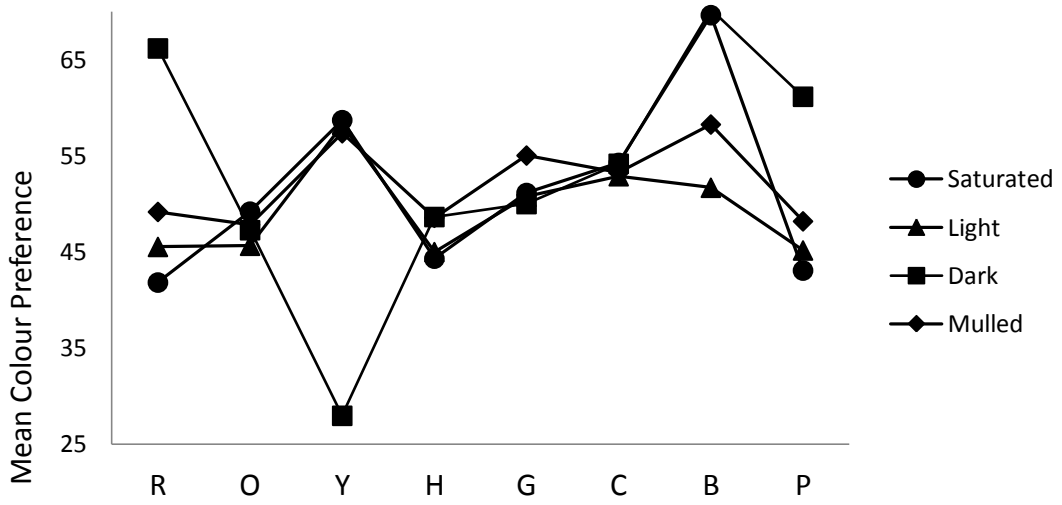

Figure 1. Mean preference ratings for the 8 colours from the "saturated", "light", "dark" and "muted" sets, averaged for males and females. The x-axis gives the hue: Red (R), Orange (O), Yellow (Y), Chartreuse (H), Green (G), Cyan (C), Blue (B) and Purple (P).

Experiment 3

Figure 1 gives the colour preference curves for the 8 Munsell hues and the four stimuli types (saturated, light, dark, muted). Preliminary analysis indicated that Mexicans showed yellow-blue dichotomy. That is, in general, higher colour preference appeared for the Munsell hue stimuli (specially for the saturated and dark exemplars) and lower for the yellows (very

specially for the dark exemplar). Important differences related with lightness also appeared for another two categories (red and purple), where the dark exemplar received better evaluations.

To check the correspondence between Munsell hue denominations and categories, the stimuli colorimetric co-ordinates (see Schloss, Pogessi & Palmer, 2011, table 1) were used to computer their L*, C* and H* values. This information and Lillo et al. (2007) allowed to check the BCC predicted for each stimuli. Some relevant no-consistencies appeared. For example, because its reduced L* level (52.8) the stimulus classified as dark yellow according the Munsell taxonomy, was near of the boundaries between this category and the green and the brown ones. Similar situations appeared for light red and dark orange.

Discussion

The Mexican is a language with eleven BCTs for naming eleven BCCs similar in colorimetric characteristics to Castilian (Lillo et al, 2007) and English (e.g. Boynton & Olson, 1987; Sturges & Whitfield, 1995). Two Mexican BCTs, café and Rosado, denominates the same BCCs named marrón (brown) and rosa (pink) in Castilian. Another relevant difference concerns to the relevance of the blanco (white) category. Blanco appeared in the Mexicans elicited lists less frequently than the other primary categories (amarillo-yellow, verde-green, azul-blue and negro black).

As figure 1 indicates, Mexicans preferences were lower for the Munsell yellow than for the blue ones, as founded in similar experiments for the English (e.g. Palmer & Schloss, 2010). On the other hand, experiment 3 preliminary analysis indicates that BCC could play some role to explain the differences in the colour preference of stimuli sharing the same Munsell hue denomination.

Acknowledgements

We thank our subjects for their participation. This research has been supported by the *Ministerio de Ciencia e Innovación de España*, grant PSI2008-04166/PSIC, and a FPI (BE48/09) grant from the *Universidad Complutense de Madrid*.

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An Investigation of the Appearance Harmony of Materials

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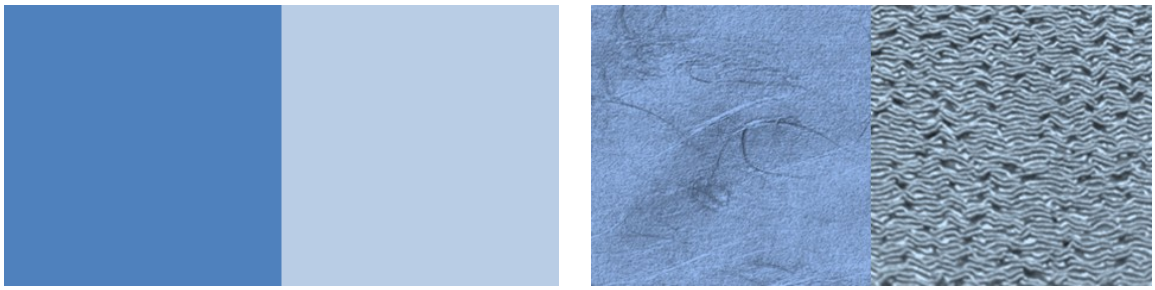
Abstract

Color harmony has long been of interest to researchers in different fields who design the colors of various objects. When sensing harmony among actual objects, not only the harmony among the colors but also the appearance of harmony of the materials is an important consideration. In the present study, we investigated the appearance of harmony of various materials by conducting psychophysical experiments to collect quantitative data. In our experiments, we prepared 30 samples of 50 mm x 50 mm square pieces made from the following real materials: fabric, paper, stone, wood, leather, metal, plastic, glass, rubber, cork, and tile. In order to help subjects distinguish color harmony, we provided samples with a grayish color except for the brownish-colored wood materials. The material samples generated 435 round-robin pairs that were arbitrary coupled and presented to the subjects, two samples at a time. Each pair was arranged horizontally in a viewing booth under an illuminant D65. Two experiments were conducted. In the first experiment, samples were placed such that their surfaces and the viewing direction became perpendicular to the subject. In the second experiment, the subjects were allowed to tilt the pair of samples to provide a comprehensive judgment of harmony, based on the reflectance properties of the actual surface in addition to the 2D surface appearance. In experiments, a forced-choice, 10-point scale to rate harmony-disharmony was used for data collection. Our results indicated that the sample pairs with similar surface appearance were viewed as harmonious, even though their materials were different. Furthermore, the appearance of harmony of the materials was significantly affected by the subjects' reactions to the reflections of the tilting samples. These results suggest that appearance properties should be studied in a more in-depth manner by using actual materials rather than reproduced images on a monitor.

1. Introduction

Color harmony has long been of interest to researchers involved in color design with various objects (Judd, 1975), (Ou, 2006), (Kuehni, 2012). When sensing harmony among actual objects, both harmony among colors and the appearance of harmony among materials are important considerations. Figure 1 shows two examples of a color harmony pair. The pair in Figure 1(a) shows color patches typically used in color harmony studies. Figure 1(b) shows real materials: a *washi* (handmade Japanese paper) and a crape fabric. Basic colors shown in Figures 1(a) and (b) are nearly the same. According to color harmony theory, the pair in Figure 1 harmonizes. However, as shown in Figure 1(b), the appearance of materials with harmonized color does not necessarily harmonize. Although the appearance of harmony in relation to specific materials has been investigated, harmony among different materials has not received adequate attention.

In the present study, we investigated the appearance of harmony among various materials by conducting psychophysical experiments. We conducted two experiments using 30 real materials. In Experiment A, subjects were allowed to tilt the sample pairs to provide a comprehensive judgment of harmony, which was based on the reflectance properties of the actual surface in addition to surface appearance. In Experiment B, samples were placed such that their surfaces and viewing direction became perpendicular to the subject. In this experiment, subjects judged how harmonious/disharmonious each sample pair appeared based on 2D surface appearance. These two experiments, overall, investigated the appearance of harmony among various materials.



(a) A color harmony pair without textures *(b) A color harmony pair with textures from different materials*

Figure 1: Examples of color harmony pairs with/without textures.

2. Experimental Setup

2.1 Experimental Stimuli

We prepared 30 samples of 50 × 50 mm square pieces from the following real materials: fabric, paper, stone, wood, leather, metal, plastic, glass, rubber, cork, and ceramic. All materials and their specifications are shown in Figure 2 and Table 1, respectively. In order to help subjects distinguish color harmony, we provided samples with a grayish color except for the brownish-colored wood materials. In Figure 3, "×" represents the chromaticity of each material on the CIE xy chromaticity diagram. The material samples generated 435 round-robin pairs that were arbitrarily coupled and presented to subjects, two samples at a time. Each pair was arranged horizontally in a viewing booth (Macbeth Judge II) under an illuminant D65 in a dark room. The distance between the subject and samples was 300 mm (viewing angle was 10°).

2.2 Experimental methods

Our experiments were conducted from two different experiments as follows.

(1) Experiment A:

Subjects were allowed to tilt the sample pairs to provide a comprehensive judgment of harmony based on the reflectance properties of the actual surface in addition to surface appearance.

(2) Experiment B:

Samples were placed such that their surfaces and viewing direction became perpendicular to the subject. In this experiment, subjects judged how harmonious /disharmonious each sample pair appeared based on 2D surface appearance.

After dark adaptation for two minutes, subjects began evaluating pairs based on the respective experimental method. A forced-choice, 10-point scale was used to rate harmony-

disharmony. Subjects determined the appropriate rate for each combination and wrote it down it on answer sheets. In each experiment, the evaluation was carried out for 435 pairs and conducted more 30 pairs again selected from 435 pairs to confirm reproducibility.

Figure 4 shows an experimental snapshot during evaluation of appearance harmony in Experiment A. Subjects were asked to wear gloves in order to alleviate tactile confounds when making judgments. In each experiment, subjects conducted the evaluation in a specified order and changed the evaluation samples on their own. Five subjects participated in this experiment. All subjects were native Japanese with normal color vision. Each experimental session lasted around three hours.

Figure 2: Material dataset.
(The samples form a line from the upper left.)

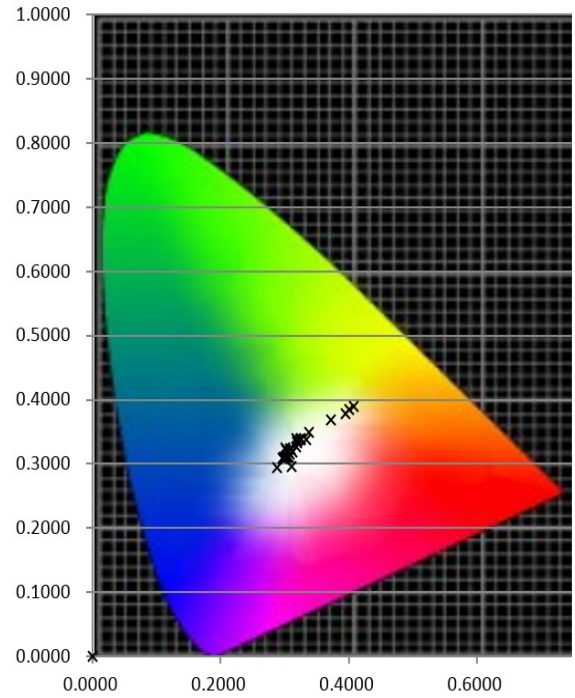


Figure 3: Chrominance of material samples.

Table 1. Specifications of the material dataset.

Category	Remarks	#
Stone	Rustenburg	1
	Bianco brouille	7
	Caledonia	25
	White pearl	19
Metal	Almite gray	2
	Chrome	26
	SUS HL	14
Glass	Pearl gray	20
Plastic	Opal	15
	Black	9
Leather	Saddle leather matte	3
	Pig suede	21
	Calfskin	27
Fabric	Cotton	4
	Satin	10
	Boa	16
	Crepe	22
	Felt	28
	Wool	30
Paper	H-2	5
	P-14	11
	Drawing paper	17
	Washi (handmade)	23
	Silver-coated paper	29
Wood	Paulownia	6
	Bamboo	12
	Japanese cypress	18
	Cork	24
Ceramic	Tile	13
Rubber	Black	8

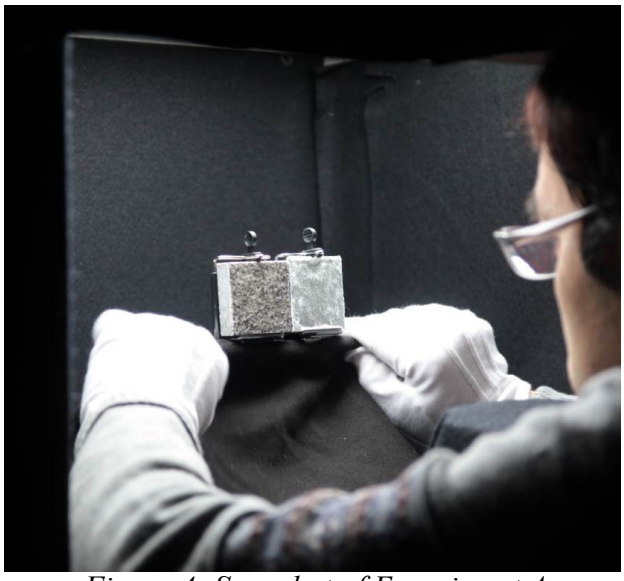


Figure 4: Snapshot of Experiment A.

3. Results And Discussion

3.1 Intra- and inter- subject variances

Table 2 summarizes intra- and inter-subject rating variances in each experiment, respectively. The intra-subject variance was derived from thirty samples shown twice. The inter-subject variance in the right row of Table 2 shows the variance of averaged ratings among 435 samples. As shown in Table 2, we confirmed that the values of intra-subject rating variance were smaller than for inter-subject rating variance.

There is one notable aspect of the observed variance. As shown in Table 2, the ratings in Experiment A varied by subject, whereas ratings in Experiment B were stable among subjects. This suggests rich information, such as reflectance properties obtained by moving objects, was sensitive to perceptual quality ratings. On the other hand, poor information obtained from the 2D surface appearance was insensitive to perceptual quality ratings.

This above result shows that the evaluation of appearance harmony using actual material samples is different from 2D surface appearance obtained from captured images. We argue that actual material samples are very important for evaluating appearance harmony among materials, enabling accurate observation (e.g. changes in glossiness within object surfaces).

Table 2. Intra- and inter-subject rating variances.

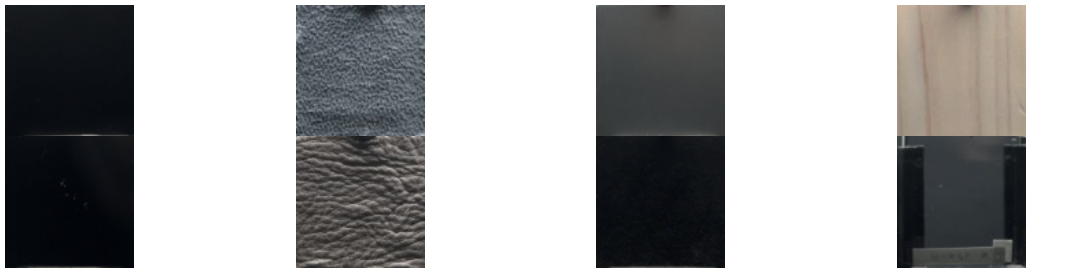
	Intra-subject variance					Inter-subject variance
Experiment	Sub. 1	2	3	4	5	
A	0.267	1.733	0.845	1.328	0.224	3.797
B	0.500	0.784	0.448	0.457	0.414	3.491

3.2 Harmonious change between Experiments A and B

Rating values changed greatly between Experiments A and B. The average rating value across all subjects changed +3.4 at the maximum (pair 8 and 9) and -2.4 at the minimum (22 and 27) from Experiment A to B. Pair 8 (black plate, rubber) and 9 (black plate, plastic), as

shown in Figure 5(a), had a low rating value in Experiment A, because reflection properties provided remarkably different appearances. In contrast, the rating value in Experiment B was high because both surfaces resembled the same black plane. Pair 22 (gray crepe, fabric) and 27 (gray calfskin, leather), as shown in Figure 5(b), had a high rating value in Experiment A because uneven surfaces elicit similar reflection properties. In contrast, in Experiment B, a low rating value was obtained based on differences in surface information such as roughness and color.

We analyzed the change in inter-subject variance among rating values by comparing Experiments A and B. The inter-subject variance of pair 2 (almite gray, metal) and 21 (pig suede, leather) changed remarkably. In Experiment A, all subjects evaluated the pair as disharmonious, because of differences in surface reflectance properties. However, in Experiment B, subjects changed their evaluations because the materials had a similar gray color but different roughness properties. In another case, the inter-subject variance of pair 18 (Japanese cypress, wood) and 20 (pearl gray, glass) was stable throughout both experiments. The pair had completely different characteristics, including surface reflectance, texture, and color. Therefore, the rating values were stable and low in both experiments.



#8 #9 #22 #27 #2 #21 #18 #20

(a) (b) (c) (d)

Figure 5: Examples of experimental pairs.

3.3 Distributions of samples in the appearance harmony space

We performed principal component analysis (PCA) on all ratings across materials to aid visualizing the distribution of material classes in the feature space of appearance harmony. We created a 30 × 30 diagonal matrix in which the line and column refer to 30 material samples. Each element of the matrix shows an averaged rating value of a pair, and we assumed symmetry among rating values. Since a diagonal shows a rating for a pair with the same materials, the diagonal components were considered as the maximum rating value. From the matrix, 30 dimensional and 30 PCs were derived. Therefore, materials with the same harmony properties have the same PC coefficients.

Table 3 shows the percent variance of the first three PCs. For the first PC, similar variance was obtained across experiments. Throughout all experiments, the first three PCs accounted for nearly 99% of the variance. This means that regardless of the representative methods to show appearance harmony among materials, we can get an approximate impression of the overall distribution using just the first few PCs.

Table 3 Percent variance of first three PCs.

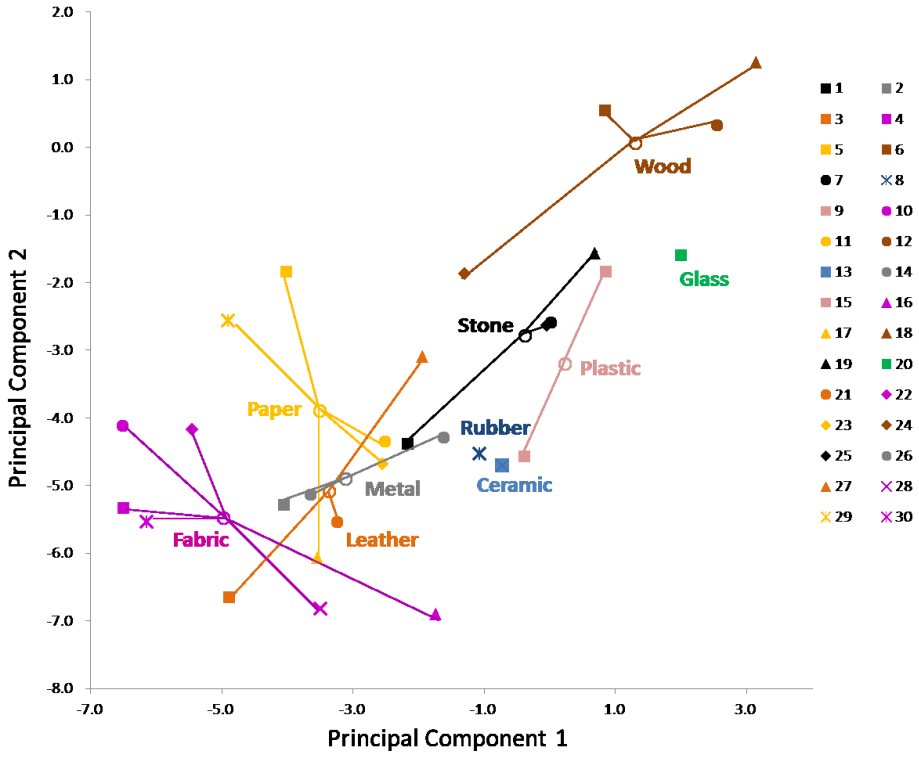
	PC1	PC2	PC3
Experiment A	0.817	0.969	0.990
Experiment B	0.812	0.975	0.993

In Figure 6, we plotted ratings for each sample projected onto the first two PCs and color-coded each image by its true class membership. Open circles for each material indicate the average of each material class and the same color corresponds to the same material category. There are notable aspects of the observed distribution in the PC space. As shown in Figure 6(a), in Experiment A, most of the material categories were isolated. This means that the degree of harmony depends on material clusters by moving a real object. In contrast, in Experiment B, material categories overlap each other as shown in Figure 6(b). This means that the degree of harmony does not depend on material clusters in a stationary state.

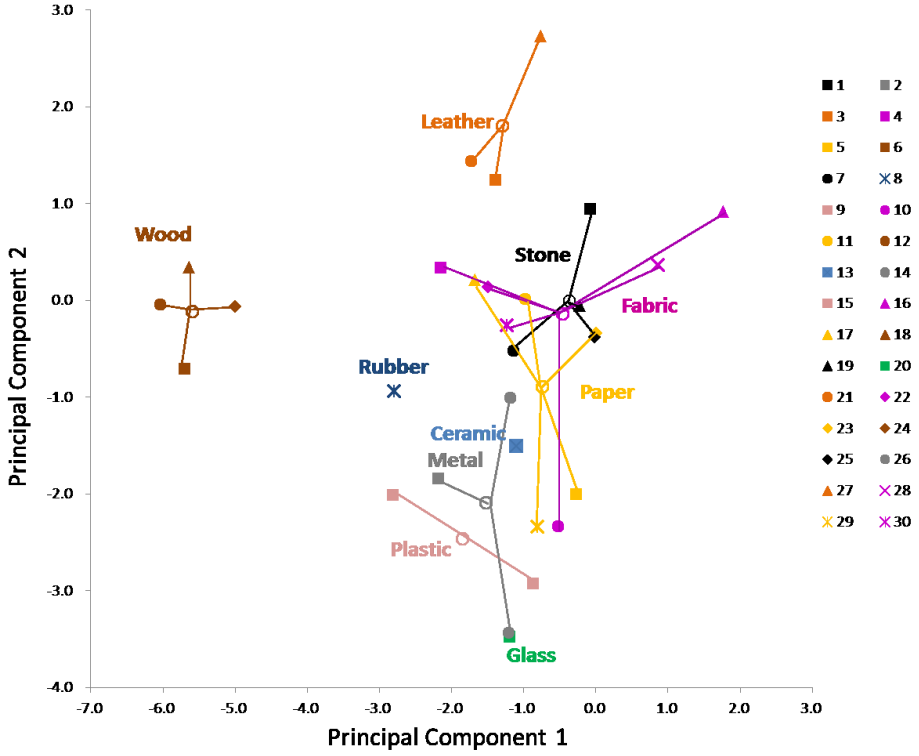
Here, we focus on the leather materials. In Experiment B, leather was disharmonious with other samples because of its specific texture. Therefore, the cluster in the PC space was separated into other material clusters. However, in Experiment A, the leather category overlapped across some categories such as fabric and paper, because of similar surface appearance. Thus, we found that the material category does not necessarily influence appearance harmony during a stationary state, but harmony depends on category clusters by moving material samples.

Figure 7 shows pictures of material samples on the projected components in the first two PC spaces in Figure 6. The boundary color of each picture corresponds to the material clusters. We classified each sample with common properties, and a line surrounded them. Categories surrounded by a solid line consist of the same materials, and categories surrounded by a broken line include samples across different materials. The common properties are indicated with the categories.

In Experiment A, we found that the reflectance properties of material surfaces were considered an important factor for appearance harmony. In contrast, in Experiment B, surface textures were principal factors for appearance harmony regardless of the material clusters. In both experiments, samples of wood were plotted closely. As described before, we corrected grayish color samples, but not the brownish-colored wood materials, to distinguish color harmony. This result suggests that color is still a notable factor in determining the appearance harmony among materials. The stones group is a good example. In Experiment A, stones were plotted near plastics and metals, since their glossy appearance from these objects resembled each other. However, in Experiment B, stone's appearance harmony moved nearer to fabrics and papers given similarities in rough textures.

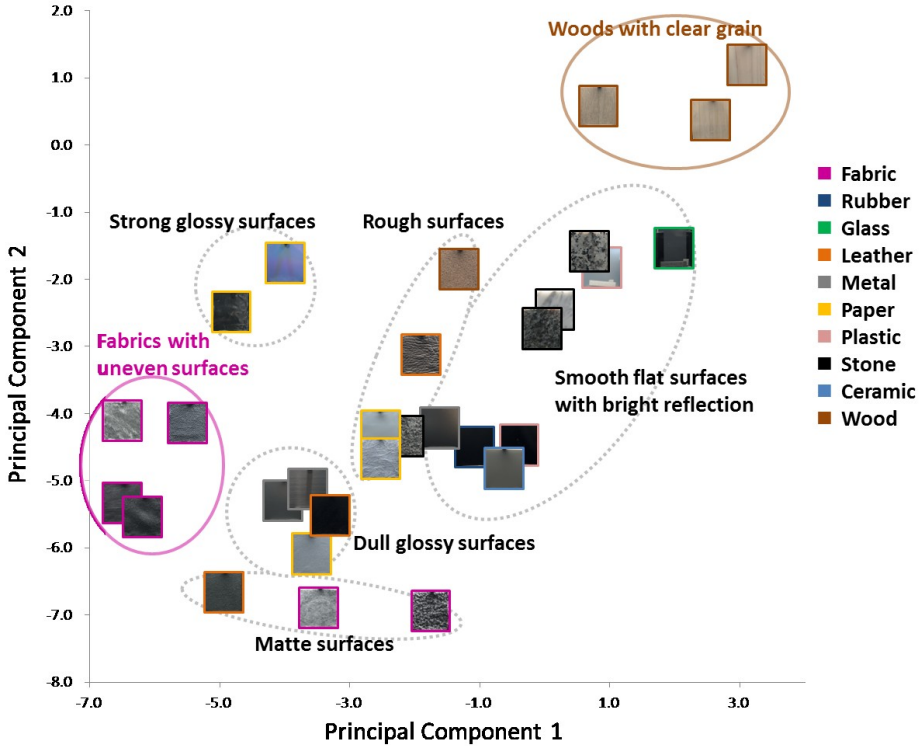


(a) Experiment A

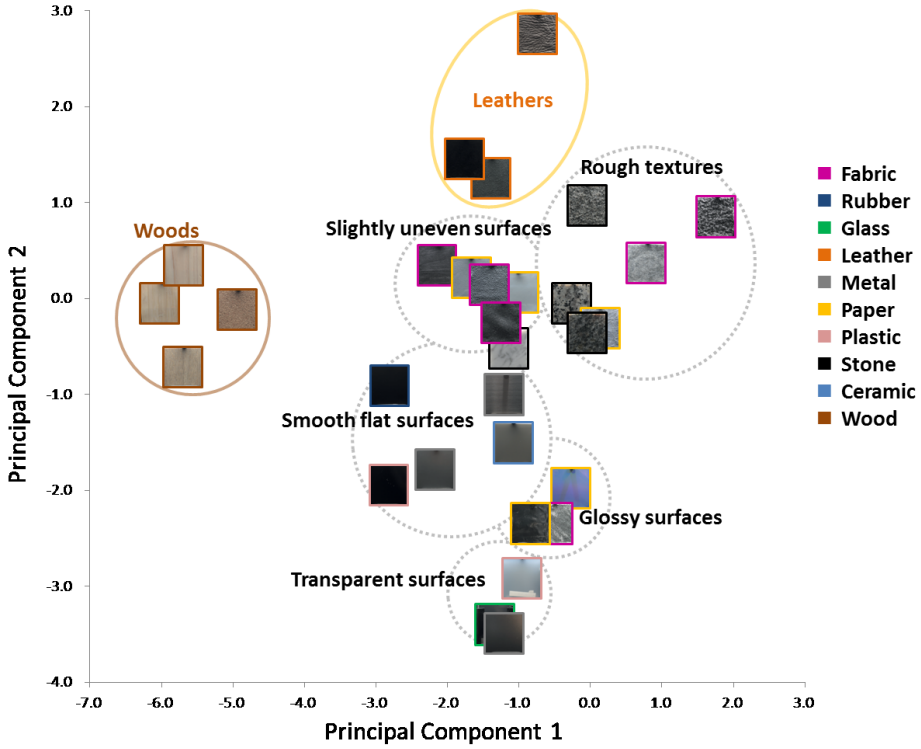


(b) Experiment B

Figure 6: Distribution of samples in the first two PCs.



(a) Experiment A



(b) Experiment B

Figure 7: Categorized samples with common appearance harmony.

1. Conclusions

We investigated appearance harmony among various materials by conducting psychophysical experiments. We conducted two experiments using the following real materials: fabric, paper, stone, wood, leather, metal, plastic, glass, rubber, cork, and ceramic. In the first experiment, subjects were allowed to tilt the sample pairs to provide a comprehensive judgment of harmony based on the reflectance properties of the actual surface in addition to surface appearance. In the second experiment, samples were placed such that their surfaces and viewing direction became perpendicular to the subject. Our results indicated that sample pairs with similar texture patterns were viewed as harmonious, even though their materials were different. Furthermore, the appearance of harmony among materials was significantly affected by subjects' reactions to reflections among tilted samples. These results suggest that appearance properties should be studied in more depth by using actual materials rather than images on a monitor.

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Color e identidad cultural en las haciendas Mexicanas. El caso de la Ruta del Tequila en Jalisco, México.

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Resumen.

El legado cultural de una sociedad representa una herencia única e irremplazable, construido con elementos materiales como construcciones y objetos e inmateriales como expresiones, conocimientos y técnicas pone de manifiesto los vínculos e interacciones entre las personas y su entorno.

Uno de los lenguajes que forma parte de este legado cultural es la arquitectura y su relación con los mensajes visuales que comunica.

Dentro de estos lenguajes aparece el color como un elemento significativo en la arquitectura que transmite ciertas emociones y expresiones de un modo de vivir y percibir el universo simbólico de un pueblo, y en México esto es distintivo.

Las haciendas mexicanas presentan esta relación entre su edificación, el uso del color y las múltiples relaciones culturales que se tejen a partir de éste diálogo. Signo de una cultura que convive con él en todas sus manifestaciones.

En esta presentación se plantea la existencia de colores predominantes, comunes, y significativos en cinco haciendas del Valle del Tequila que señalen **un rasgo de identidad cultural.** El objetivo del proyecto se centra en identificar la presencia de códigos cromáticos, analizando la relación entre el color, la arquitectura y la identidad cultural en la región.

A partir de un diagnóstico de detección, clasificación y generación de base de datos de Haciendas del Valle del Tequila y con la aplicación de entrevistas, recopilación de historias de vida y diarios que registran las observaciones in situ sobre los sujetos de estudio en cada localidad y en cada hacienda, se analiza la percepción sobre el color en las haciendas de Jalisco y la importancia de los mismos como símbolos de identidad cultural.

Palabras Clave:
Arquitectura y color, identidad cultural, semiótica del color.

Introducción.

Construido con elementos materiales (construcciones, lugares, objetos) e inmateriales (expresiones, conocimientos, técnicas) que ponen de manifiesto los vínculos e interacciones entre las personas y su entorno, el legado cultural de una sociedad representa una herencia única e irremplazable.

Uno de los lenguajes que forma parte de este legado cultural es sin lugar a dudas la arquitectura y su relación con los mensajes visuales y espaciales que comunica.

Dentro de estos lenguajes aparece el color como un elemento significativo en la arquitectura que provoca ciertas emociones y transmite expresiones de un modo de vivir, de sentir, de ver el universo simbólico de un pueblo, y en México esto es distintivo.

Las haciendas mexicanas aparecen entonces como un caso que resalta esta relación entre su edificación, el uso del color y las múltiples relaciones culturales que se tejen a partir de éste diálogo.

Jalisco es uno de los estados que por su riqueza de recursos naturales y factores geográficos, topográficos e hidrológicos, fue cuna de muchas y muy productivas haciendas dedicadas al cultivo, la ganadería y la minería en el siglo XIX.

De acuerdo a relatos de Mariano Bárcena, en 1888 existían en el estado 377 haciendas, de las que se estima desapareció la tercera parte entre 1910 y 1950, luego de la Revolución (González V. , 1998).[5]

Actualmente existen cascos de haciendas que han perdurado y que constituyen una acumulación de valores históricos, culturales y económicos. Tales edificaciones se encuentran hoy sumamente destruidas. Son una excepción las que han soportado en buen estado el paso del tiempo, gracias al cuidado de sus actuales propietarios y personas interesadas en su recuperación.

Una de las características que sobresale en la relación con la arquitectura de la época de las haciendas, es el uso del color de las mismas. Signo de una cultura que convive con él en todas sus manifestaciones, desde la alimentación, vestuario, celebraciones y viviendas.

La situación que detona el proyecto es la ausencia de un análisis sobre el papel del color como signo de identidad cultural en la arquitectura de las haciendas de la región, el estado de destrucción en que se encuentran la mayoría de ellas en Jalisco, se plantea entonces la pertinencia de generar una reflexión que abra nuevas puertas en la gestión cultural e involucre estos elementos como protagonistas.

El contexto socio espacial del problema de investigación

Entre la base del volcán Tequila y el valle del río Grande se abren amplias extensiones tapizadas de agaves azules que se han venido utilizando desde el siglo XVI para producir alcohol de tequila. En este paisaje cultural todavía se encuentran antiguas destilerías en actividad y haciendas que datan del siglo XVIII.

[5] Hay bibliografía valiosa acerca de la historia y condición actual de las haciendas Jalisciense. Tal es el caso del libro "Por las haciendas de Jalisco", editado por la Coordinación Editorial de la Universidad de Guadalajara, en el que la autora Olivia Campos de Gallo presenta una compilación fotográfica sobre varias de estas edificaciones en el estado.

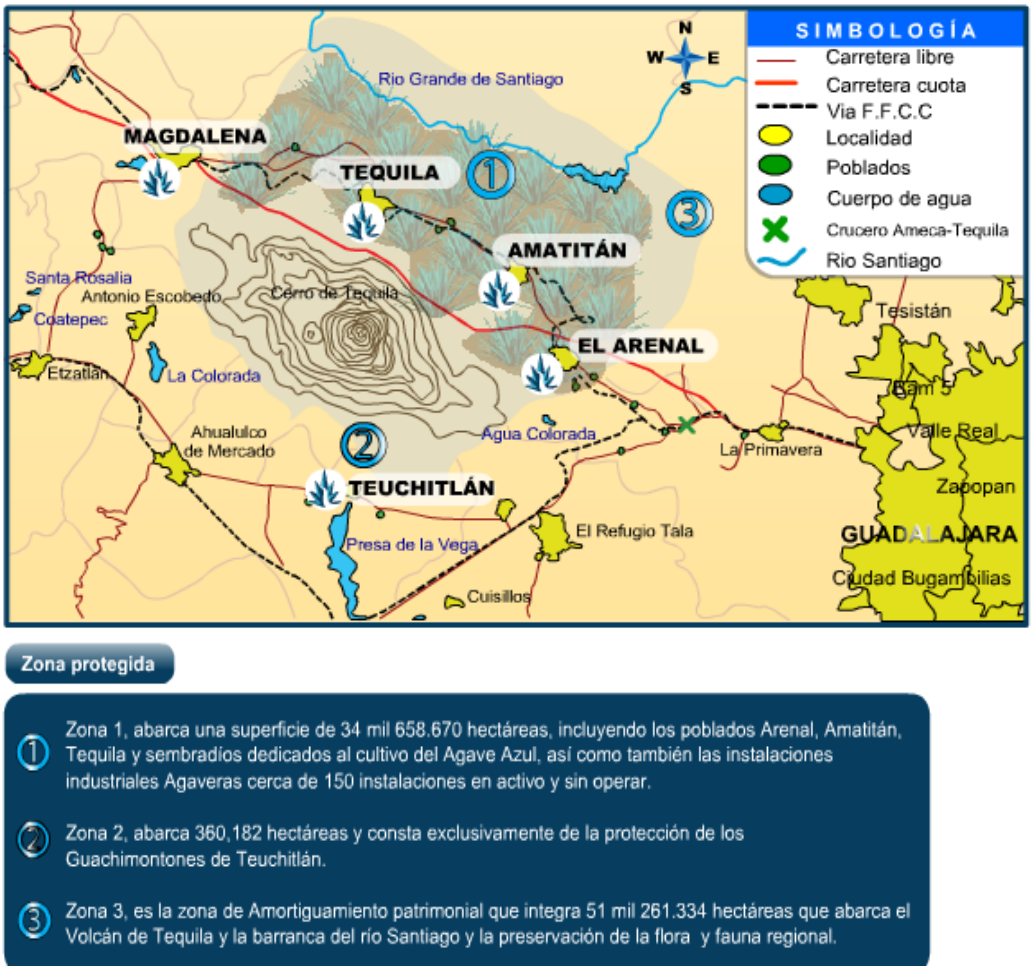

Figura. 1 Mapa del Paisaje Agavero. Fuente: www.rutadeltequila.org.mx

El sitio declarado Patrimonio Mundial por la UNESCO, con el nombre "Paisaje Agavero y Antiguas Instalaciones Industriales del Tequila" cubre una extensión de 34.658 hectáreas.

Se trata de un entorno cultural vivo con campos en los que se explota el agave azul (agave tequiliana) que produce el mezcal y el vino del mezcal creando un único paisaje cultural.

Metodos.

Dentro de la metodología planteada se escogieron las técnicas de investigación relacionadas con la semiótica, que coinciden sobre todo en el hecho de que el lenguaje es una institución social, y por tanto el sistema de signos de que hace uso es siempre un sistema de signos convencionales. Y por otro lado la etnografía visual, que comprende la exploración visual de la producción cultural y el uso de la imagen (en este caso los colores como elementos de la misma) en un contexto histórico y social determinado. Ambas metodologías están justificadas por la naturaleza del trabajo que profundizó en el análisis de los signos y símbolos como parte del conjunto de elementos que conforman la identidad cultural de un pueblo y del aspecto visual de los mismos, resaltados en el estudio del color como eje del trabajo etnográfico.

El trabajo de campo se orientó a detectar, clasificar y generar una base de datos de Haciendas del Valle del Tequila en el estado de Jalisco en construcciones realizadas en los siglos XVIII y XIX para trabajar in situ sobre la relación entre los colores, la percepción de los mismos por los sujetos de estudio, las características constructivas y la configuración de los códigos cromáticos que se desprendan de su análisis.

Para el abordaje sobre la percepción del color en las haciendas, se utilizaron herramientas de medición de color a través del empleo de fotómetros y software correspondientes.

La investigación documental fue para analizar los principales aspectos arquitectónicos, de uso de los edificios, su contexto histórico y social y sus posibles relaciones utilitarias y simbólicas con el color.

Los instrumentos escogidos para el acopio de información fueron las entrevistas a profundidad, las historias de vida y el diario que permitieron registrar las observaciones in situ sobre los sujetos de estudio en cada localidad y en cada hacienda.

Métodos cualitativos. Entrevistas e instrumentos de percepción

Con el objetivo de conocer la percepción e identificación de determinados colores que presentan las haciendas del Valle del Tequila, y particularmente del Paisaje Agavero y sus municipios se realizaron entrevistas personales a dueños, cuidadores, restauradores, arquitectos, ingenieros, guías de turistas, y personas involucradas con el contexto de las haciendas y del Paisaje Agavero.

La muestra se constituyó de la siguiente manera: 30 personas. 15 mujeres y 15 hombres. Edades de 18 a 75 años. Con respecto a Las profesiones y perfiles también se cuidó que estén distribuidas de forma pareja.

Además de tener la oportunidad de registrar opiniones personales respecto al tema se les invitó a seleccionar entre una muestra de colores aquellos con los cuales identificaban a las haciendas, a los municipios y a la arquitectura mexicana, con el fin de obtener un panorama sobre su percepción sobre el color y la identidad cromática de la región.

Los colores fueron tomados del atlas del Sistema Natural del Color NCS y están homogéneamente distribuidos en el atlas, cubriendo el rango completo de tinte, negrura y cromaticidad. Se invitó a los entrevistados a escoger los cinco colores que considere típicos y con los cuales identifique a cada una de las siguientes categorías.

1. Haciendas del Valle del Tequila.
2. La arquitectura de los Municipios del Valle del Tequila.
3. La arquitectura mexicana.

La lista de colores escogidos para el análisis, además de buscar un equilibrio que cubra todo el rango de variables del color del Atlas, contiene los colores que surgieron del diagnóstico y la muestra de color verificada en cada una de las haciendas analizadas.

Quedando ordenada la plantilla de la siguiente forma:

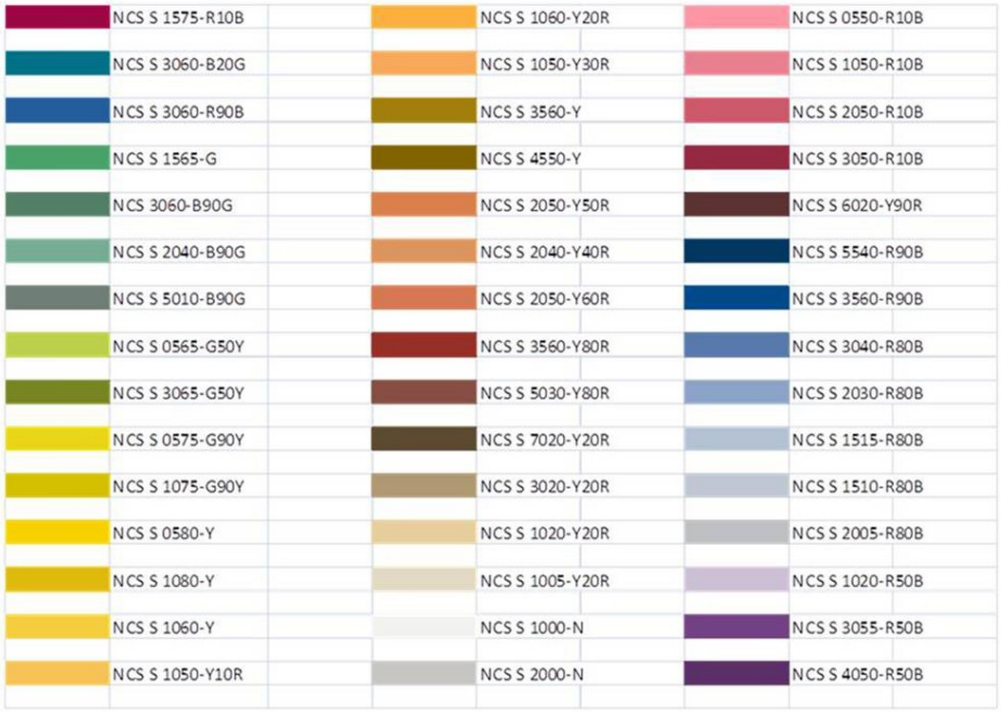

Figura 2. Instrumento que se aplicó con la tabla de colores del Sistema Natural del Color NCS. Fuente: Elaboración propia.

Resultados.

Para este trabajo se seleccionaron 5 Haciendas que por su estado de conservación o restauración permitieron iniciar el proceso de estudio de semiótica del color.

En Magdalena: la Ex Hacienda Estancia de Ayllones. En Amatitán: la Ex Hacienda de San José del Refugio (Tequila Herradura). En El Arenal : las Ex Haciendas El Careño, La Providencia y La Calavera.

Mismas que se compararon con la presencia de una gama de tonos cromáticos que se repiten en los centros históricos de cada uno de los municipios mencionados.

Ex Hacienda de Estancia de Ayllones

Figura 3. Ex Hacienda Estancia de Ayllones. Fotografías Abel Aranda.

Colores Predominantes:

La paleta de colores predominantes tiene como protagonista al color naranja rojizo seguido de amarillos ocres y detalles en azules en los interiores.

Se tomaron muestras de los colores y se les identificó con el sistema de ordenamiento de color Natural Color System[6]:

[6] El Sistema de ordenamiento de color NCS, supone que la visión del color funciona por medio de un mecanismo inhibitorio, sobre la base de seis sensaciones elementales, agrupadas en tres pares de opuestos: blanco- negro, amarillo-azul y rojo-verde. El objetivo de este sistema es describir los colores tal como son vistos por los seres humanos.

Ex Hacienda de San José Del Refugio

Figura 6. Ex Hacienda El Refugio. Fotografía Abel Aranda.

Colores Predominantes

Al entrar se observa en todo el conjunto como color predominante el amarillo ocre, con guardapolvos en color rojo indio, en casi todas las instalaciones, incluida la casa principal. Marcan una diferencia al principio del recorrido las casas de los trabajadores que presentan colores también muy saturados, con una gama variada que va desde azules y verdes, hasta rosas y terracotas.

Ex Hacienda La Providencia

Figura. 7. Ex Hacienda La Providencia. Fotografía Abel Aranda.

Colores Predominantes:

La paleta de colores que predomina, es casi monocroma y se encuentra delimitada en la gama de los naranjas en el exterior, ocres en las arcadas y galerías con guardapolvos en colores tierra.

Ex Hacienda El Careño

Figura 9. Ex Hacienda El Careño. Fotografías Abel Aranda.

Colores Predominantes

El conjunto arquitectónico que conforma la Ex Hacienda El Careño presenta una paleta cromática que está protagonizada por un gran contraste entre el color blanco de los muros en casi toda su extensión y los colores que en este caso aportan sus materiales, como en la fachada las piedras rojizas oscuras y en los interiores los colores de los cerámicos que agregan amarillos y azules.

Ex- Hacienda La Calavera

Figura *10. Ex Hacienda La Calavera. Fotografías Abel Aranda.*

Ahora el complejo es sede del centro de interpretación del Paisaje Agavero en El Arenal.

Colores Predominantes

Durante la visita a la Ex Hacienda La Calavera, se pudo observar detalles de los colores originales en su interior, así como también la influencia de ciertos colores en la restauración de su fachada y algunas áreas del conjunto.

En general tanto las zonas originales respetadas y resaltadas, como la intervención, presentan una gama cromática cálida que va desde el protagonismo de los amarillos anaranjados con guardapolvos en rojos y tierras, hasta la presencia de naranjas y ocres en columnas y detalles.

La aplicación del instrumento sobre percepción del color en el contexto de las entrevistas realizadas arrojó una serie de paletas de colores que resultaron preferidos por la mayoría de los sujetos vinculados directamente con el objeto de estudio. El análisis se organizó por categoría:

Para el apartado que corresponde a los colores predominantes en las haciendas del Valle del Tequila, los resultados fueron los siguientes:

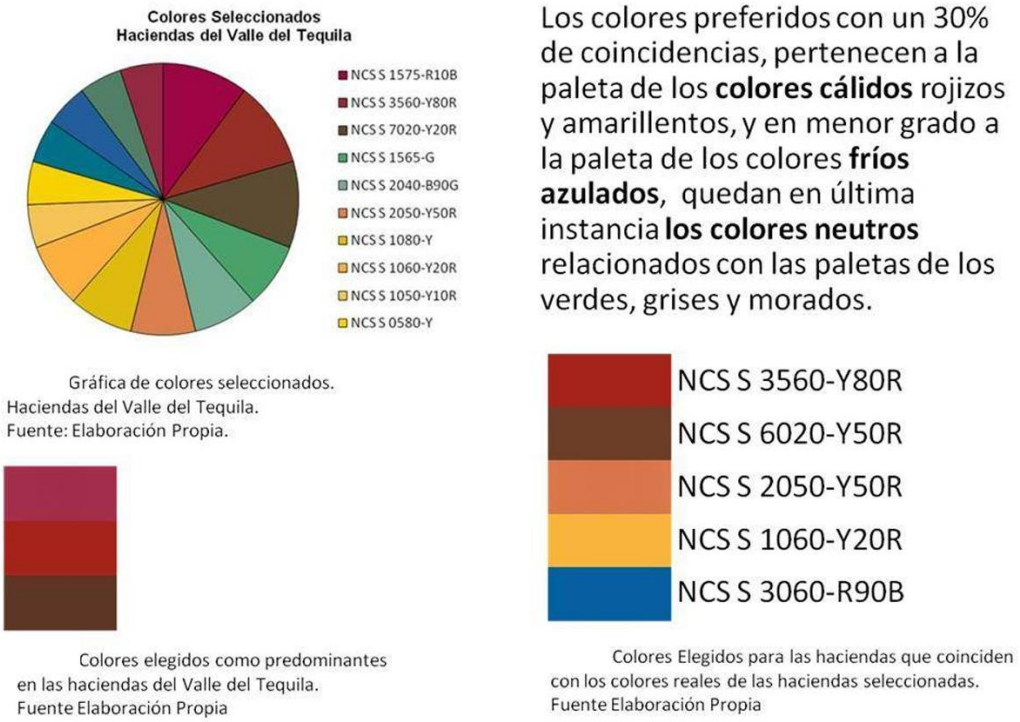

Figura 11. Colores seleccionados para las Haciendas del Valle del Tequila. Fuente: Elaboración propia.

Para el apartado que corresponde a los colores predominantes en la Arquitectura de los municipios del Valle del Tequila, los resultados fueron los siguientes:

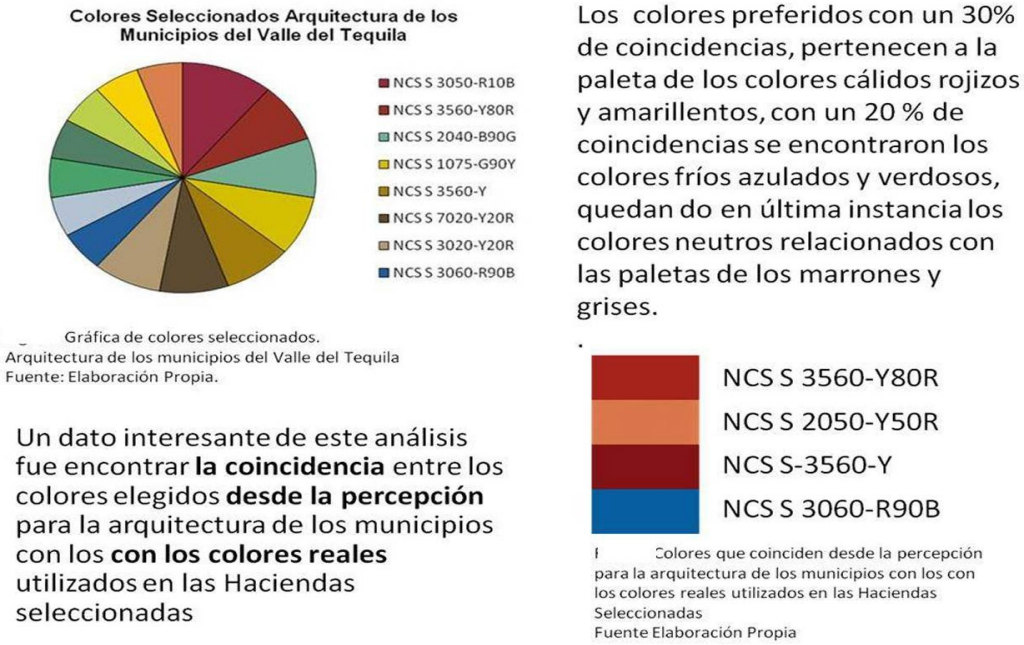

Figura 12 Colores Seleccionados para la Arquitectura Mexicana. Fuente Elaboración Propia.

Para el apartado que corresponde a los colores predominantes en la Arquitectura Mexicana, los resultados fueron los siguientes:

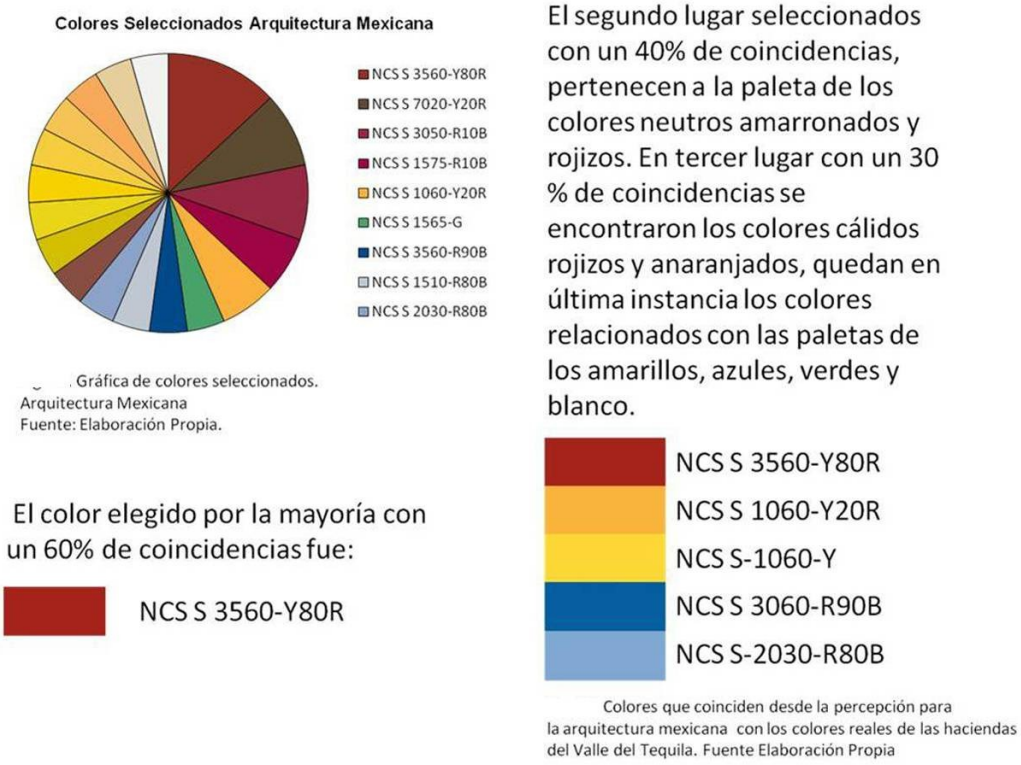

Figura 13 Colores Seleccionados para la Arquitectura Mexicana. Fuente Elaboración Propia.

A continuación se presentan los resultados obtenidos desde la percepción de los entrevistados:

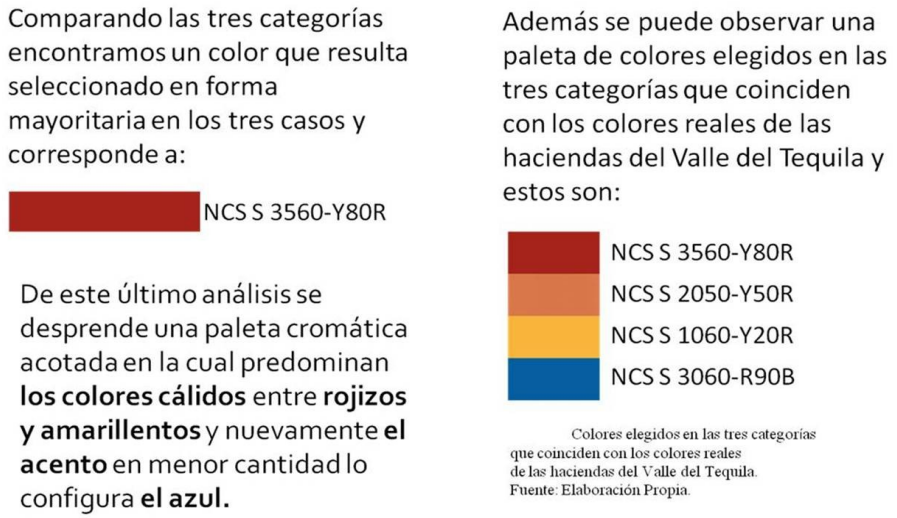

Figura 14. Colores elegidos por los entrevistados en las tres categorías. Fuente Elaboración Propia.

Discusion:

El planteo de la existencia de códigos cromáticos en las haciendas del Valle del Tequila en Jalisco tiene como principio la identificación de la semiosis del color con relación a la

arquitectura típica de la región y la conformación de una identidad cultural de la época en la que estas construcciones fueron erigidas y la influencia de las mismas en el contexto arquitectónico actual.

Semiótica del color e Identidad.

La pregunta que abre el proceso de esta investigación sobre la existencia de colores predominantes, comunes, y significativos en las haciendas del Valle del Tequila que señalen *un rasgo de identidad cultural***,** tiene que ver con la experiencia y percepción que se puede reconocer, al recorrer distintos lugares de México, y "vivir" respecto a la arquitectura, el protagonismo con que el color se presenta en la vida cotidiana de las ciudades y los pueblos.

En México el color nos "habla" desde múltiples aspectos que nos cuentan una manera particular de vivir, de sentir, de concebir el mundo que los rodea.

En el caso del Valle del Tequila y especialmente en la ruta del paisaje Agavero, se puede disfrutar una amplia gama cromática observable en los tonos azulados y verdosos de sus paisajes y curiosamente el contraste que se generan con la paleta de colores tierras con las que se alzan las construcciones tradicionales y la imagen construida de los pueblos, entre las cuales las haciendas han jugado un papel preponderante.

El eje rector de este trabajo se ubica dentro del análisis y la interpretación de los colores en las haciendas mexicanas como signos de una identidad cultural desde una perspectiva semiótica. El elemento "color" forma parte del sistema de signos que constituyen la semiótica visual, que permite analizarlos como un sistema que representa las maneras en las que una sociedad organiza su percepción sobre el mundo y sobre la vida.

Dondis sostiene que el color tiene una afinidad más intensa con las emociones y está cargado de información siendo "una de las experiencias visuales más penetrantes que todos tenemos en común." (1987:64). Por lo tanto constituye una valiosa fuente de comunicadores visuales. En una cultura, compartimos y nos comunicamos produciendo nuevos construcciones de sentido, entre otros elementos, a través del color.

El color como signo

Magariños de Morentín (1981:91) destaca la función semiótica del color:

> El estudio del color, en cuanto portador de la función semiótica, se diferencia del estudio psicofísico o neurofisiológico, en que mientras estos últimos identifican y analizan el color por sus características mecánicamente medibles y dependientes de circunstancias físicas del sujeto y/o del ambiente, el enfoque semiótico considera al color como elemento objetivamente *apto para sustituir* a entidades de otro universo y para organizarse en conjuntos significativos.

Además de la importante función informativa que cumple el color en la naturaleza en general, también está la función estética que tiene en la sociedad humana, donde es utilizado como un elemento para la composición formal y la creación de armonía visual en el entorno habitable.

En suma, todo lo que es capaz de representar otra cosa, es un signo.

El color como elemento simbólico suele formar parte, junto con otros aspectos como la forma y la textura, de símbolos visuales más complejos, por ejemplo banderas, alegorías, emblemas, escudos de armas, marcas comerciales, logotipos, isotipos. “Los códigos sobre los que se construyen estos símbolos, más sofisticados, obedecen por lo general a los códigos de los elementos visuales que los componen” (Caivano J. L., 1995:264)

Códigos Cromáticos – Identidad Cromática

En el lenguaje visual, de acuerdo con Vilchis (1999), existen cuatro códigos fundamentales: morfológico, cromático, tipográfico y fotográfico.

Los códigos cromáticos comprenden entonces los esquemas de color que son atribuidos a un determinado mensaje, en este caso arquitectónico y urbano.
Para entender los códigos cromáticos es necesario conocer las dimensiones del color, y los conceptos que ayudan a explicar el color. Las dimensiones se pueden medir: la primera es: matiz o croma, es el atributo que permite clasificar los colores como rojo, amarillo, azul, etcétera. Cada matiz tiene características propias y por eso es posible diferenciarlos. La segunda es el valor o brillo, se refiere al grado de claridad o de oscuridad de un color, es decir, se refiere a la cantidad de blanco que se ha añadido a un tono. La tercera es la intensidad o saturación, indica la pureza de un color respecto al gris, es decir, se refiere a la cantidad de gris que se ha añadido a un tono. A medida que aumenta la saturación, la cantidad de gris disminuye. Los colores de fuerte intensidad son los más brillantes que pueden obtenerse.

Los códigos cromáticos generan identidades cromáticas, utilizadas para enfatizar el carácter de los edificios, acentuar sus formas, su grado de compartimentación o la articulación de sus diferentes espacios, rebasa en nuestro caso de análisis las fronteras de lo funcional para penetrar en el universo de lo simbólico como transmisor de ideas, como artífice de un lenguaje visual codificado capaz de revelar desde la organización de una determinada estructura social, económica o de poder hasta enarbolar la vigencia de determinados credos o satisfacer necesidades estéticas. Por ende, su presencia como recurso cultural resulta fundamental en la comprensión de los contextos patrimoniales que así lo destacan como son Las Haciendas del Valle del Tequila, en Jalisco.

En este trabajo estos códigos cromáticos se aplican al análisis de los mismos en la relación con la arquitectura y la conformación de una identidad, cultural y cromática. Se subraya una vez más cómo el color representa uno de los aspectos que de forma más categórica condiciona la realidad que nos rodea.

Los ejes conceptuales planteados aquí servirán de guía para establecer una relación entre los códigos cromáticos identificados en forma objetiva y subjetiva, tanto desde la medición del color como desde la perspectiva semiótica de percepción de los mismos por parte de las personas relacionadas con ellos, para vincularlos como elementos de una identidad cultural, conformada, comunicada y resaltada en la gestión del patrimonio cultural del Paisaje Agavero como factor de desarrollo para la comunidad y la región.

Conclusion.

Como ya se ha mencionado el color constituye una de las expresiones materiales del hombre en su capacidad de crear cultura, de imponer sus criterios incluso sobre el propio medio. Las haciendas del Paisaje Agavero no sólo remiten a las dimensiones constructivas, estéticas o artísticas, sino también a las identitarias como resultado de la conjunción de innumerables variables a tener en cuenta. A saber: la diversidad ecológica; las experiencias históricas, responsables de la aplicación de determinadas técnicas constructivas, de la planificación urbanística, organización y características de los espacios construidos, de sus usos sociales y significados simbólicos; la diversificación de actividades productivas; o las diferencias internas que han conformado la estructura social de la región en los ámbitos rurales.

Esta arquitectura y sus colores, constituyen una de las señas de identidad más representativas del entorno y por sí misma, en su riqueza y diversidad, ha de ser valorada como un elemento cultural de enorme potencial.

En México, el color surge desde la naturaleza y la historia. En el Valle del Tequila, y especialmente en el Paisaje Agavero, lo encontramos en sus plazas y sus calles, en los mercados y en las casas; constituye un lenguaje y una metáfora, una forma de comunicación, una experiencia sensorial. El color está siempre presente en la vida de ésta región.

Las paredes de las haciendas, pintadas con la gama cromática ya mencionada, actúan como un filtro entre el espacio público y el privado. La vida sucede a través de estas paredes, los muros son pintados una y otra vez, dejando en cada capa, un sinfín de historias, secretos y memoria.

La clave para responder a la pregunta de investigación que origina este trabajo sobre la existencia de colores predominantes, comunes y significativos en las haciendas del Valle del Tequila que señalen un rasgo de identidad cultural, está presente en el recorrido de las haciendas seleccionadas en las cuales podemos observar cómo el color es utilizado para enfatizar el carácter del edificio, para acentuar sus formas, para indicar su grado de compartimentación o la articulación de sus diferentes espacios.

Catálogo de colores

Para responder al objetivo de identificar la presencia de códigos cromáticos estableciendo la relación entre el color, la arquitectura y la identidad cultural y con el fin de aportar una metodología y material para futuros proyectos o intervenciones en torno al color en las Haciendas del Valle del Tequila y en especial en el Paisaje Agavero, se propone a continuación la elaboración de un catálogo de colores, que proveniente del análisis físico pigmentario sumado a la metodología semiótica de percepción de los mismos en la población, lo cual tiene como resultado una sugerencia de 14 colores, predominantes, comunes y significativos dentro de la región, presentes en la gama cromática no sólo de las haciendas, sino también del contexto urbano de los municipios que la integran.

Figura 15. Catálogo de colores para las Haciendas del valle del tequila.
Fuente: Elaboración propia.

Los mismos están identificados en el sistema de ordenamiento de color Natural Color System y pretenden ser una guía que contiene una visión particular sobre el color como elemento simbólico de la cultura y como un elemento protagonista de la identidad cultural local.

La arquitectura de las haciendas del Paisaje Agavero y, por extensión, el uso que éstas hacen del color, constituye, ciertamente, la piel de sus pobladores, contribuye a reafirmar la identidad de una región y los factores de diferenciación cultural que le dan razón de ser. Testimonios, en suma, de una particular manera de vivir en la continuidad del espacio y del tiempo. Quizás sólo por esto valga la pena aprender a mirar.

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There are Colours that Kiss Us: Beauty as a Factor of Sustainability

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Abstract

The present article has as main aim to reflect on the role of beauty in architecture and design, reintroducing the idea of beauty in the discussion of sustainability. In fact, the word beauty, often considered superficial, subjective and even unethical, seems to have lost some of its meaning but, according to Satish Kumar, author of the concept *Reverential Ecology*, beauty emerges as a consequence of truth and goodness. Something, which is not good, can never be beautiful. Based on this assumption, we analyze a few case studies – Exhibition: *My country through your eyes* (Portugal); Urban Intervention: *Light in the alleys* (Brasil); Design: *Studio Dandoen* (Mozambique) - and reflect on the importance of language and symbolism of light and colour in the construction of beauty as first criterion for any project. Being both objective and subjective, beauty cannot be reduced to an idea, to something existing on the surface of objects to be seen, being rather a way of life. Resounding in the depths of being, the trinity - *beauty*, *truth* and *goodness* -, uniting subject and object, transcends dualism thus transporting us to a sacred universe and creating the conditions for genuine sustainability.

Keywords

Ecology; Spirituality, Design, Beauty, Light, Colour

Introduction

Based on the concept of *non-duality*, ie, the absence of a separation between the physical, rational, emotional and spiritual dimensions of the subject, and of this with the whole to which it belongs, this paper focuses on how the concepts of light, colour, beauty, design, ecology and spirituality are interlinked and mutually activate each other in a process of elevation of consciousness.

Although beauty is a deep part of our emotional lives, Westerners rarely treat it as a fundamental value, elementary to the structure and order of reality, rather undervaluing its connection to sustainability. *Taste is not to be discussed*, goes an old popular saying that has served to support all aesthetic variations of contemporary society. But for philosophy, namely for Kant (1790 [1998]), it is possible to discuss what is beautiful and good. Content and form of these concepts may vary according to historical circumstances and subjectivity of artists, but the feeling of beauty, which is the foundation of the judgment of taste, is universal. By analyzing the possibility of taste deriving from certain characteristics of

perception that correspond to certain values, this article seeks to understand beauty not as something superfluous, but as a kind of symptom of the relationship of the subject with the world around it. I.e., starting from the analysis of light and colour in different projects, we seek to understand the consciousness behind human actions, in this impetus to transform reality.

During the last two hundred years, with death of nature, modern West has abandoned beauty, defending economy as final value. For Lipovetsky (2014) capitalism, which in recent decades has spread throughout the world, appears as a system incompatible with an aesthetic life, one that is worthy of that name.

> (…) the capitalist mode of production is stigmatized as modern barbarism that impoverishes the sensible, as economic order responsible for the devastation of the world: "disfigures the whole earth", making it uninhabitable from all points of view. The opinion is widely shared: the dimension of beauty recedes, that of ugliness spreads. The process linked to industrial revolution continues inexorably: it is a nasty world, which, day by day, is being designed. (Lipovetsky 2014:15)[1]

Barragan, disapproving of the extremes of the modern movement, also alerts to the idea of the living machine causing not only the reduction of architecture but also of the human being.

> Alarmingly, the words beauty, inspiration, fascination, magic, enchantment, as well as serenity, silence, intimacy, emotion and amazement disappeared from architectural publications. All of them received loving acceptance in my soul, and though far from having done them complete justice in my work, they never stopped being my lighthouse. (Barragán 2003: 22)[2]

The void left by the absence of beauty has been filled by a ruthless greed but, for Satish Kumar (2014), until beauty returns to the forefront of our cultural life, there cannot be real change in the ecological paradigm. For several authors (Sinde (2005), Kumar (2008), Capra (2012), etc), Descartes and modern rationalism were essential for the story of this emptiness and degrading mode of thinking and living in the modern world. However, for several years now, scientific reductionism that saw the world as a machine, seems to gradually give way in all areas of science and at all levels, to interdependent *relationalities*, where subject and object are not separate and everything is relative, existing in a dynamic flow. From a conception of identity characterized by modern regulation we passed, in post-modern times, to a fluid experience (Bauman, 2001). Thus, based on this fact, what is

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[1] *(...) o modo de produção capitalista está estigmatizado como barbárie moderna que empobrece o sensível, como ordem económica responsável pela devastação do mundo: "desfigura a Terra inteira", tornando-a inabitável sob todos os pontos de vista. A opinião é amplamente partilhada: a dimensão da beleza recua, a da fealdade espalha-se. O processo engrenado com a revolução indústrial continua inexoravelmente: é um mundo desagradável que, dia a dia, se desenha.* (Lipovetsky 2014:15)

[2] *De modo alarmante desapareceram das publicações de arquitectura as palavras beleza, inspiração, fascínio, magia, encantamento, assim como serenidade, silêncio, intimidade, emoção e assombro. Todas elas encontram amorosa aceitação na minha alma e, ainda que distante de lhes haver feito plena justiça na minha obra, nem por isso deixaram de ser o meu farol.* (Barragán 2003:22)

proposed here through an analysis of light and colour, are new clues for understanding the phenomenon of beauty and its important role in the process of balancing economic, environmental and social objectives. From this perspective, in a time when overvaluing images seems dangerous because it overrides word and concept, the trinity - *beauty, truth goodness* -, awakening the loving look that knows how to see, beyond all images, the web of life and the intelligent principle which gives them life, sustains them and animates them, thus creating the conditions for true sustainability.

Beauty in the West: historical fragments

The question of beauty belongs to a fixed set of classical questions in philosophy, which allows us, together with the contribution of artists' definitions of *beautiful*, to reconstruct a history of aesthetic ideas through time.

The pre-Socratic[3] philosophers were the first to speculate about the cosmological problem and the origin of things, drafting a theory for the explanation of man and cosmos. Regarding the human-being, they realized he has a *Psyché*, which can be understood as the soul, that which gives life, an essence or interiority different from the body and not dissolved by death. I.e., a (permanent) principle, which orders what exists.

Socrates[4], one of the founders of Western philosophy, in its constant search for knowing the human being, created the division of body and soul. This led him to meditate on the spiritual existence of mankind, having concluded that it is the spirit, which holds universal concepts, and knowledge is also processed there. For Socrates, the soul is thus the seat of consciousness, the source of knowledge, moral intelligence and reasoning, being eternally true and good. In *Hípias Maior* (Plato séc IV BC [2000:26]), the biggest dialogue around beauty, Socrates recognizes that *beauty is difficult*. According to him, to find beauty we must begin by understanding the knowledge that leads us to the truths of the world. Only through knowledge do we get to see the beauty in its fullness, because beauty is eternal and unchanging and will never be anything other than beauty, which is absolute and unique. Beauty by itself is not the body and is not in the sensitive (world which we interpret through the five senses), but nevertheless, it is through the senses that we can approach beauty.

As for Socrates, for Plato[5] beauty is also only found in the absolute knowledge, thus being absolutely rational. Plato develops the concept of the world of ideas, or *Psyché*, and the world of sensitivity. In the *Myth of the Cave* (Plato séc IV BC [2001]), where he develops the theory of the two worlds, the world of ideas, in a superior, absolute and static plan, is explained by the theory of reminiscence, where knowledge is only possible in this life through reasoning, and where the sensible reality of human things was just an inept imitation of the world of ideas. Thus, according to Plato, beauty is goodness, truth, perfection; it exists in itself, it lies in the world of ideas, in memory, reasoning, separated from the sensible world. I.e., physical characteristics are from a second level, and beauty is in the attitudes of the person, in his character, behaviors, and virtues.

[3] *Pre-Socratic/ VII to V centuries BC*
[4] *Socrates/ 469-399 BC*
[5] *Plato/ 428-347 BC*

It is Aristotle[6] who makes the first move to bring rupture to beauty being associated with the idea of perfection. According to him, essence and appearance cannot be understood separately, as they are in an integrative relationship, and beauty resides in the search of balance between essence and appearance. Unlike his teacher Plato, he believes that beauty is inherent to man; after all, art is a particularly human creation. Because he conceives beauty as coming from the sensible reality, it ceases to be something abstract to become concrete. Aristotelian beauty becomes material. Following the criteria of symmetry, composition, ordinance, proposition, balance, etc., it is no longer immutable, nor eternal, but can evolve.

The idealized vision of beauty that existed throughout antiquity[7], reflected in the art of its people, has changed with the advent of the Christian world. According to the values of the church, God created the heavens, the earth and the whole world and, when He contemplated creation, He saw that everything was very good. The entire universe is thus beautiful, because it was built according to the image and likeness of its creator, and saying the world was beautiful was the same as saying it was good.

Throughout the Middle Ages[8], these values of the church were so strongly rooted that they did not allow for questioning the world. Art was not seen as a way to change reality or to propose a different view of it, it merely mirrored nature. Beauty was thus not considered an aesthetic problem, rather being essentially seen as a divine attribute (symbolic dimension). Reflecting a harmonious combination of beauty and virtue, it was everywhere and was synonymous of good and truth. Gothic art (XII century), represents well this medieval duality of beauty/divine. Light and colour emerge as a metaphor of spiritual realities and start being considered in the explanation of qualitative beauty as the result of a spontaneous reaction, which differs from numerical proportional beauty, recovered from the concept of proportion of antiquity.

The transition from the Middle Ages to Renaissance[9], is done gradually as social, philosophical, economic and religious differences are established. A new, empirical and scientific vision of man and nature will appear, opposing the medieval conception of the world. In this context, aesthetic judgment emerges as a human capacity with an intermediate position between intellect and senses. Guided by ideals of perfection dictated by classical beauty Renaissance artists, while seeking beauty in nature of the Greek past, take a rational method necessary for the pursuit of beauty through what is seen. In other words, beauty is understood as something experienced in the sensible reality. The idea of beauty no longer exists *a priori* in the spirit, because it is a product of the experience of the subject. Along with creating the need to use nature as a model of art, the artist's responsibility to choose what is most beautiful in nature is also created, so that art can overcome the simple natural truth and achieve beauty (the masterpiece).

Between the XVI and XVIII centuries the aesthetics of Aristotelian inspiration continued to dominate, but in parallel, aesthetic ideas that affirm the subjectivity of beauty started gaining importance. Indeed, with the advances in physical sciences and challenges presented by philosophies of René Descartes[10] and Thomas Hobbes[11], emphasis shifts from

[6] *Aristotle/ 384-322 BC*
[7] *Antiquity/ 4000 BC to IV century*
[8] *Middle Ages/ IV to XIV centuries*
[9] *Renaissance/ XIV - XVI centuries*
[10] *René Descartes/ 1596-1650*
[11] *Thomas Hobbes1588-1679*

the subject of beauty to the person who perceives it. Descartes, considered to be the father of modern philosophy, understands the human being as characterized by the mind / body dichotomy. The world and human body, viewed as a machine, become object of analysis by reason, where subjectivity, sensitivity and corporeality are subject to analysis of rational determinations. With the concept of judging, or taste, initiated in the mid XVII century, first in Italy and Spain, then in France and England, and later in Germany, and the birth of aesthetics as philosophical discipline, beauty becomes thus rooted in human subjectivity which, ultimately, is defined by the pleasure it provides, i.e., the sensations or feelings it evokes.

Also defending the subjectivity of beauty but opposing Descartes' rationalism, a philosophical movement, empiricism, arises in the British Isles, with John Locke[12] and David Hume[13], which claims knowledge on beauty comes only or mainly from sensory experience. The philosophy of Spinoza[14], considered an obvious response to Descartes philosophy' dualism also argues that *ugly* and *beautiful* are subjective and personal terms. For him, mental and physical cannot be in contradiction because essence and appearance are attributes of the same substance, which is God, and therefore exist in perfect interaction. Beauty is thus no more than an effect on the viewer and only in relation to our imagination can things be called *beautiful* or *ugly*.

The expression *I know not what*, often regarded as a refuge for ignorance, which many authors from the XVIII century used to externalize the mysterious and indefinable charm of beauty had a very important role during the formation of modern aesthetics. On the one hand, it marks the final crisis of the theory followed for a long time in the West, which states that beauty coincides with harmony and proportionality of the parties, according to explicit rules. On the other hand, it marks the beginning of an understanding of the own, irreducible individuality of that which we ascribe aesthetic value.

It was still in the XVIII century, in the philosophical work *Aesthetica*, from Baumgarten, that the term aesthetics appears for the first time. Here, the aesthetic judgment is presented as a sensitive judgment on perfection. In its origin, aesthetics had as main purpose to form public taste, whatever the explanatory interpretations of aesthetic judgment. But Kant[15], the main creator of contemporary aesthetics, develops his critic so as to make aesthetics autonomous of any utility, moral or intellectual interest, rather seeking to explain its essential meaning. On the basis of Kant's taste judgment, there is no subjective purpose connected to interest, nor an objective one connected to goodness, but rather an endless purpose, inasmuch it favors the shape of the object in its formal representation, which is the condition for the possible harmonious relationship of representing faculties and feelings of pleasure. This state of mind, the free play of faculties of knowledge can be shared and communicated, surpassing the private and personal level of liking, evidenced by the senses. The aesthetic communicability and capacity to be discussed rely on the universality of the subjective conditions of aesthetic judgment, because without them man could never evaluate the form of a sensitive object as beautiful or ugly. This means for Kant taste is the faculty of aesthetical judgment, enabling man to assess whether a thing or work is beautiful but, though our aesthetic judgments have a subjective basis, they aspire to universality.

[12] *John Locke/ 1632-1704*
[13] *David Hume/ 1711-1776*
[14] *Spinoza/ 1632-1677*
[15] *Immanuel Kant/ 1724-1804*

Kant also lists a category that transcends taste: the sublime that enables us to evaluate the real according to greatness, beyond sensible beauty.

In total break with the XVIII century and totally changing the place assigned to judgment of taste and to Kant's aesthetic experience, Hegel's[16] aesthetics arises, rejecting the criterion of taste, considering it superficial, inadequate and external to art.

The modern age in the West, having reached its fullness precisely at this time, XVIII-XIX centuries, also coincides with the development of a more complex and differentiated artistic sphere. From the XIX century, with Arthur Schopenhauer[17], Friedrich Nietzsche[18] and, in the twentieth century, with Martin Heidegger [19] and the phenomenological aesthetics, the decentralization of the secular concern with beauty would produce the ever increasing explosion of aesthetics in particularized and differentiated versions. The works of Benedetto Croce[20] and John Dewey[21], moved the question of beauty to the concepts of *art as expression* and *art as experience*.

To Almada Negreiros [22] in Portugal, beauty is the door to the revelation of deep meanings (hidden, hermetic), which it represents and who give themselves (or not) to our personal reading, as individuals forming a community. That is, beauty is not an aesthetic category but the expression of unanimity of existence in universal diversity - "Beauty is not a personal taste. It's all personal tastes"[23] (Almada apud Castro, 1987: 32). It is therefore necessary, in order to know it, to go and search the key to "all personal tastes."

We then see philosophical aesthetics giving way to the countless theories of art. Only after the 80s of the XX century, did the debates about post-modernity bring aesthetic issues back to the center of the arts, culture and philosophy scene. After the art-for-the-gods, art-for-princes, and art-for-art (Lipovetsky, 2014), we are now at a stage where art for the market triumphs. The supposed emancipation of artists and art, claimed by XIX century artists is thus very relative, since it is increasingly accompanied by economic dependence on the forces of market.

With the triumph of artistic capitalism, aesthetic phenomena will no longer return to the small peripheral and marginal worlds. Integrated in the universes of production, sails and communication of material assets, they represent huge markets shaped by international economic giants, with the generalization of aesthetic strategies for commercial purposes in all sectors of consumer industry.

Thus, at the end of XVIII century, it was still stated that humanity could move towards freedom, reason and goodness through education of aesthetics and practice of arts. For the German Romantics, beauty was the access to the absolute and was placed with art on the summit of the hierarchy of values. Today, with capitalist aesthetics, the more art infiltrates into everyday life and the economy, the less it is loaded with high spiritual value; the more the aesthetic dimension is generalized, the more *beauty* appears as an accessory with no other purpose than that of animating, decorating, making the vulgar, futile and superfluous life appear sensual.

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[16] *Georg F. Hegel/ 1770-1831*
[17] *Arthur Schopenhauer/ 1780-1860*
[18] *Friedrich Nietzsche/ 1844-1900*
[19] *Martin Heidegger/ 1889-1976*
[20] *Benedetto Croce/ 1866-1952*
[21] *John Dewey/ 1859-1952*
[22] *Almada Negreiros/ 1893-1970*
[23] *A Beleza não é um gosto pessoal. São todos os gostos pessoais. (Almada apud Castro, 1987:32)*

Can beauty save the world? Some logs to fuel a big fire

The pursuit of beauty has followed the history of mankind. Different times and cultures create different aesthetic standards according to their tastes and preferences. The consumer society was educated to relate beauty with appearance and, according to the market, concepts are sold and human understanding of aesthetics becomes standardized, thus stimulating the fragmentation of the human being, with the consequent loss of unity which characterizes him, formed as inseparable essence and appearance.

Indeed, ethical hypermodern aesthetics has proved powerless to create a reconciled and harmonious existence. We dreamt of it having a focus on beauty, but it turned into competition. Aesthetic productions proliferate, but quality of life is threatened. We consume more beauty, but our life is no longer beautiful. According to Lipovetsky, "this is how we have to mourn a beautiful utopia, now that we know it is an illusion to believe that beauty will save the world"[24] (Lipovetsky 2014:38).

But if aesthetics has been proved powerless to determine the challenges of collective future, techno scientific reason without the aesthetic dimension is unable to lead us in the way of a beautiful and tasty life.

Apparently, in the 2500 years that make up the history of philosophy there are ongoing issues and invariable topics. The question still remains: what is beauty? Can beauty save the world? In the XIX century, the French philosopher Victor Cousin wrote a work entitled *Du Vrai, du Beau et du Bien* (1858 [2007]), expressing his conviction that philosophy, in all ages, is centered in the basic ideas of *beauty*, *truth* and *goodness*. A recent general approach to the concept of *beauty* in the *Encyclopedia of Aesthetics* (2008) concludes that even after Nietzsche, many philosophers and artists of the XX century continued to pursue this traditional connection of *beauty* with *truth* and *goodness*. Satish Kumar, in an article written on this subject at *Resurgence & Ecologist* Magazine (2014:1), argues that we should practice, pursue and promote this trilogy in different areas of our lives. According to him, science, spirituality and art flow through this trilogy: for *truth*, science; for *goodness*, spirituality; for *beauty*, art. That is, in order to know the truth we need science, because the purpose of science is to seek the truth. But genuine science is much more than math, measurements and accuracy. Thus, pointing out that there are many more ways to discover the *truth* than to rely only on a particular methodology, Satish Kumar indicates intuition, experience, introspection, understanding and meaning, for example, as equally important factors for knowledge, as evidence and experience. In fact, if we are faithful to the meaning of science, the way it is practiced in the modern world, then this concept alone is not enough because it can serve both the military industry and money, as well as subdue the natural environment and exploit human beings. According to this author then, *truth*, the knowledge of *truth*, should be integrated in *goodness*, that is, the good of oneself and of all beings. And because *goodness* is a quality of the spirit, saying there must be complete unity between *truth* and *goodness* is the same as saying there should be a full union between science and spirituality.

Spirituality tells us of relationships, empathy, compassion, good sense and wisdom, and

[24] *(...) é assim que temos de fazer o luto de uma bela utopia, agora que sabemos que é uma ilusão acreditar que a beleza salvará o mundo.* (Lipovetsky 2014:38).

is not the same as a structured religion of any particular belief, but even the eminent scientist Einstein said that "science without religion is blind and religion without science is lame" (Einstein apud Kumar 2014:1).

In the modern world there is too much emphasis on truth, science, physical facts, calculation and measures but not on kindness, compassion, meaning, wisdom and good sense. Thus, the balance has to be restored, but restored in a beautiful way. That's why art has to be an integral part of human achievements. Science is linked to *truth*, *goodness* to spirituality and arts to *beauty*. In this perspective, we can say that in any human endeavor, there is only real *beauty* if *truth* and *goodness* are present.

Satish Kumar also makes a correspondence with a new trinity: head, heart and hands. With our head, our thoughts and our intellect, we understand t*ruth*; with the heart we experience *goodness* and with the hands we create *beauty*. Unfortunately our education and economic system give more importance to the head than the heart and hands. Intellectual, cerebral, jobs are usually better paid and, according to the prevailing character in our society, manual labor must be done by machines as fast as possible, or by cheap laborers, including at home, or by emigrant workers from poorer countries.

Figure 1. Development of heart, head and hands in total harmony, (Photos: World Observer Online, accessed 15 Feb 2014, <http://worldobserveronline.com/2013/08/27/a-boy-and-his-bird-child-forms-inseparable-bond-with-injured-sparrow-which-now-travels-with-him-wherever-he-goes/>.; Crescer com afeto, accessed 15 Feb 2014, <http://crescercomafeto.com.br/news/uso-exagerado-das-telinhas-pode-insensibilizar-criancas/>.; Obvious Magazine, accessed 15 Feb 2014, <http://lounge.obviousmag.org/lunatico/2012/06/arte-d.html>.)

But our society needs a greater picture than this, it needs a holistic view. The image of a balanced society is to honor and respect mental work and manual labor in the same way, because we need both. Thus, only when we develop head, heart and hands in perfect harmony, can science, spirituality and art be in total coherence, leading to the trinity - *beauty*, *truth*, *goodness* -, as an integrated whole.

According to Satish Kumar, respect for nature – *soil*, respect for ourselves – *soul*, and respect for others – *society*, are the keys to true sustainability. This other trilogy, present in the concept of *Reverential Ecology* created by the author for the times of ecology, is inspired by the true holistic thinking emanating from the work *Bhagavad Gita*. According to the *Bhagavad Gita* (séc IV BC [2007]), which is the essence of Vedic knowledge of India and one of the greatest classics of philosophy and spirituality of the world, nature, society and the individual as *self* form a triangle, an interconnected whole that we have to

take care of every day of our lives. In fact, these three concepts are not distinct and, when we join nature, humanity and spirituality, the concept of *Reverential Ecology* also embraces the trilogy - *beauty, truth* and *goodness*, thereby acquiring a key importance in the consciousness of our human community.

Also for Pedro Sinde, what ecologists are missing is a metaphysic. According to the author, there is only one truly ecologist vision and it is necessarily spiritual.

> How can ecologists convince someone that nature needs to be saved, if they cannot see beyond it? The assumptions are the same as those that destroy it, only the points of view as to what to do with it are different. (Sinde 2005:15)[25]

In this perspective, we realize that to rethink beauty and its connection to design and sustainability immediately implies a reflection on all of these concepts, establishing judgments of value and always having respect as a permanent source of measurement and stimulation. I.e. it fundamentally implies to rethink of the importance of spiritual dimension, where atmospheres of light and colour play a key role.

From ancient Greece the relationship of light and colour to the phenomena of visual perception has been established, regarding this as the point of contact, the interface between the physical, mental and spiritual world. In fact, it is the infinite possibilities for games and interaction between light and matter, which originate certain environments, atmospheres of light and colour which, by stimulating or hiding the spiritual dimension, enable a greater or lesser awareness of our presence on Earth, paving the way for different forms of relationship with the world, more or less respectful of the whole to which we are connected.

Light and colour in the construction of beauty: case studies

Figure 2. Geographical location of the three case studies: Portugal, Brazil and Mozambique, (Photo: F9Consulting, accessed 23 Mai 2014, <www.f9consulting.com/emp_estamos.php>.)

[25] *Como é que os ecologistas podem convencer alguém de que é preciso salvar a natureza, se não sabem ver para lá dela? Os pressupostos são os mesmos daqueles que a destroem, só os pontos de vista quanto ao que fazer com ela é que são diferentes. (Sinde 2005:15).*

Due to the reflective nature of the act of projecting, research in artistic areas as well as in design and architecture, frequently tends to approach more qualitative methods than quantitative ones. According to Popper, in *The Logic of Scientific Research* (1934 [1972]), statements can only be logically justified by statements and, if it is so, to identify variables of identification of beauty is more a task of theories and abstractions, than of concrete case studies. However, these will continue to be important in as much as they can disprove the hypothesis, which guarantees the scientific character of research.

Thus, the three case studies presented here, geographically located in Portugal, Brazil and Mozambique, have a direct or indirect relationship to the Portuguese culture and, based on the principles introduced in the theoretical exposition of the concept of beauty, they have as goal, by identifying the consequences and impact of application of light and colour to practical design situations, to encourage the reflection and discussion about beauty and its relationship to sustainability.

Case Study 01
Exhibition: My country through your eyes, Cristina Rodrigues (Portugal)

Designed for the general public, *My country through your eyes* is a traveling exhibition from artist/architect Cristina Rodrigues, taking portuguese rural universe to the main urban centers of the country and other countries affected by the phenomenon of depopulation, environmental desertification and economic decline. It consists of six art installations, which, by developing the perfect dichotomy between tradition and modernity, consumption value and emotional value, transport us to the essence of our cultural identity.

Figure 3. Map: Idanha-a-Velha, Portugal; Musical instrument: tabret (Adufe); Exhibition: My country through your eyes, (Photos: Idanha-a-Nova, accessed 17 Mai 2014, <http://en.wikipedia.org/wiki/Idanha-a-Nova >.; O Correio-Mor, accessed 17 Mai 2014, <http://3.bp.blogspot.com/O4WAo7K6xOQ/ToAv5ozSf4I/AAAAAAAAD1U/O7GBCTGZjnY/s320/adufe_mini3.jpg >.; Cristina Rodrigues, accessed 17 Mai 2014, <http://www.cristinarodrigues.co.uk/portfolio/the-blanket-·-idanha-a-velha/ >.)

If we take a special look at the Raia area of Idanha-a-Nova (Portugal), which reflects a strong cultural identity, the exhibition tells the story of several objects, part of portuguese rural day-to-day, which often go unnoticed but appeal to a more collective memory. Identity is something so profound that it completely leaves an impression on who we are

and on our relationships with sentimental objects. In contrast to the consumer society that teaches us that everything has a short term life, in this exhibition the sentimental value of objects assumes a central and timeless place. It is comprised of six installations which reflect the ideas of decline of rural communities and subsequent loss of local traditions; they all speak of the feminine through atmospheres of light and colour; they are all large-scale, and they are produced in very different materials, all of them starting with donated objects, which belonged to public and private spaces of Idanha-a-Nova. A large part of the material used was collected at the municipal shipyard of this town and were already obsolete. The idea was to give life to objects that were still present in the collective memory of people from Idanha-a-Nova and to bring them to the forefront of the contemporary, rearranged in beautiful bursts of color. Satin ribbons, silk ribbons, lace from the Lace Factory in Porto - the only factory in Portugal that still produces lace with the first machines from portuguese industrial revolution - drying strings and nylon strings, they all show the wide variety of materials. Everything has a very specific meaning and nothing is there by accident.

The title of the exhibition comes from a collection of photographs and interviews to people from Idanha-a-Nova who, according to the artist, taught her a lot about their country. But in a globalized world, it is often at the local that one finds universal stories. Or local culture is, in this global world, transversal to many cultures. Narratives from the women of Raia, who participated in the production of the pieces together with the artist, along with the joy of sharing these creative moments in community, portray not only the generosity and hope of portuguese people, but also arouse the universal humanism present in each of us.

(1) Installation "The blanket, gold & silver"

Figure 4. The blanket, Berlim, (Photos: Cristina Rodrigues, accessed 17 Mai 2014, <http://www.cristinarodrigues.co.uk/portfolio/the-blanket-berlin-version/>.)

The Installation *The blanket, gold & silver*, 8m long and 5m wide, is a quilt made of hand painted tabrets that resemble the squares of a crochet bedspread. These tabrets are united by satin ribbons woven in a variety of colours that evoke the colorful traditional costumes worn by women of Beira Baixa, Central Region of Portugal. This piece moves the tabret from its traditional context (musical instrument constructed traditionally by women), transporting it to the museum as a centerpiece of the feminine universe of this region.

(2) Installation "The Chapel"

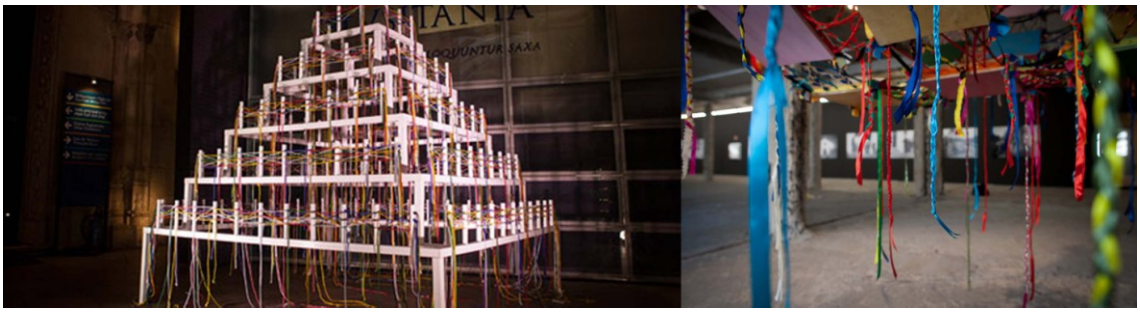

Figure 5. The chapel, (Photos: Cristina Rodrigues, accessed 17 Mai 2014, <http://www.cristinarodrigues.co.uk/portfolio/the-chapel/>.)

Inspired by the pyramids of candles found at the door of churches, the installation *The Chapel*, made with feminine materials, is a celebration of the feminine world and the role of women as guardians of traditional culture. It is women who bear the heritage of their cultures, who share with younger generations, thus ensuring its continuity. When emigrants, they carry that heritage across borders and share it with their children, who were born in a new culture and are part of it. Gradually these women are integrated into the host community and the heritage they carry and share will be touched by this new culture and involved in it.

(3) Installation "The Queen"

Figure 6. The Queen, (Photos: Cristina Rodrigues, accessed 17 Mai 2014, <http://www.cristinarodrigues.co.uk/portfolio/the-queen-i/>.)

The Queen is a piece dominated by a crown of tin that was part of the procession of *Our Lady of Almortão* in Idanha-a-Nova, from which colored ribbons and paper flowers come out, inspired by portuguese popular folk festivals. By bringing the sacred side to this side of life, this installation pays tribute to the mother of Jesus Christ and to all beautiful women, not only physically but also in terms of values: perfect beings in their sublime beauty.

(4) Installation "Dressed Moor I"; (5) "Dressed Moor II"; (6) "Dressed Moor III"

Figure 7. (4) Dressed Moor I; (5) Dressed Moor II; (6) Dressed Moor III, (Photos: Elle, accessed 17 Mai 2014, <www.elle.pt/agenda/exposicao-o-meu-pais-atraves-dos-teus-olhos-entrevista>.)

Each of these three installations, (4), (5) and (6), tells us about the expectations of women, the role models to follow, what we expect of a woman and what we need to develop internally and externally. Like every woman, each *Moor* has its own character: some more unassuming and simple, some more exuberant. The last *Moor*, *Dressed Moor III*, the most sophisticated, speaks of the old, of the memory of objects, of how easily outer beauty ceases to be, while what is truly beautiful, sublime, stays forever. In this *Moor*, then, the top thus tells the stories that chair lived, and its body became sublime because it resisted all trends and is here.

> The deeper the interiority of the being (ens), the deeper is his expected existential annulment. Therein lies the sublime, be it the experience of space or the overwhelming energy the factor through which the individual decreases. (Barragan apud Durão 2009)

In the end, what this exhibition tells us is that we need to seek a holistic relationship with the territory. There is no urban and no rural. No inland and coast. Spaces are a continuity, as in a body, where we should work not only in the exterior, but also in the interior and its relationship with the sublime. The exterior, this part of aesthetic beauty, is only one side, but the relationship with the sublime is higher and inner evolution relationship. The sublime expresses the inexpressible, causing aesthetic reactions where the sensitivity turns to extraordinary aspects, and where light and colour play a key role.

Case Study 02
Urban intervention: Light in the alleys, Boa Mistura (Brasil)

Boa Mistura is a multidisciplinary team from Madrid, with intervention projects in public space in countries around the world. The background of the group in areas as diversified as graffiti, illustration, graphic design, urban art, studio painting, etc., are reflected in the creativity of their approaches. Developing an attitude of civic responsibility towards the city, they understand their work essentially as a tool to transform the street and create bonds between people.

Figure 8. Brasilândia Village, S. Paulo, Brasil, (Photos: Veja, accessed 20 Mai 2014, <http://veja2.abrilm.com.br/assets/images/2012/11/109612/favela-brasilandia-violencia-sp-20121114-02-size-598.jpg>.)

The project *Light in the Alleys*, developed in 2012 at Brasilândia Village neighborhood, one of the slums at the outskirts of the city of S. Paulo, in Brazil, is a participatory intervention of urban art, which resorts to colour and critical attitude, to try and change positively the "dense" slum conditions.

Structurally, the Brasilândia Village develops lengthwise, responding to the topography of the hills along which the great road infrastructure is implanted. In the background, transversal elements of communication facilitate access to homes. These areas, known as *back alleys* (*becos*) in flat areas and *alleys* (*vielas*) on the stairs, are the real organizers of life within the community. These narrow winding streets form a kind of an urban network that enters into dialogue with residents.

The project aimed at answering this spatial complexity. Thus, for developing the project it was critical to inhabit the place, recognizing its smells, textures, sounds and tastes. To love it and try to understand how life works on that ocean of houses in the shadow of skyscrapers.

Figure 9. "Beauty" (Beleza) Alley, before and after the intervention, (Photos: Boa Mistura, accessed 20 Mai 2014, <http://www.boamistura.com/luz_nas_vielas.html>.)

People feel prouder of the resulting work when they are co-authors. Also the design processes that start *at the bottom* are capable of activating forms of participation and sharing of ethical values in large communities. Thus, in terms of process, the word *Beleza* (beauty), used in the slum to greet people, served as inspiration for the project. Then all, adults and children, began cleaning those streets, which would receive words of motivation, carefully planned and painted so as to hold a distorting effect when seen from afar.

Figure 10. "Firmness" (Firmeza) Alley, before, during and after the intervention, (Photos: Boa Mistura, accessed 20 Mai 2014, <http://www.boamistura.com/luz_nas_vielas.html>.)

For the group, the words – Beauty (beleza), Firmness (firmeza), Love (amor), Sweetness (doçura) and Pride (orgulho) - are the best portrait of the slum. Therefore, distorting (flattening) the perspective from a point, these words were framed by a smooth color that, covering all building materials, democratized space. Throughout the work, the alleys, multiple windows, doors and walls, have gained a more colourful universe, showing the difference that art and the opportunity to learn from it, does in people's lives. As referred by Durão (2009), "Art makes us see, hear, think and feel reality at a deeper level, by creating shapes, not of imitation, but of inner revelation."

Figure 11. Alleys "Love" (Amor), "Sweatness" (Doçura) and "Pride" (Orgulho), after the intervention, (Photos: Boa Mistura, accessed 20 Mai 2014, <http://www.boamistura.com/luz_nas_vielas.html>.)

In the end, besides the chromatic, visual effect, the collaborative work of artists with the community, and vice versa, has recorded these positive and vibrant words, not only in the alleys, but within each child and resident of the place. Barragan tells us the word "astonishment" vanished from architecture but now, in Brasilândia, when we walk in its alleys, we see "Beauty" written underneath a hill full of houses. In the promotional video of the work, one of the authors also stated: "For me beauty is to have shared with the community, to have met all these people, (...) I take with me a light in the heart that will never go off"[26].

[26] *Luz nas vielas* (2012), Vídeo, directed by Boa Mistura, accessed 20.04.2014, <https://www.youtube.com/watch?v=sX5S-bBZyi0#t=730>.

Case Study 03
Design: Design Studio Dandoen (Mozambique)

Figure 12. Map of Maputo (Mozambique); Dandoen Studio (site); Capulanas (fabric with colorful patterns used by Mozambican women as a skirt), (Photos: Globo Mundo, accessed 20 Mai 2014, <http://g1.globo.com/mundo/noticia/2010/09/conflitos-em-mocambique-fazem-brasileiros-se-sentirem-aprisionados.html>.; Studio Dandoen, accessed 20 Mai 2014, < http://ab3535.wix.com/dandoen>; Helena Soares, 2011)

The Dandoen design studio founded in 2011 by designers Ab Oosterwaal and Alies Molini, in Maputo (Mozambique), is based on a philosophy of *Conscious Design*, inspired by the environment in which it operates. Believing that design should focus on local materials and appropriate techniques, and in partnership with local labor, their projects are focused on the production process, minimizing imports and integrating local and recycled materials, such as wood, leather, glass and *capulana* fabrics to create unique high quality products.

Aiming at involving local people, this design studio also develops training workshops, employing local talent and promoting the development of their skills in developing Mozambican quality products, where African patterns and its saturated colours gain new hypothesis for interpretation.

Thus, by practicing what they preach, they own a studio for carpentry and sewing, where products (furniture, clothes, bags, etc.) are made by hand with a concept of social and sustainable development. The bags, made from advertising banners; or furniture, with sketches of the iron bars of Maputo, whose patterns emerge in native woods, such as sandalwood, or other used for cargo transportation, as pallets - are examples of products which use Mozambican noble materials or other disposable materials which were thrown away as garbage.

Figure 13. Studio Dandoen: Furniture projects, workshops, clothes, etc., (Photos: Studio Dandoen, accessed 20 Mai 2014, < http://ab3535.wix.com/dandoen>)

In African languages there is no word for art but several to convey that something is beautiful or to refer to an object that has been produced. Thus, all objects are made with great aesthetic sensibility and show great respect for African culture. African fabrics such as *capulanas*, as well as their designs and colours, are an obvious choice in the development of these projects. Traditional patterns, printed in these tissues, for example, are not only decorative. Each pattern is linked with a name, a saying, or an idea, and when a particular cloth is dressed, this sends a silent message to everyone who sees it. They are patterns and colours that speak of the relationship between husband and wife, between this woman and other women, and between the person and the community. Often patterns are abstract, while others include plant and animal motives, and still others, perhaps the most surprising to the non African eye, show everyday objects like appliances, money, etc. Thus, when developing a Design with Awareness, exploring in the different projects all these visual and chromatic elements, which hold great symbolism, it is the entire people and culture, which is being respected.

Conclusions

We recognize that analyzing light and colour in a holistic context, in order to rethink beauty and its connection to sustainability, is an attempt to approach design, architecture and artistic project in general, from a theory formulated in intuitions, conjectures, albeit disciplined by a penetrating critique. I.e., it is true that the speculative nature of the study presented here, by not putting the scientific method nor the results of science above any other field of human knowledge, does not exempt from a certain metaphysical instrumentation, guided by judgments of value. However, as referred by Popper in The Logic of Scientific Research:

> The fact that judgments of value permeate my proposals does not mean that I'm making the mistake I accused the positivists of – that of seeking to kill metaphysics, by disregarding it. (Popper 1959 [1972:39])[27]

I.e., within scientific research certain, consistent metaphysical explanations should not be rejected, because if there have been metaphysical issues obstructing the scientific way, there were also others which contributed to its progress.

In trying to synthesize all aspects presented in this paper, the case studies analyzed here, reflecting on concepts such as light, colour, beauty, design, ecology and spirituality, represent an appropriate methodological approach to the justification of the hypothesis raised: from the point of view of sustainability, the trilogy *beauty, truth, goodness*, should be the first criterion for any project.

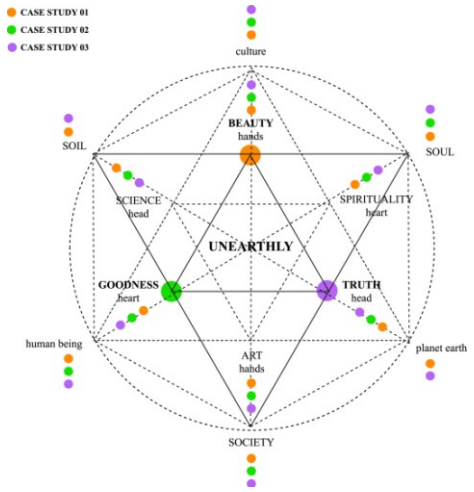

Figure 14. Application of case studies to the holistic view of trilogies underlying the concepts of Reverential Ecology: Soil, soul, society; and Beauty: beauty (art / hand), truth (science / head), kindness (spirituality / heart), (scheme: Helena Soares, 2014)

In seeking to understand, explore and describe all complex situations involving the interaction of the discussed concepts, the variety of the projects studied raises "*controversial*" issues on how to design in a perspective of elevation of consciousness. One of the questions we can immediately formulate, among others, which will follow, is how we can learn from the past, in a perspective of true respect for nature, for ourselves and for others?

Although the mode of investigation in this study is part of the mixed type, the case studies presented here, envisaging the understanding of the uniqueness and comprehensiveness of each case at the same time, have a strong descriptive nature, being therefore considered as a qualitative plan modality. Throughout the preparation of this work, we also realized the importance of extracting information by collating multiple sources of evidence, which led to searching diverse projects and approaches for the case

[27] *O facto de juízos de valor permearem as minhas propostas não quer dizer que estou incidindo no erro de que acusei os positivistas – o de procurar matar a metafísica, desconsiderando-a. (Popper 1959 [1972:39])*

studies we were to investigate. With regard to validity (legitimacy) of the case studies, we can somehow consider that the results can be generalized, they can be applied to other situations. Since this is a study of a qualitative nature, the guaranty of reliability (credibility) is more difficult to achieve. However, throughout the development of research, we will have the opportunity to understand the possibility of reapplying the conclusions to new projects, as well as the possibility of new researchers reaching similar results on the same studied phenomenon.

When we make a comparison between these three case studies, it is noticeable that Portuguese language and therefore, directly or indirectly, its culture, underlying them all, despite the obvious and justified cultural differences. This fact, together with the geographical location of two of the case studies in the southern hemisphere (Brazil and Mozambique) and Portugal also being considered a country in southern Europe, can somehow justify the use, in all of them, of chromatic colours, references of the culture of Southern countries.

In an attempt to identify the most important facts related to each case, we found that all projects involve different forms of social participation. It is a new approach to art and design, where the success of each project, is also measured by their impact on the community. Each of these projects of community work, by being also developed by authors of a nationality different from the zone of intervention (case studies two and three) or, as in the case of Portugal, by a Portuguese living in England, challenges our notions of cultural and global. Cultural identity is a construction, whose peculiarity is the ability to make us stick together. That's the reason why it is so important. Today we have a cultural identity that is becoming globalized, we are increasingly less united, but the truth is that when we work in community, as can be seen in each of these projects, something extraordinary happens: the sense of solidarity, this value that is as rare as important in this community work and, in the case study in Portugal, in the donation of objects, arouses feelings of generosity and mutual aid, as well as our "consciousness of a common destiny" (Morin, 2008) and that all human beings are subject to the same problems, vital and deadly. These case studies are also three example of globalization with emphasis on differences and not standardization. Globalization has led to homogenization, loss of diversity, which is, according to several authors, one of the factors responsible for the loss of beauty in the world. Thus, each of the projects, by bringing out in each place what is most authentic, truer, in an attitude of respect for the culture, accentuates the difference, praising the spirit of each place which spontaneously manifests. Questions like recovery - of materials and objects, as well as their stories - manual labor, civil rights and civic participation, which are at the core of each of the projects examined, thus create dense narratives of the community, also expanding our notion of art, design, beauty and sustainability.

Edgar Morin (2008) states that the world needs less prose and more poetry. In this perspective, each project reviewed here also explores, through different ways of working light and colour, the visual effects with high density poetic results, which transport us to different levels of reality. In an effort to achieve a high level of aesthetic construction, light and colours, while being memory lines reveal the unseen by working reality beyond the visible. By evoking memories of strong cultural identity, the bursts of color that flow from each of the installations, in the case of Portugal, or from furniture and clothes, in the case of Mozambique, build differentiated, striking images and identity, carrying us "(...) to this universe of sacred beauty that resonates in echo in the depths of the psyche, away from all

the condition of mere decorative element" (Durão, 2009). Perhaps this is where we really become aware of the trilogy beauty, truth and goodness, present in each of the projects.

In fact, although starting from different forms of approaching light and colour, they all respect this trilogy, stating symbolic values and strong social and cultural identities. In the first case study (Portugal) - *My country through your eyes* - colour is often crafted from the colour of the materials themselves, suggesting a reflection on culture and art. In an attempt to build a speech in images, each of the installations stimulates our senses, invoking memories and opening our hearts to new visual experiences. That is, creating environments of strong communion and intimacy, light and colour induce specific performances of movement in space and time, producing particular emotions, which transport us to different levels of reality. In Brazil the project - "Light in the alleys" - where the walls were painted to hide degradation, by democratizing space, the focus is placed on the psychology and symbolism of colours. Thus, colour or colours, as action configuring objects and spaces, serves as channel for silent projection of an argument. In Mozambique, because there is already a signal of time on recycled furniture, truth present in colour and materials actually shows the natural course of man in extending creation.

Here, by glorifying in everyday experience its symbolic dimension and strong cultural charge, colours have as main function to restore or reinforce a sense of community. The reuse of materials, such as in Portugal the reuse of objects, builds places of memory and forgetting, trauma and nostalgia, action and not action, noise and silence, where experiences are lived and inscribed.

In this perspective, we can say there are colours that kiss us. In fact, from a holistic point of view, the key to a higher consciousness is the consciousness of non-duality. And, in turn, the key to the awareness of non-duality is not only not resisting the perception of the different levels of reality (Nicolescu, 2005), but also *multi-sensoriality*, where light and colour play a key role.

Although some questions are left unanswered, we do hope the present work stimulates discussion about beauty in a more serious way, and that this may interfere with the consciousness in the act of projecting.

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Stories of Blue in the Lands of Río de la Plata[1]

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Yes, blue isn't just a hue. —Jean M. West

Abstract

Blue is an emblematic color and has a deep meaning for Argentina. In this paper, we will try to begin to trace the path of the use of this color in the country, especially in textiles, since colonial times until today. During the colonial period, natural blue dyes used in blankets and "ponchos" were goods that embodied both the traditional wisdom of textilery crafted by indigenous peoples and African slaves, as well as the productive and commercial goals of the Spanish colonizers. Since the May Revolution (1810), the sky-blue became in national flag: an iconographic feature of the nation's incipient discourse. The exact shade of that blue would be the subject of power struggles between different political groups. Blue is, also, throughout the ages, the color of the uniformed, whether military or academic.The color of uniformity, of the regulated. It is also used incessantly in blue-collar work clothes. To address the historical approach, bibliographic references, archived graphic material and heritage textiles will be used. From the symbolic and productive values detected, the way in which they are expressed, change or disappear in contemporary textiles will be analyzed. To accomplish this, guided observation and surveys about use preferences and valorative perception will be drawn.

Key words: History, textiles, color and identity

The work done over the past five years on the use of natural dyes within the framework of the project internship, *Color and Light in Urban Spaces, Designs, and the Context of Social Practices and Human Semiotics*[2], has given us the opportunity to become acquainted with some texts dealing with indigo—an emblematic dye for the production of blue—and its peculiar geographical and historical route.

In connection with its use in the Argentine Republic, it is the dye used in the famous Macha Flag, exhibited in the Museo Histórico Nacional (National Historical Museum). It is believed that this flag was carried by General Manuel Belgrano in the freedom campaign to Bolivia's highlands in 1813. Some time ago, we got interested in the discussion regarding the blue shade used in the National Flag and its meaning.

[1] River Plate

[2] UBACyT Project conducted by the architect Jose Luis Caivano in the Color, Light, and Visual Semiotics Program of FADU, UBA.

Feeser, Daly Goggin, and Fowkes Tobin (2012:1) define three overlapping categories where color operates: the aesthetic, the economic, and the social. The first one is related to the visual quality of colors.

> "Another kind of value ascribed to color is economic value: the labor, capital, and expertise invested in the production, circulation, and application of pigments and dyes as well as in the production of colored objects that are consumed as commodities within historically specific systems of economic exchange and distribution. Color's ultimate value, however, is conferred through the multiple and sometimes conflictive social, religious, and cultural codes that determine the value of color as an aesthetic property and as a desirable commodity".

It is important to understand how the value of blue is built in Río de la Plata mainly in textile products, taking into account this interplay of socio-economic and cultural factors

As for its material aspect, the sources to obtain the color before the appearance of synthetic dyes were decisive. For instance, regarding the influence zone of the Aymara culture, Bertonio (1612:472) mentions a plant with which the blue color can be obtained called *quesña* in his language. In his article on Ikat en Tastil, Rolandi (1973:183) states that blue prevails in the pre-Hispanic samples found. In his report to the National Science Academy (1962:81), Fester refers to the evidence of the existence of indigo dye of the variety *Indigofera suffruticosa* in Paracas' (Peru) textile bales.

The use of certain plants, which appear in the analysis of dyes used by artisans in more recent times, can be assumed. Regarding Bolivia, Girault (1969:27ss) also mentions various leaves: *ayapana* (*Eupatorium ayapana*), *platanillo* (*Indigofera suffruticosa*), *ppiti ppiti* (*Cestrum tinctorium*), and *mullaca* (*Muhelenbeckia fructiculosa*).

Guido Boggiani , quoted in Millán de Palavecino (1900[1953:4]) makes reference to the area of Paraguay and men's habit to paint their bodies with *ñándypá* (*Genipa oblongifolia o americana*)[3] juice to prepare for war. When the liquid rusts, it dyes the skin bluish black and has an astringent effect. This reminds us of Julio Caesar, who once recounted the story of how Celtic groups painted their bodies blue for the battle. It is supposed that they used *Isatis tinctorea*, commonly known as *glastum* or *pastel*. Both cases react to oxidation in contact with air. Even today, this "magic", typical of ink dyes, is sometimes associated with blue. In these cases, blue offers protection, and will keep on doing so in the long tradition blue has been used in uniforms.

With regard to the Argentine region, Millán de Palavecino (1953:7) tells us about the Araucanians, who, in the City of Azul [4]and its surrounding area, use "the stones they pulled out from the earth" to dye things blue. In addition, the author mentions the use of indigo by Amazonian groups and, in general, by all the Andean groups.

A slight digression: The City of Azul is currently the hub of the homonymous district, located in the Province of Buenos Aires. In 1832, when Juan Manuel de Rosas was the governor, he had a fort built in that area to avoid Indian raids. The fort was called San Serapio Martir del Arroyo Azul (San Serapio, Martyr of the Blue Stream). The name of the stream and, by extension, of the city is the translation of its Pampa name, *Callvu Leovu*. It

[3] Other names: blue jagua, jagua, white jagua, caruto lluale, yoale, tejoroso, maluco, tejoruco, shagua, xagua, yaguare, huito.
[4] Azul = blue

is said that the origin is related to the color of the borage flowers that grew along the banks. The stream has its source in the Sierra de la Tinta (Ink Range), aboriginal toponym referred to the clay that can be extracted from the hill.

Going back to Millan de Palavecino, she points out the use of indigo in the 20th century in Cuyo, Calchaquíes Valleys, Catamarca, and Córdoba, and *palo azul* (*Cyclolepis genistoide*) in Santiago del Estero. In his research work conducted in Santiago del Estero, Mazzola (2005:207ss) confirms the use of *palo azul*, whereas in his work done in the same province, Stramigioli (2004:115) cites *palqui negro* for obtaining light blue. Both of them refer to the historical use of wild indigo[5], *Indigofera suffruticosa*, hard to be recovered today. Lastly, the use of *jume negro* (*Allenrolfea vaginata*) as well as of *palo azul* are corroborated in the painstaking thesis written by Guerrero Maldonado (2008). The existence of native varieties of indigoferas is recorded in several scientific publications. In fact, the Darwinion Catalog[6] mentions three native species: *Indigofera asperifolia*, *sabulicola,* and *suffruticosa*; two endemic: *Indigofera latifolia* and *parodiana.* In short, the Latin American continent had blue dye sources by the time of the conquest.

The Spanish crown promoted a production structure that exceeded the domestic volume: the *obraje*[7]. The epicenter of the textile production was the Governorate of Tucumán, which, in the 16th century, included the current provinces of Santiago del Estero, Tucumán, Córdoba, Salta, La Rioja, Jujuy, and Catamarca. Nowadays, we can find the gleam of textile wisdom in the work of first-rate artisans. A curious fact is the town of El Añil (Indigo), located in the vicinity of Juárez, Santiago del Estero.

Blue turns into merchandise. Although back then there are sources of dyeing products in Latin America for a wide range of colors, some are more suitable to fit in new trading circuits, such as Pau Brasil or cochineal, and, naturally, indigo. Fester (1962:87) mentions an agreement between a citizen of San Miguel de Tucumán and a priest from Córdoba to set up an indigo extracting plant in the Province of Catamarca in 1616. In a report entrusted to him by the Argentine Committee for the Trade Show in Philadelphia, Napp (1876:274), lists dyeing matters, where he includes two types of indigo.

In the 17th century, textile plants appeared and were managed by Jesuits in Córdoba, Misiones, Catamarca, and Buenos Aires[8]. It is well known that, apart from the indigenous labor force, the Society of Jesus used African slaves on their farms. Most slaves brought to the lands of the River Plate came from the occidental African coast. They were peoples with a long tradition in the use of indigo as well as in the manufacture of cotton, as shown in the Yoruba *adire* or the striped fabrics of Ivory Coast. *Earth clothes*, manufactured under these circumstances, are defined as a kind of object that carries the traditional wisdom of indigenous textile weaving, African groups, and the European technique

[5] Also known as *amaretá*, *acibul chico*, *ka´ahoví* (blue grass) in Guaraní, a*ñilsillo*, *añililo*, in many provinces.

[6] Catálogo Darwinion (Darwinion Catalog). Instituto de Botánica Darwinion (Darwinion Institute of Botany) http://www2.darwin.edu.ar/Proyectos/FloraArgentina/FA.asp . Academia Nacional de Ciencias Exactas, Físicas y Naturales (National Academy of Natural, Physical, and Exact Sciences). Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) (National Council for Scientific and Technical Research).

[7] Textile plant. Single enterprise that incorporated most, if not all, of the processes of wool or cotton cloth manufacture: dyeing, carding, spinning, weaving, fulling, and finishing. First established in Puebla, Mexico, during the 1530s. An *obraje* could house between 4 and 40 looms, and employ from 40 to 250 men, women, and children.

[8] There were 400 workers, mostly blacks, on the Jesuit farm of Jesús María, mentioned by Furlong (1978).

incorporated by the Jesuits upon bringing both equipment and technicians to the missions. Considering that a rod of canvas was used as trading currency in the middle of the 16th century, blue baize represents the materialization of the socio-cultural and economic circumstances of the Colony.

In his complete study on River Plate *ponchos*, Corcuera (1999:71), reflects upon the transmission of knowledge in the use of textile techniques by Africans, and compares the "striped Jesuit *ponchos*" or "the 60-striped *ponchos*", woven in blue and white narrow stripes that were later sewn, using the narrow fabrics of Senegal, Gambia, and Guinea.

In an article about the relationship between indigo and slavery in Latin America, Wells (2007:5) states,

> "Although there is no definitive proof that Africans were imported specifically for their knowledge of indigo cultivation and processing, few Europeans had experience cultivating or processing indigo. Because so many slaves had prior experience with indigo in Africa, their skills complimented and supported the indigo economy, certainly helping to make it a profitable business."

Regarding the use of blue by Africans in the lands of the River Plate, there are some references in texts that show the African American culture. In the text where he tries to reconstruct "black" Buenos Aires from archeological urban artifacts found in various places, Schavelzon (2003:6-150) mentions blue necklace beads made up of crystals and marbles, and concludes that there was a predilection for the color, because, of the 854 found in the old Santa Fe, 537 were blue.

Furthermore, Yañez (2013) thoroughly analyzes 600 reports of escape of slaves published in *La Gaceta Mercantil de Buenos Aires* between 1823 and 1831. He supports the theory that "their garments could transcend their mere material use and become objects of cultural significance and assertion of their own identity"; thus, he sets out in detail their apparel.

> *Podemos suponer, sobre la base de lo relevado en los anuncios de fugas, que el mundo afroporteño en la segunda y tercera décadas del siglo XIX era un mundo regido por el color. La importancia que la percepción cromática tiene para las distintas culturas (con relación a sí mismas y como factor de diferenciación frente a un "otro" social) no puede pasar inadvertida. Tampoco, la índole cultural e histórica de dicha percepción y la preferencia de los colores. De este modo, la relación color-identificación social nos parece que puede ser aplicada a la relación que los afroporteños tuvieron en dicho contexto. (* "We can assume, based upon the data revealed in the reports of escapes, that the African Porteño[9] world during the second and third decades of the 19th century was a world ruled by color. The importance of the chromatic perception has for the different cultures (in connection with themselves and as a differentiation factor before the social 'other') cannot pass unnoticed. Neither can the social color-identification be applied to the relationship African Porteños had in such context.")

[9] *Porteño*: of/from the City of Buenos Aires.

He quotes numerous examples, such as "The young Portuguese mulatto, Manuel del Nacimiento, who wore, at the time of his escape, 'a blue jacket, striped breeches, and a gray hat". Finally, in the total number of garments described, men's blue garments represent 28.5%; women's total number of blue garments is 10.3%; blue and white combined, 5.8%; and light blue, 4.9%. In children's clothes, blue also predominates, with 24.4%, and light blue, 5.9%.

Going back to the importance of indigo-blue as a protagonist in trade routes, we find the database compiled by Jumar (2010: 14-20) with the information of 15,000 customs notes belonging to the period between 1779 and 1783. One of the elements he tracks down is indigo. He finds 62 consignments from Buenos Aires, partly to be exported, partly to be sent to Córdoba, Misiones, and the Buenos Aires campaign. In addition, Viceroy Vértiz (1777-1783) promoted the sowing and production of indigo in Tucumán.

Ledesma (2010:161ss) recounts that, after the expulsion of the Jesuits, in a letter from Melchor Rodríguez to Viceroy Nicolás Arredondo[10], he explained "how he lifted the province out of a debt situation, making considerable profit thanks to the promotion of cattle breeding, wax work, as well as the production of linen and indigo". He also quotes a letter from Governor Riglos to Viceroy Marqués de Sobremonte on April 30, 1806, to which he attached fabrics that evidenced the improvements obtained in the production of rosaries, wax, and textiles.

> *El muestrario, que incluye muestras de tejidos fabricadas por los naturales de Chiquitos entre los años 1766-1809, es sumamente valioso, dado que nos permite conocer cómo era el algodón que se tejía en estos pueblos, así como los motivos y los colores empleados. El mismo se encuentra en el Archivo General de la Nación y fue publicado por el Dr. Ricardo Caillet Bois. Ruth Corcuera lo mandó analizar, es algodón americano y sólo el azul es teñido.*("The collection of samples, which includes fabrics made by the locals of Chiquitos between 1766 and 1809, is extremely valuable, since it allows us to know what the cotton weaved by these people was like, as well as the motifs and the colors used. It is kept in the General Archive of the Nation and was published by Dr. Ricardo Caillet Bois. Ruth Corcuera had it examined. It is American cotton and only blue is dyed.")

Finally, the productive importance is reflected on certain publications. On November 29, 1801, *Telégrafo Mercantil* publishes an article about its cultivation and its extraction method. Some articles on its cultivation also appear in *Semanario de Agricultura, Industria y Comercio* by Hipólito Vieytes (1802-1807).

However, the availability of the blue dye does not seem to be the only reason for its frequent use in clothing, taking into account the number of references that appear in all the consulted bibliography and the illustrations of the time (Paucke, D´Hastrel, Essex Vidal).

[10] Chiquitos, September 29, 1794.

El Gaucho enlazando. In *Trages y costumbres de la Provincia de Buenos Aires.*Litografía de Bacle y Cia. Impresores Litográficos del Estado.1833

In Corcuera's text (*ibid.*) these references are multiplied in the color of *ponchos*. The *poncho* given to General San Martín by the Pehuenches is a nice example. In it, the construction of the blue space is added to the Mapuche-Tehuelche tradition. Mege (1998:62) states that

> "An elegant travel rug must be intensely black and gleam with flashes of blue. Blue should not be allowed; it should only be hinted at through the sheen of black. Blue in fabrics is an exaggeration, it seems disproportionate to humanity, and it presupposes an excessive significance. It is like assigning a man's garment colors that are not reserved for the symbolism of what is human. Blue is the color of sublime divinity".

The deep symbolic meanings of blue in non-Hispanic cultures exceed this article, yet we cannot ignore them.

Pastoureau (2010:121ss) finds, during the 18th century, the culmination of the triumph of blue, not only because of the use of indigo on a large scale (finally the imported dye is adopted throughout Europe over glastum), but due to its appreciation in the clothing practices during the Lutheran Reformation and among the well-off classes, its symbolism associated to progress, the dreams and freedom of the Romantic movement, as well as the French and American revolutions. In the lands of the River Plate, in the midst of the independence period, blue used in ponchos is anticipated as an iconographic feature of the national discourse. The *Reyuno*11 poncho (given by the king) becomes the Patria poncho when given by the national government.

In 1810, blue appears in the uniform of the Regiment of the Homeland's Dragoons, made of thick dark blue baize, and red lining. Corcuera (*ibid.*) dates its appearance back to the Regiment of Lancers. The British, in turn, wore a red jacket. The first uniform in this regiment adopted in 1760 by Captain Pedro Nicolás Escribano consisted of a short blue jacket, with a red collar, lapels, and cuffs, as well as red breeches. Another of the oldest

[11] Rey=king

regiments was Pueyrredón's Hussars (1806), who wore a blue jacket, and was identified with light blue and white ribbons given to them by the parish priest of Luján.[12]

The National Cockade was created in 1812, and in this resolution, the adoption of light blue and white officially appears as the national colors. Manuel Belgrano chooses the same colors for the creation of the National Flag in the same year, but it is formalized in 1816. We will not discuss the origins of those colors: the Bourbon colors, the sky, or the Marian tradition, since countless authors have already done so.[13] Its exact hue, as already discussed (Nirino, 2009:182), is shown as a power dispute among political groups. The arbitrary cut of the continuous "color" represents not only a space of color but also a space of power. All controversy aside, the material base of the national blue has at present its textile Pantone: 16-4132 TC.

Going back to the past, the blue *poncho* is commonly worn by the troop. Corcuera mentions different orders for *ponchos* placed by the Independence army. Both the intensive use of *ponchos* and uniforms, and the demand of blue fabrics of the European market create a production problem.

Regarding that matter, Panettieri (2000:245), goes through the history of the industry of the woolen cloth. Beyond Manuel Belgrano's efforts to promote the creation of the woolen cloth factories, the first one, La Industrial del Plata S.A., was created by Francisco Carulla. Located in Retiro quarter, it had a steam machine, 19 looms, and 70 workers (mostly women and children), but it did not thrive. It was acquired by Adrián Prat, who brought experienced workmen and new machinery. In it, wool was spun, woven, and dyed blue.

We assume that it then became easier to obtain the dye. Von Baeyer achieved the first synthesis of artificial indigo in 1880, and Heumann, the industrial one in 1890. From that moment, although the color kept its strong symbolic value, it lost its material value.

Blue was established as the color of the national uniforms along the years. In 1810 and 1814, there was a "General Uniform", assigned to all revolutionary military forces, and was an extension of the one worn by the infantry. It consisted of a dark blue jacket, collar, cuffs and red lapel, and white inner lining. Thus we could mention successive modifications and adaptations, such as the uniform worn by the Marine Officers of the United Provinces (blue jacket and trousers), the uniform of the Marine Corps (1816), the uniform of the Republican Squadron (1826), and, of course, the Regiment of Mounted Grenadiers.

The color was abolished during the civil wars (1835) and Rosas' government (because of its light blue color, a symbol of the unitary opposition party, that was replaced by the federal red), and newly adopted in 1853. Taking a leap in time until the 20th century, in 1923, there are new Army regulations for uniforms. The dress uniform appears, commonly known as a double-breasted navy jacket made of navy blue baize. In the '50s, the wool jacket comes into use. In fact, "navy woolen cloth" is practically synonymous with blue woolen cloth. In 1986, the regulations are amended, but blue remains current: navy blue woolen trousers, a white shirt, a navy blue wool sweater with reinforcements in shoulders and elbows, and loops in the shoulders; black shoes or short black boots; a black beret with the Army badge; a navy blue jacket with a zip fastener. On the web page of Fundación Soldados, there is an interpretation of the color of the uniform of the cadets of the Nation's

[12] The ribbons had the colors and the measurements—14 inches—of the Virgin of Luján.

[13] The initial reference material is "La Bandera Nacional de la República Argentina" ("The National Flag of the Argentine Republic"), http://manuelbelgrano.gov.ar/seccion-biblioteca/la-bandera-nacional-de-la-republica-argentina/ Open-access publication.

Military Academy, "Blue predominates, like a horizon that reminds us of the constant search for permanence, the call to transcend, what transcends and the invitation to what is divine". Poetry apart, this passage does not include the grim associations during our history's tragic periods.

Blue is not exclusive of the Army, as we can see if we check the illustrations of the book by Marenco about police uniforms and uniforms of private schools. Even in the cartoons of *Super Hijitus*[14], a blue uniform appears, just like the one worn by the *Comisario*[15].

In a very obvious way, blue continues being associated to the idea of what is national in many diverse objects, such as stamps, soccer shirts, one of the models of El Justicialista[16], Juan Gálvez[17] coupé, and the light blue dress made by Dior for Evita. Likewise, the Marilú doll has a version in a blue dress (almost like the traditional song), one of the most popular dolls and an icon of the national production of toys due to the substitution of imports during the '40s. Some curiosities, like the label of Pampa paper rolls, a national factory of Pianola rolls in the early decades of the 20th century, and a long list of plastic artists we have not yet explored. Another example is the work of 1967 by Carlos Gorriarena, "Banderas" (Flags)[18].

The other connotation, which has a line of continuity with the colonial times, is the one referred to work. Part of the production of labor *earth clothes* was sent to Potosí to be worn by the Indians doing forced labor in the mines. The River Plate *poncho* is worn by the Creoles, indigenous peoples, and blacks, and it constitutes a characteristic part of the *gaucho*[19] clothing. We have already seen that blue is one of the most used colors in textiles for various reasons.

Today's working clothes appear as protagonists. At Ombú,[20] an emblematic brand for the "working man", blue is one of the basic colors both for professional clothing and for the free time wear line, created more recently. The same color is still used in the espadrilles or *alpargatas*, typical field workers' shoes, of Arabic origin brought to America in the 16th century. Firstly manufactured in workshops and then by the originally called "Sociedad Anónima Fábrica Argentina de Alpargatas" (Argentine Factory of Espadrilles, PLC) (1883), it continues being made in the traditional blue by the same company, under the brand Rueda. With a similar style, Pampero canvas shoes are also emblematic. Under the same brand, sold by Alpargatas in 2010, many working clothes lines are developed. Naturally, blue is also fundamental here.

Lastly, let's explore the current uses. At the beginning of the year, in an exercise done in the Textile Design degree course,[21] three groups of students gathered various elements related to the use of blue, whether in graphic or verbal form: pigments, objects, labels,

[14] Cartoon character created by M.García Ferré. The televisión show was broadcast between 1967 and 1974.

[15] Chief Constable, other of the characters of Hijitus s cartoon.

[16] An automobile manufactured between 1953 and 1955 by Industrias Aeronátuticas y Mecánicas del Estado (IAME) (Aeronautic and Mechanical Industries of the State) during Juan Domingo Perón's second term in office.

[17] Juan Gálvez (1916-1963). Was an Argentine TC racer. Won 9 championships . The Konex Foundation awarded a Diploma of Merit in 1980 as one of the top 5 drivers in the history of Argentine.

[18] Museo Nacional de Bellas Artes (National Museum of Fine Arts). Gorriarena (1925-2007) was a renowned Argentine painter.

[19] *Gaucho*: South American cowboy.

[20] Brand belonging to Gafa Company, founded in 1926.

[21] Nirino Chair, School of Architecture, Design, and Urban Planning, UBA.

packages, songs, designations, historical bibliography, and so forth. They also conducted a series of surveys to find out the meaning of blue among users and in which blue in objects had more sense. One of the activities was a brief survey. On a total of 170 adult persons of all ages and genders (three groups between 18 and 70), the meanings associated with blue were:

35.29 % The sea, water, and related elements (rain, fish, deep water)
20.58% Sensations/perceptions: depth and mystery above all, followed in a lesser degree by stillness, sadness, magic, safety, strength, freedom.
16.47 % The sky and related concepts (infinite, wind, bird).
5.8 % Color: my favorite color, transparent, pigment, indigo, iridescent.
5.8 % Music: several songs, Cristian Castro was the most mentioned.
4.7 % Clothing: Boca soccer team shirt, uniforms, shirts, velvet.
4.1 % Places: planets, France, home town, Viedma, glacier.
3.5 % Sundry objects: flag, sign, Facebook, monastery, stone.
3.5 % Sundry: blueberries, Prince Charming,[22] homeland, former girlfriend.

Regarding the most proper uses, clothing was the most mentioned (underwear, uniforms, shirts, robes, T-shirts), and accessories, such as shoes, backpacks, and scarves. And, finally elements related to painting: for walls, buildings, swimming pools, for the hair, pictures, and ink.

As for the users, blue seems to be perceived as a color for all; more specifically, women in general, women in their fifties, sailors.

We still have to analyze the records of labels and packaging, as well as of literary texts and songs, such as "Cuartito Azul" (Little Blue Room).[23] Nevertheless, and in line with "Cortázar's Year", commemorating the centennial of the writer's birth, his short story, "No se culpe a nadie" ("No One Is to Blame") (1976:11) is worth mentioning,

(...)*ese gusto azul de la lana que le debe estar manchando la cara ahora que la humedad del aliento se mezcla cada vez más con la lana, y aunque no puede verlo porque si abre los ojos las pestañas tropiezan dolorosamente con la lana, está seguro de que el azul le va envolviendo la boca mojada* (...) (this blue taste of the wool that must be staining his face now that the humidity of his breath is mixing more and more each time with the wool, even if he cannot see it, because if he opens his eyes, his eyelashes bump painfully against the wool. He is certain that his wet mouth is being enveloped in blue..."

A menacing presence, a blue that is not at all reassuring, nor celestial. In brief, blue is never just a color.

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PSYCHOLOGY

"Light at the End of the Tunnel: An Artist's Book with a View"

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Abstract

Referencing masterworks from art historical sources is a time-honored process of color discovery for both the student and the mature artist. More compelling, for the student, is to recognize a parallel with art history and the cultural and social differences and similarities with our present-day moment. To explore this, for color study, I developed a project entitled, "Light at the End of the Tunnel." My slide presentation will outline the technical, conceptual and optical wonderment of this project as well as the students' studio practice and the projects evolution. Using basic principles of optical mixing and the study of the iconic works of artists like George Seurat (1859-1891) and Chuck Close (b.1940), students were also introduced to the Victorian amusement know as the "perspective theater." This tabletop device constructed in layers of cardboard demonstrated scenes of remarkable depth when viewed from a fixed vantage point. This structure became the prototype for the tunnel book construction used in this color project. To enhance the novelty and conceptual complexity of this exercise, the historic green space in downtown Atlanta known as "Piedmont Park" was the setting for our project. Seurat 's Neo- Impressionist masterwork *A Sunday Afternoon on the Island of La Grande Jatte* (1884) was used as a departure point for compositional analysis and color examination. Like Seurat's social commentary on Parisian society, students worked to capture the present moment using this public park to focus on the people and their activities in this popular urban setting. An analysis of local color was revealed in a variety of ways: as seasonal color, light and atmospheric perspective and a flair for observing people and their interconnectedness to the park as a place for recreation and rendezvous' …both real and imagined.

Referencing masterworks from art historical sources is a time-honored process of discovery for both the student and the mature artist. More compelling, for the student, is to recognize a parallel with art history and the cultural and social differences and similarities with our present-day moment. Developing an assignment in my *Color Theory and Application* course that would engage the senses, embrace cultural and social reference points in art history and open a vista of opportunity for students to understand color principles is the focal topic of this slide presentation.

Color Theory and Application is the second of three required design courses in the freshman core program of the Foundation Studies Department of SCAD Atlanta (Savannah College of Art and Design). The course is a ten-week intensive experience that examines color theory principles and emphasizes research, observation and analytical skills. The course has specific goals and objectives to prepare each student for using color and of its relevance to every major area of concentration at the college. While teaching in the Foundation Studies Department, SCAD Professors work with the broadest cross- section of the student body, where students major in a wide selection of disciplines in all areas of the fine and applied arts and design.

Of the four campuses of Savannah College of Art and Design, I teach at the campus located in Midtown Atlanta where, situated in close proximity to the college, there is a very large public green space nearby called Piedmont Park. This 211-acre urban park, known as *Atlanta's Common Ground,* has a rich history since its development in the early 1880's. The park is continuously evolving to suit the needs of the growing metropolis of Atlanta. There is a dedicated, environmentally thoughtful conservation effort that insures an ecologically sound future of the park so that it will continue to be a viable part of the urban fabric of the city for generations to come. Piedmont Park has evolved from a forest to a farm to a fairground to an extraordinary urban public park that is visited by scores of people all year long. The concerts, festivals, sporting and civic events coexist with families on a holiday picnic, a dog park, a Botanical Garden, a lake, countless joggers, bicyclists, birdwatchers and just about every other form of social recreation is enjoyed on the park grounds.

Assigning field trips to augment each course at SCAD is part of the curriculum and I was eager to fulfilled this course requirement and, at the same time, use the resources of the city as a meaningful teaching tool. I had been interested in developing assignments that would engage a variety of color theory topics and would also introduce important Atlanta landmarks, like Piedmont Park, to the students since many are newcomers to the city. In addition, I wanted to develop a creative approach to the introduction of the historical principles of optical color mixing, an approach that would engage the students beyond the confines of the classroom setting-- beyond the typical museum visit and beyond the gallery lecture. The idea of utilizing Piedmont Park as the outdoor classroom was the perfect marriage for all the elements needed for the scope and complexity of this project.

Piedmont Park is an idyllic space for the observation of color and light in the open atmosphere and to study local and seasonal color change. Importantly, the park was the perfect backdrop to stage a recreation of the most pivotal art historical work for the understanding of optical color mixing: the 1884 masterwork *A Sunday Afternoon on the Island of La Grande Jatte* by Georges Seurat (1859-1891). Piedmont Park had all the right essentials to recast the story line of the Seurat painting. To create a comparison of visual reference points and the socio-political and cultural history of the *La Grande Jatte* with Piedmont Park could all be had within a few hours of engagement and a short walk from the SCAD Atlanta campus. However, it is the people watching, one of the most prominent spectator sports one can engage in at the park, that was the most vital connection to the *La Grande Jatte.* Students were asked to develop a new narrative reconstructed in time and place by observing the rituals of self-presentation, the perceived mixing of classes, the look of the fashion and how urban and suburban cultures engaged in leisure activities.

Additional resources for the study of the basic principles of optical mixing included examples from art history such as the paintings of the contemporary artist Chuck Close (b.1940) and examples of textiles like Kente Cloth were introduced. However, the project focused on the iconic Post Impressionist work of Seurat. Emphasizing the compositional strategy in the Seurat painting, the stylizing of the figures, their placement in space and the symbolic rituals of leisure revealed a backstory of the social organization of Parisian society and how modern Paris was growing up around the Isle of La Grande Jatte. As the project began, students studied and documented Piedmont Park, with an emphasis on observing its *local color* and the pedestrian activity in order to recreate a parallel universe in the present moment. Students were to scrutinize the Seurat composition and study all the elements of the work, including the background for a hint of the encroaching industry as an environmental

summary of Paris in the late 1800's. The goal was to compare and contrast the promenade of Parisian society with the cultural mix of people in Piedmont Park today. An analysis of theplacement of the figures in the foreground and middle ground and the apparent display of detachment and artifice in the stiff postures of the people in the painting was essential in the process of creating a visual interpretation.

The project developed in several stages and students worked in situ at the park and then proceeded to transfer their ideas into the finished artist book. Each student developed a photographic diary and sketches of Piedmont Park. The next phase of the project was to construct the artist book using a format known as a tunnel structure. Students created a maquette of a tunnel book structure that would serve as the proto type of a viewing stage for all the elements of the project when finished. (Figure 2). To study artist books and book structures for this project, the Special Collection of Artist's Books at the SCAD Library was an invaluable resource. Students were able to explore the collection and have a hands-on experience with various examples of contemporary books that used a tunnel design. The structure for our tunnel book was constructed in layers of cutout cardboard which, when viewed though a frame from a fixed vantage point created a perspectival scene of remarkable depth. The structure of our artist book was also modeled after the historical Victorian amusements known as the perspective theater. This was a tabletop structure that originated as far back as the 1600's with the development of the paper toy known as the peep show. There is a rich history of tabletop perspective theaters, the evolution of which lead to the genre of paper toy panoramas. Several replicas of these paper toy perspective theaters were examined in the classroom for further study and became the model our tunnel book construction used in this color theory project.

Once the major influences of the Paris landmark were decided on, students had a great bit of latitude to develop real or imagined scenarios as the creative centerpiece of their work. The designs then focused on the rudiments of optical color mixing techniques and a review of the theories of color science and light of the Neo Impressionist era. Students could choose to resolve the optical color mixing in paint or as a digital solution. The dots and dashes and very small strokes color application was emphasized and there was discussion and demonstration of how small adjacent dots of pigment could appear more alive than traditional mixtures. Importantly, the small dabs of paint would blend in the eye for intense luminosity when viewed up close or further back where the dots visually interact giving the illusion of a spatial and atmospheric effect. To examine how every dot is a rich stroke of color and to interpret the color blending without using black pigment was emphasized. Students who worked toward a digital solution combined their efforts to discuss a strategy for the technical interpretation of the different effects and possibilities of optical mixing using the Photoshop program and this approach was no less challenging.

When all the parts were assembled into the tunnel structure and the segments of the scene were placed in the environment of the stage the artwork achieved the intended look and illusion. (Figure 1 and 3) The conceptual and optical wonderment of the project was revealed, especially when viewed from a fixed vantage point. The distilled forms, the optical color mixing and the students' flair for observing people and their interconnectedness to the park was a compelling comment on recreation and rendezvous'….both real and imagined.

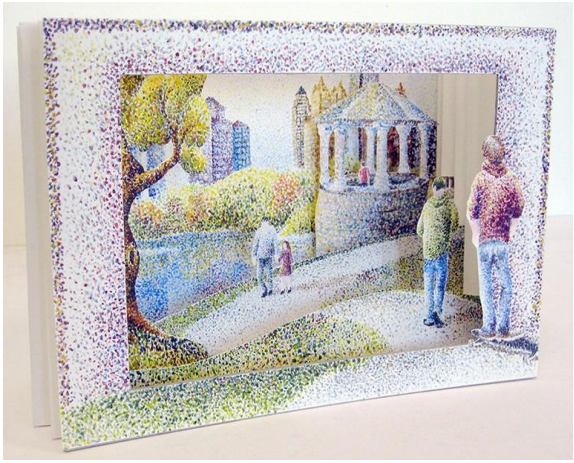

Figure 1. Adam Lindenaw, SCAD Atlanta, 'Tunnel Book: Optical Color Mixing" 10 x 12 x 12"

Figure 2. Monica Phillips, SCAD Atlanta, photographic maquette for Tunnel Book. 10 x 12 x 10"

Figure 3. Sae Byull, SCAD Atlanta "Tunnel Book: Optical Color Mixing" 10 x 12 x 12"

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Colores Históricos y Colores Nuevos en la Construcción de Identidad: La Gente Elije.

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Introducción

Proyecto "Recuperación de Fachadas de calle Estado-Rancagua"

El Ministerio de la Vivienda y Urbanismo del Gobierno de Chile, impulsó el año 2013 un "Plan Piloto Recuperación de Fachadas" para barrios o zonas de ciudades con alto deterioro del espacio público. La Municipalidad de la ciudad de Rancagua acudió a este llamado, presentando un proyecto para la recuperación de las fachadas de 65 propiedades en la calle Estado, con valor patrimonial o paisajístico. Las construcciones presentaban descuido y deterioro por falta de mantención y abundante contaminación visual, de rayados y señalizaciones inadecuados para un eje urbano tan relevante en la historia de Chile. El proyecto que aquí se presenta, se circunscribe al diseño cromático de las fachadas a intervenir, el que incluye todos los elementos arquitectónicos anteriormente mencionados.

Antecedentes Históricos

El origen de la calle Estado

Don José Manso de Velasco fundó la ciudad de Rancagua en el valle central de Chile, el 5 de octubre de 1743, sobre terrenos cedidos por la iglesia católica y por indígenas. El trazado de la ciudad, en forma de damero (tablero de ajedrez), es un ejemplo típico del patrón urbanizador español en América. El damero fundacional de Rancagua consiste en 8 manzanas por lado (64 en total) con una plaza central, más dos calles que la atraviesan por su centro, generando la plaza en cruz, su principal característica. El centro y principalmente una de estas calles, originalmente llamada Camino del Rey (hoy calle Estado), fue escenario, tres siglos después (1814), de una de las batallas más importantes de la historia de la independencia del país, la batalla de Rancagua, en 1824 se juró la Constitución Política y en 1825, Cabildo y pronunciamiento a favor del Director Supremo, don Ramón Freire.

En la época actual la calle Estado fue declarada Zona Típica por el Consejo de Monumentos Nacionales, debido a su relevancia urbana e histórica. Además, la calle cuenta con una serie de edificios declarados Monumento Nacional, como son la Iglesia de la Merced, Zona de Conservación Histórica, la Plaza de Los Héroes, la Gobernación es Monumento Histórico, Casa del pilar de esquina que es Museo Histórico y la casa de la Cultura, son Monumento Histórico,

Desde hace un tiempo, la calle se hizo peatonal, adquiriendo una agradable escala humana para su recorrido la contemplación de los principales construcciones patrimoniales de adobe de mediados del siglo XVIII que han sobrevivido terremotos y la invasión inmobiliaria y comercial. Actualmente en el eje Estado conviven habitantes que residen en viviendas y edificios con construcciones destinadas al comercio y servicios.

Zonificación EH / Plan Regulador:

El Plan Regulador Comunal vigente otorga a la Calle Del Estado un carácter especial dada su connotación arquitectónica y de gran contenido patrimonial, designándola Zonificación EH para resguardar sus edificios patrimoniales y zonas típicas, destinando además, una serie de definiciones de carácter de diseño arquitectónico para nuevas edificaciones ubicadas en este eje. En la siguiente imagen se indican la ubicación de la calle, con los edificios declarados Monumento Histórico, de Carácter Ambiental y de Interés Arquitectónico según lo indicado en el Plano Regulador Comunal de Rancagua vigente (Figura 1).

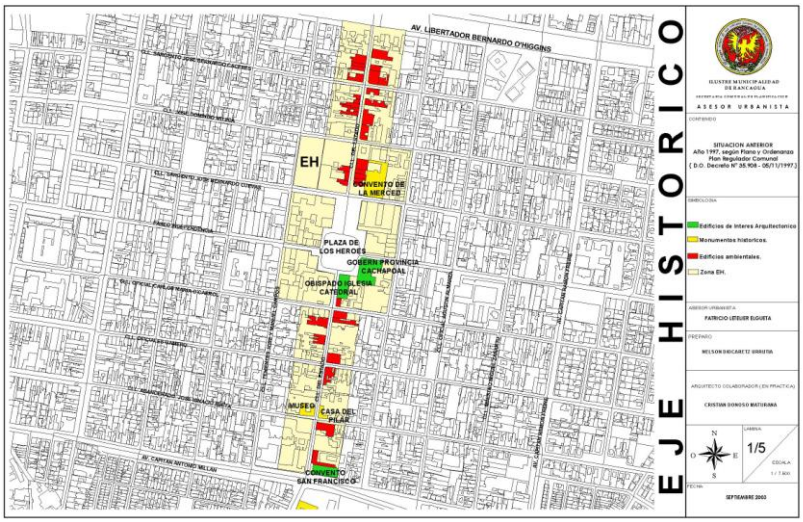

Figura 1. Situación actual de las edificaciones localizadas en el Eje Estado (fuente: Ilustre Municipalidad de Rancagua).

El color: de los principales materiales y colores de las casas y edificios durante la colonia y los primeros años de la República en Chile, en Santiago y ciudades del valle central.

La construcción de los edificios y casas fue la fusión de un estilo traído principalmente de España, y de la forma vernácula de los antiguos habitantes indígenas del territorio, la que dio por resultado construcciones de adobe y cal, con estilos que privilegiaron el uso del ladrillo, arcilla y cerámica vidriada entre otros materiales. Este estilo de construcción, conocido popularmente como "colonial" se masificó por toda América, y en el caso de Chile, se desarrolló de preferencia en la zona central. A partir del periodo republicano, llegó el neo clasismo ítalo-español de la mano del arquitecto italiano Joaquín Toesca, quien arribó a Chile en 1780 a construir las viviendas y principales edificios de la clase acomodada chilena. La arquitectura colonial en Rancagua, al igual que en Santiago, tuvo como principales materiales de construcción el adobe, la cal y el ladrillo, siendo estos elementos los que configurarían el

escenario en el que se desarrollaría la vida en las villas y urbes de la época. A continuación un listado con los principales colores y tonos de las fachadas de las viviendas durante la época colonial y los inicios de la República.

Tierra. Si bien las casas de la época fueron en su mayoría teñidas con cal, muchas de ellas mantuvieron el color que la propia tierra otorgaba. Llamaba la atención a los viajeros el adobe: "La mezcla que se utilizaba para unirlos no era más que un polvillo del cual se hacia un barro claro untuoso, de color rojizo, que se encontraba en las cercanías del lugar" (Feliú, 2001:56).

Blanco. El blanco es el principal color de las fachadas de la época, el que se obtenía mediante el proceso de blanqueamiento que otorgaba la piedra caliza sometida a calor y pulverizada sobre el adobe (Figura 2).

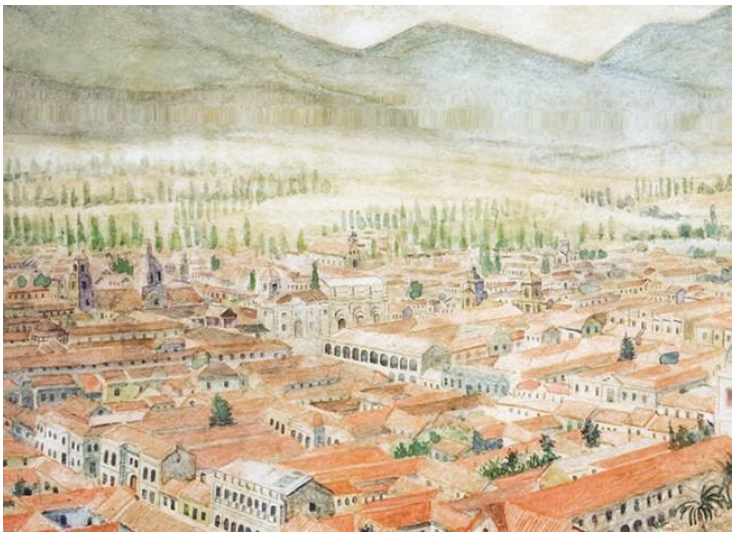

Figura 2. Detalle de "Vista de Santiago desde el Santa Lucía", de T. R. Harvey, Santiago, 1860 (fuente: "Santiago de Chile, Catorce mil años" Santiago, Bicentenario, 2010)

Rojo. El color rojo fue utilizado en importantes edificios coloniales como "La casa colorada" de 1770 (Figura 3) y para la fachada principal de "La casa de los diez", en Santiago. Es posible que este pigmento se haya obtenido de las minas de amarillo ocre de España, de minas de la actual región de Coquimbo, en Chile, o incluso también importado desde Brasil. Para la obtención de este color el mineral es sometido a altas temperaturas, proceso mediante el cual el mineral pierde agua y se convierte en óxido de fierro rojo.

Figura 3. Vista actual de la Casa Colorada, Santiago, 2010 (fuente: http://www.otromundoesposible.net/ciudades-de-latinoamerica/santiago-de-chile)

El color rojo no sólo fue utilizado para fachadas. Los techos de tejas daban el color rojizo característico a la zona central. Según el padre Guarda, "los colores que predominaron en las villas y ciudades era el blanco de sus fachadas y el rojo de sus techos que contrastaban con el azul del cielo" (Guarda, 1978).

Rosa. Principalmente por medio de la observación de material gráfico, fue posible observar el tono rosa en fachadas, como en la obra de Alberto Orrego Luco de 1890 o la obra anónima de 1880 se observan la catedral, el palacio arzobispal y plaza de armas, todas ellas en tonos rosas y amarillos (Figura 4).

Figura 4. A la derecha, "Catedral, Palacio Arzobispal y Plaza de Armas" de autor anónimo, 1880. A la izquierda, detalle de la "Alameda de las delicias", de Alberto Orrego Luco, 1890. En ambas imágenes se observan construcciones de tonalidad rosa (fuente: "Santiago de Chile, Catorce mil años" Santiago, Bicentenario, 2010)

Azul y celeste. El azul, presente en obras de la época, resalta principalmente en detalles de ventanas, puertas, algunas fachadas de viviendas de la ciudad de Santiago y techos de iglesias. En la obra "Vista del cerro Santa Lucía", se observa el azul en la cúpula de la iglesia y el zócalo de la vivienda, mientras que en la obra anónima de 1875, "El Mapocho y los Tajamares", se observa el azul en las fachadas. Por otra parte, la obra de Oskar Trepte muestra como el azul sigue vigente el siglo XX, en los portones de un local comercial. El celeste, como variedad del azul en mezcla con la cal, fue un color bastante utilizado a juzgar por las pinturas de la época, así como el blanco, celeste, azul, rojo y amarillo, como puede apreciarse en la pintura de los tajamares.

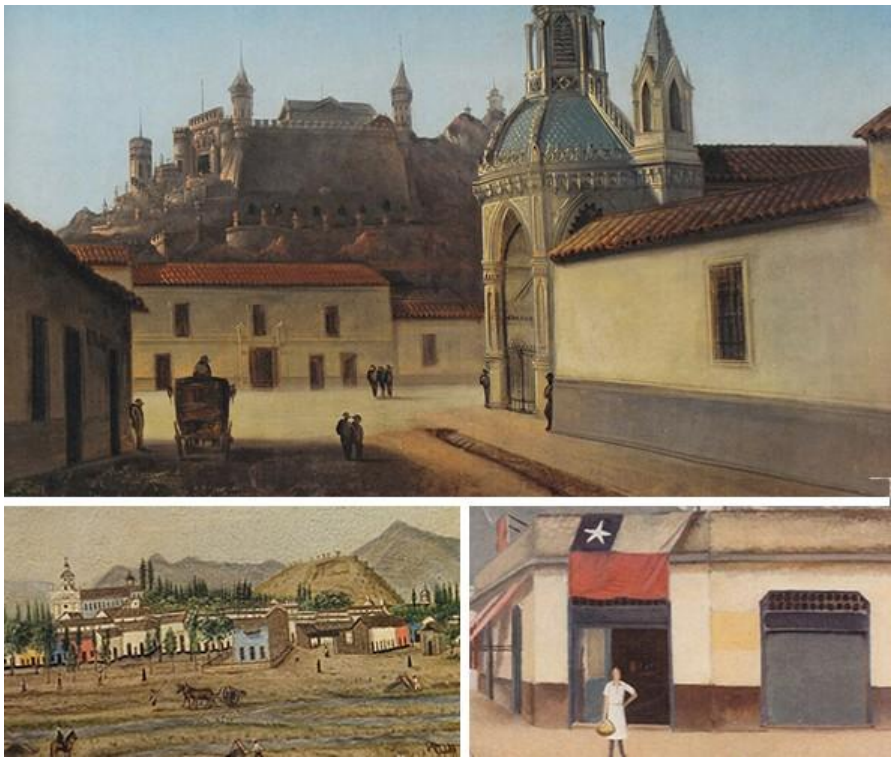

Figura 5. Tres instantes de la historia donde está presente el azul, durante la colonia y la época moderna. Arriba, detalle de "Vista del cerro Santa Lucia desde la calle Carmen", de 1880. Abajo a la izquierda, detalle de "El río Mapocho y los tajamares", de 1875 y a la derecha, "Dieciocho de septiembre", de 1956 (fuente: "Santiago de Chile, Catorce mil años" Santiago, Bicentenario, 2010)

Amarillo. Este color, que predomina en las fachadas de fines del siglo XIX y principios del XX, queda en evidencia en la pintura "Estación de Pirque", de autor anónimo. La pintura de Pedro Subercaseaux sobre la batalla de Rancagua, hace aparecer el amarillo en un primer plano, color ya popular también en casas de estilo colonial (Figura 6). Así también en la obra anónima de 1880, en la cual destaca el Palacio de la Gobernación en la Plaza de Armas de Santiago (Figura 4).

Figura 6. Pinturas donde se evidencian fachadas de color amarillo en dos épocas, la colonial y la neoclásica. A la derecha, "Batalla de Rancagua", de Pedro Subercaseaux. A la izquierda, Autor anónimo, "Estación de Pirque", Santiago, de autor desconocido, hacia 1908 (fuente: "Santiago de Chile, Catorce mil años", Santiago, Bicentenario, 2010)

Colores del damero fundacional de Rancagua en la época actual

Tomando como base las 64 manzanas del centro histórico de la ciudad de Rancagua, se realizó un estudio cromático de todas las fachadas de las de esta área, en base a relevamiento cromático con la cartilla "Millenium" de la empresa de pinturas Ceresita. El trabajo estuvo a cargo del Taller de V año de la Escuela de Arquitectura de la Universidad Austral de Chile, realizado a comienzos del 2012. Como resultado se obtuvo un código por cada fachada, los que luego se ordenaron por categorías y porcentaje de utilización (entre 2,8% y 8,1%, ver Figura 7).

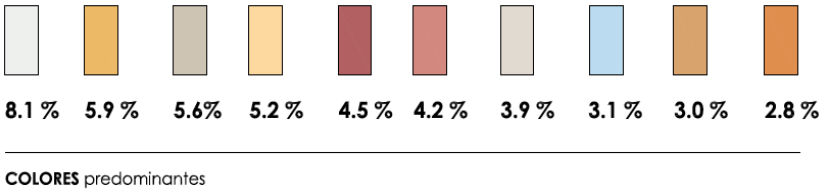

Figura 7. Porcentaje de colores predominantes en el damero fundacional de Rancagua, 2012 (fuente: Instituto de Arquitectura y Urbanismo, Universidad Austral de Chile).

Los colores se ordenaron en un esquema de importancia, con los colores más utilizados, según la superficie que ocupan en cada manzana. A simple vista se pueden reconocer algunos de los colores históricos usados durante la colonia y principios del siglo XX, que aún se conservan, que son el blanco, rojo colonial, amarillo, celeste y azul (Figura 8).

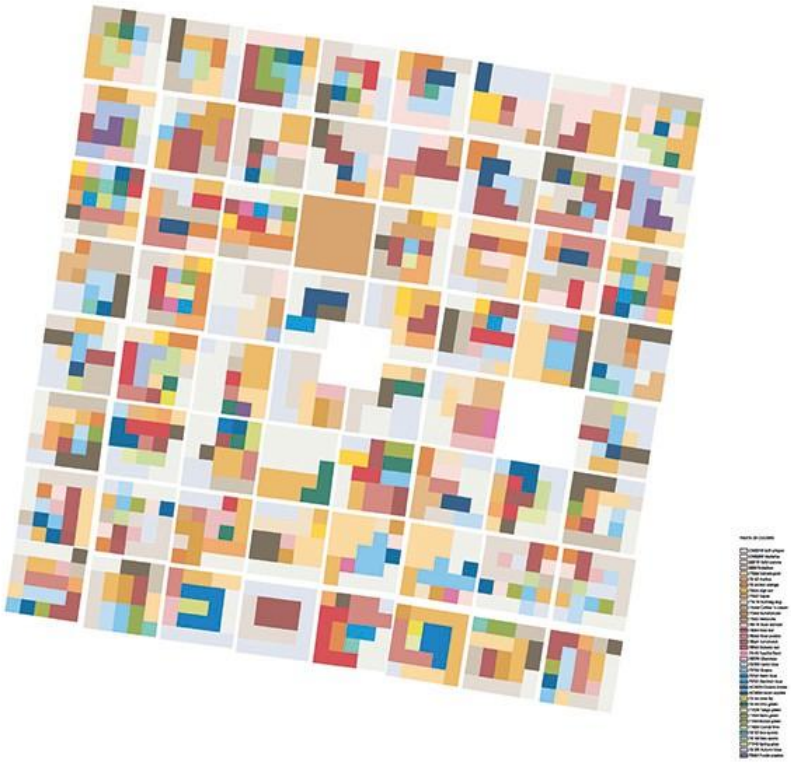

Figura 8. Esquema de colores predominantes en el damero fundacional, 2012 (fuente: Instituto de Arquitectura y Urbanismo, Universidad Austral de Chile).

Metodología

Se realizó una investigación bibliográfica para identificar los colores utilizados en las fachadas de las construcciones en el periodo a partir de la colonización hasta el neoclásico, principios del siglo XX, en Santiago y Rancagua. Esta investigación histórica tuvo que apoyarse fuertemente en observación de pinturas de la época, debido a que se encontró poco material escrito que se refiriera explícitamente al uso de colores. También se utilizó como fuente el estudio realizado el año 2012 por el Taller de V año de la Escuela de Arquitectura de la Universidad Austral de Chile, en que se relevó cromáticamente las fachadas del centro histórico de la ciudad, correspondiente a las 64 manzanas fundacionales, realizando luego una síntesis de colores, ordenándolos en cuanto a su porcentaje de presencia.

Se realizaron varias visitas al lugar, tomando fotografías de cada una de las casas del eje histórico, cuyos colores de fachadas fueron ordenados y categorizados por importancia en cuanto a cantidad de veces que se repetían. Paralelamente se identificaron aquellos colores utilizados para los elementos, como ventanas, puertas y rejas y determinando sus combinaciones con los colores de las fachadas. Finalmente se cruzó el estudio de colores actuales con la investigación histórica para el diseño de la paleta y las combinaciones posibles a utilizar, la que fue consultada y luego validada mediante participación ciudadana, en reunión ampliada con los propietarios y arrendatarios de las propiedades. Se creó el diseño

cromático de cada casa, en base a la cartilla de colores “Millenium” de la empresa Ceresita, tomando en cuenta aspectos históricos, espaciales y las preferencias de sus habitantes.

Resultados

El estudio de lo existente

A partir de la investigación histórica de los colores en tiempos pasados y del estudio de los colores existentes hoy en día, se hizo un cruce de información con la finalidad de determinar si había colores que habían permanecido en el tiempo y si había colores nuevos. Se realizó un catastro fotográfico de todas las fachadas del eje histórico a intervenir, buscando ejemplos de colores históricos y realizando un relevamiento cromático de ellos.

El color blanco. Está representado principalmente en la Iglesia de La Merced, Monumento Nacional, dos instituciones de educación dependientes de la iglesia, en dos museos históricos y en las fachadas de varias casas (Figura 8).

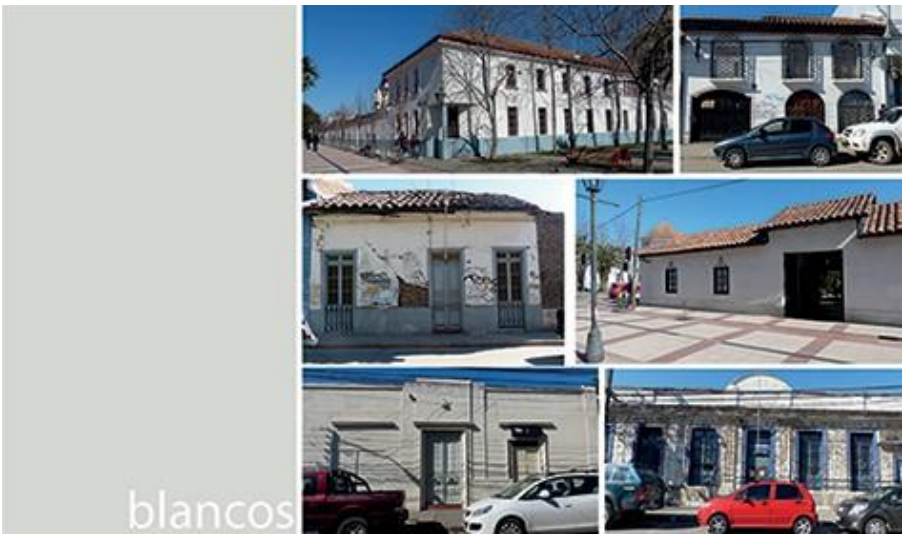

Figura 8. Fachadas de color blanco en el centro de Rancagua, 2013 (fuente: el autor)

El color rojo. Típico de la era colonial, tiene gran presencia y marca un hito en el comienzo del eje histórico, ya que la Iglesia de San Francisco está pintada de este color. También es roja del obispado, junto a la iglesia en la Plaza de Armas, así como varias casas más en los alrededores (figura 9).

El color amarillo. Se encuentra en Rancagua hoy en día un uso disímil de este color. Por una parte adhiere a formas arquitectónicas clásicas y de autoridad, como es en el edificio de la Gobernación, luego se corporiza en un edificio de departamentos y finalmente, toma un

acento tropical al combinarse con tonos cálidos como el naranja y el rojo, en casas más pequeñas (figura 10).

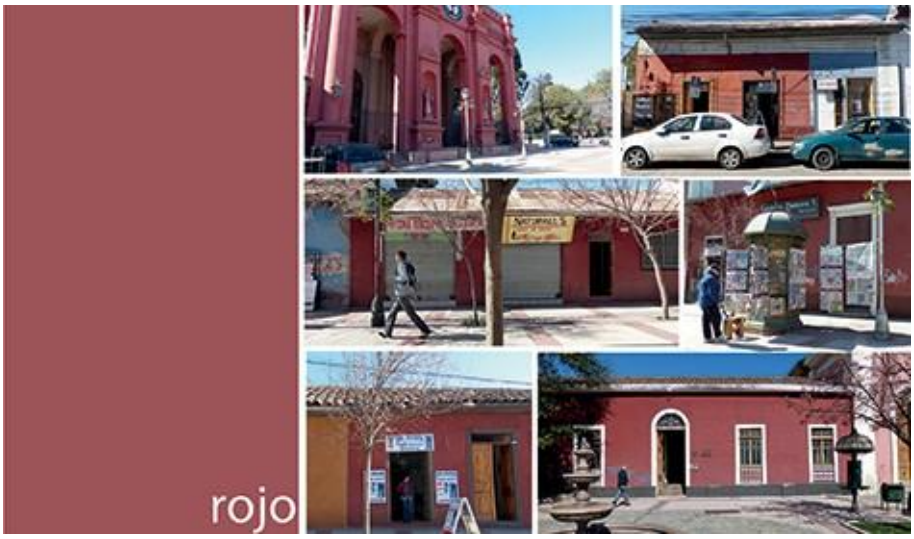

Figura 9. Usos del rojo "colonial" en el centro de Rancagua, 2013 (fuente: el autor)

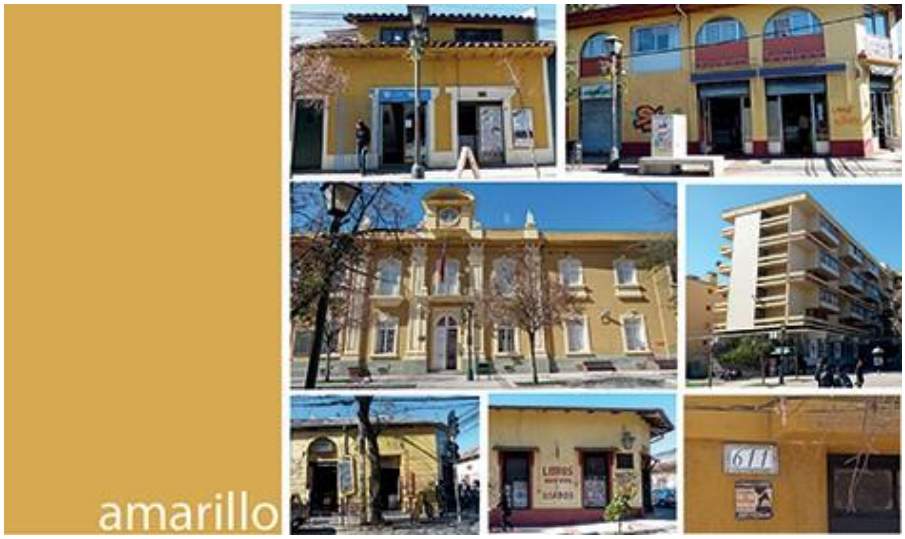

Figura 10. Uso de color amarillo tanto en edificios clásicos y en departamentos, como en pequeñas casas, con un acento más tropical, 2013 (fuente: el autor)

El color celeste. Herencia del siglo pasado, está aún presente en muchas fachadas del centro, preferentemente en casas (figura 11), color que puede encontrarse por lo demás en todo Chile ya que es muy cotizado especialmente en sectores populares.

Figura 11. Color celeste, muy utilizado para vivienda, 2013 (fuente: el autor)

El color rosado. También un color clásico, éste encuentra su máximo exponente en Rancagua en la hermosa Catedral de la Matriz, construida en 1890, en plena Plaza de Armas (Figura 12). Algunas variaciones de este color se encuentran en pequeñas casas y algo más cálido, en un edificio educacional de 3 pisos.

Figura 12. El color rosado en su máxima expresión: la Catedral, 2013 (fuente: el autor). El color naranja.

Un color nuevo, que no aparece en los registros históricos tempranos, es el color naranja. Apareció en algún momento de la historia, seguramente producto de la mezcla del rojo colonial y el amarillo, y tuvo en Rancagua un lugar donde expresarse. Sin embargo, a pesar de la calidez y alegría que tiene este color, tiene sus límites: no es utilizado en edificios públicos, educacionales, ni religiosos, solamente en viviendas o en locales comerciales (figura 13).

Figura 13. Naranja, utilizado principalmente en vivienda, 2013 (fuente: el autor)

Otros colores. Otro color utilizado es el *verde*. Hubo dos viviendas de este color, una verde turquesa y otra verde musgo, pero no fue bien recibido por los propietarios. Por otra parte, el verde muy oscuro está presente en las puertas de algunas casas, en rejas de ventanas y los portones de uno de los museos. El *azul* también está presente, en una tonalidad ultramar oscura, pero no en fachadas completas, sino en elementos como puertas, marcos de ventanas y zócalos, en combinación con blanco.

Los zócalos y los contrastes. Una característica importante de muchas casas en la calle, es la tradición de pintar el *zócalo* de la casa de un color diferente a la fachada, que puede ser el mismo color base en una tonalidad más oscura, más clara, o definitivamente otro color. Incluso, aquellas casas que no tienen el zócalo materialmente diferenciado, lo delimitan por una diferencia cromática (Figura 14). Otro elemento destacado de la calle en general, y reconocido por los propietarios e incluso por el alcalde de la ciudad, es el *contraste* cromático que existe entre una y otra casa o entre la casas y sus elementos, sin temor a combinaciones vibrantes o chocante, dándole a la calle un aspecto vital y muy peculiar.

La creación de la paleta cromática, la normativa y las preguntas sobre lo patrimonial

El proyecto cromático contemplaba no sólo el diseño puntual de los colores de la calle, sino que además, la creación de una normativa que regulará a futuro cualquier renovación de fachada. Por otra parte, la nueva paleta debía incorporar de alguna manera la historia heroica de la calle, representada a través de los colores utilizados desde la época colonial. Pero tampoco podíamos quedar ciegos a la realidad actual.

La complejidad de elaborar el diseño cromático de un sector de una ciudad de peso histórico como lo es Rancagua, fue un enorme desafío cuyo principal reto fue cómo conciliar lo histórico y patrimonial, con lo contemporáneo. ¿Qué es finalmente patrimonial?

¿no es todo aquella manifestación propia de un pueblo, aunque sea actual? Y en ese sentido

¿se debe reglamentar los colores en una calle, evitando que lo propio siga evolucionando?

¿no es esto transformar la calle en un museo, congelarla en una especie de fotografía que no es real? Estas preguntas estuvieron presentes en todo momento durante el desarrollo de este proyecto, y tiñeron su evolución hasta el final, en que esperamos puedan ser respondidas.

Figura 14. Zócalos destacados de la fachada a través de una diferencia de color o materialidad, que es contrastada, 2013 (fuente: el autor)

Se decidió usar todos los colores que nos han llegado desde La Colonia hasta principios del siglo XX, salvo el color tierra, que hoy no tiene vigencia. Estos colores son el blanco, rojo colonial, rosado, celeste, amarillo y azul. Para esto se realizó un relevamiento cromático de muestras de trozos de pinturas recogidos en las paredes y relevamiento in situ. Esta paleta debía ser complementada con colores utilizados hoy en día, por lo que se añadió el naranja y el gris. Sin embargo, la utilización de estos colores debería ser diferenciada entre aquellos colores para fachada, como el blanco, rojo, amarillo, rosado, celeste y naranjo y aquellos sólo para zócalos y elementos, como el gris y el azul (Figura 15).

La normativa recomendó colores según sus nombres (por ejemplo blanco, rojo colonial, celeste, etc…) pero en vista de que una normativa no debe tener recomendaciones a empresas específicas, los códigos de la carta Millenium de la empresa de pinturas Ceresita que se nombraron, sólo fueron dados como referencia.

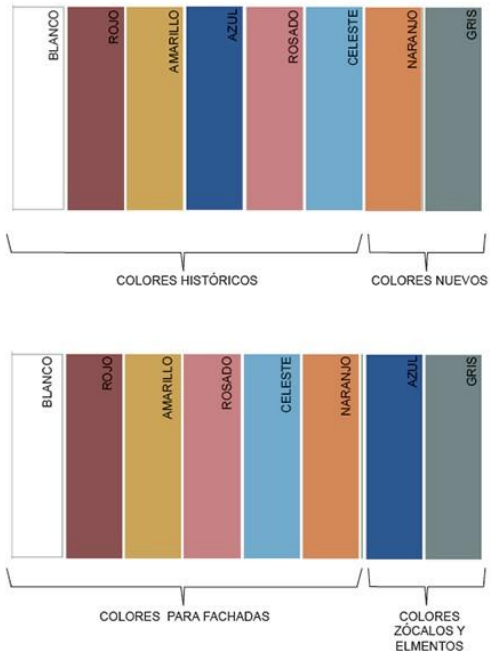

Figura 15. Paleta de colores históricos y nuevos (arriba) y ordenados por función, para fachadas y zócalos (abajo) (fuente: el autor).

Teniendo a la vista que en el tiempo, los propietarios irían renovando sus colores según la normativa, la paleta no podía ser demasiado compleja de utilizar, por lo que se diseñó una tabla de posibles combinaciones (Figura 16).

	FACHADA	ZÓCALO/MOLDURAS
1	BLANCO	BLANCO
2	BLANCO	ROJO
3	BLANCO	AMARILLO
4	BLANCO	CELESTE
5	BLANCO	ROSADO
6	BLANCO	NARANJO
8	BLANCO	AZUL
10	BLANCO	GRIS
11	ROJO	ROJO
12	ROJO	BLANCO
13	ROJO	AMARILLO
14	ROJO	NARANJO
15	ROJO	GRIS
16	AMARILLO	AMARILLO
17	AMARILLO	BLANCO
18	AMARILLO	ROJO
19	AMARILLO	NARANJO
20	AMARILLO	GRIS
21	NARANJO	NARANJO
22	NARANJO	BLANCO
23	NARANJO	ROJO
24	NARANJO	AMARILLO
25	NARANJO	GRIS
26	ROSADO	ROSADO
27	ROSADO	BLANCO
28	ROSADO	ROJO
29	ROSADO	GRIS
30	CELESTE	CELESTE
31	CELESTE	BLANCO
32	CELESTE	GRIS

Figura 16. Tabla elaborada en Excel con posibles combinaciones para fachadas y zócalos, diseñada en base a la tradición, costumbres y armonías (fuente: el autor).

El diseño de cada casa, de la calle y sus problemas

Una vez determinada la paleta de colores y la tabla de combinaciones, se le entregó a cada propietario y arrendatario la posibilidad de elegir los colores de su casa o local comercial en el marco de una reunión ciudadana. Muchos de ellos lo hicieron pero otros decidieron dejar la elección en manos de la experta. Teniendo en mano las construcciones existentes que no eran parte del proyecto y por lo tanto no se iban a intervenir, más los colores elegidos por cada propietario, se pintó a mano con lápices cada una de las casas en un plano de papel. Una vez terminado esto, se completaron los colores de aquellas casas cuyos propietarios no eligieron, bajo el criterio de armonizar los colores de cada casa en sí misma, en relación con su vecina, la del frente, las de la cuadra y finalmente la calle.

Un problema que surgió y que no se visualizó en un principio, fue la coincidencia de colores en dos o tres casas seguidas, lo que se solucionó pidiendo a los vecinos un cambio de color. En este proceso se descubrió que varios vecinos no sabían qué color habían elegido, pues aunque lo nombraban correctamente, lo asociaban a otra tonalidad. Esto reveló que la suposición de que todas las personas dominaban un lenguaje básico de color, no era verdadera.

La presentación en imágenes y la normativa

Se elaboró una carpeta con cada una de las casas, sus especificaciones técnicas de color, con una vista general de la calle, la palta de colores, la tabla de combinaciones e indicaciones generales y un esquema de colores desplegable elaborado en base al boceto a lápiz, traspasado a Autocad (Figura 17). También se incluyó el borrador de la futura normativa, la cual se encuentra hoy en día en proceso de aprobación en la Municipalidad de Rancagua.

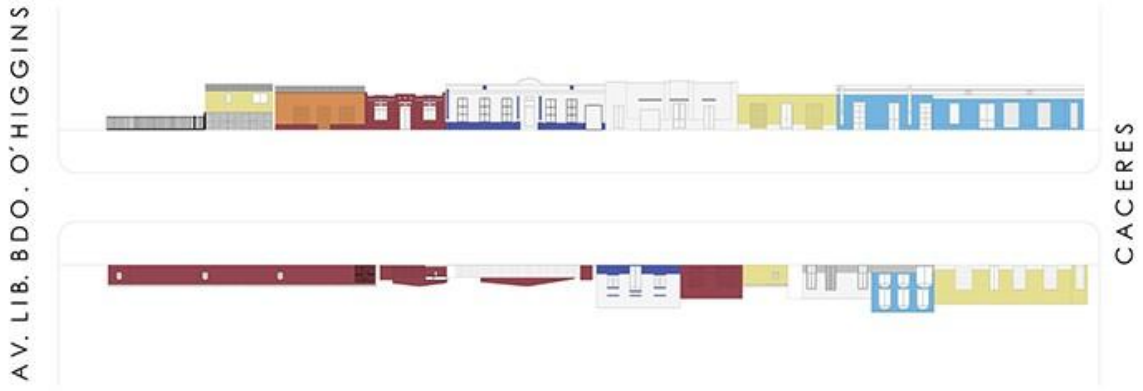

Figura 17. Vista de un tramo de la calle en la planimetría final coloreada, armonizando lo existente con los nuevos colores (fuente: el autor).

Paralelamente se realizaron dos perspectivas en que se realzó el cambio positivo de la calle a través del cambio de color y la limpieza visual de carteles y cables, en un antes-después, las que fueron usadas en actividades de socialización del proyecto (Figura 18 y 19).

Los colores in situ, la gente se toma su libertad

Una vez terminado el diseño de color, la oficina de arquitectura a cargo del proyecto procedió a la ejecución del mismo. Sin embargo, la oficina en un acto de improvisación dio a los propietarios la posibilidad de elegir tonalidades de cada uno de los colores de la paleta, lo que en algunos casos produjo interpretaciones y desviaciones importantes de la paleta original. Hasta el momento del cierre de redacción de este trabajo, la pintura aún no ha sido completada, pero se presentarán aquí algunos ejemplos de la interpretación mencionada (Figuras 20, 21 y 22).

Figura 18. Perspectiva de la calle Estado, en un antes y después de realizada la intervención cromática de las fachadas y limpieza visual (fuente: el autor).

Figura 19. Perspectiva de la calle Estado, en un antes y después del proyecto (fuente: el autor).

Figura 20. Ejemplo de dos matices que se desvían del color rojo colonial de la paleta original, a la izquierda es más claro y anaranjado y el de la derecha, más claro y rosado (fuente: Beatriz Valenzuela).

Figura 21. Ejemplo de una casa celeste en que el color utilizado interpreta bien el propuesto en la paleta original (fuente: Beatriz Valenzuela).

Figura 22. Vista de la calle con un conjunto de casas en celeste, rojo, naranja y amarillo, siendo el rojo el único color completamente desviado de la paleta original (fuente: Beatriz Valenzuela).

Conclusiones

El lenguaje del color ligado a una imagen, es un proceso cultural que se puede comparar con la lectura. Todos hablamos pero no todos sabemos leer. Se recomienda a futuros diseñadores de una imagen cromática urbana donde se incluya la participación ciudadana, una capacitación previa en cuanto a colores a quienes se vean involucrados, aunque esto en un primer momento parezca innecesario. Se necesita partir de un piso común para llegar a acuerdos válidos.

Los colores no son inocentes. Cada uno de ellos tiene una carga histórica y social, aparte de su presencia cromática, que hay que tomar en cuenta al momento de diseñar. Se vio en este estudio, que varios de los colores presentes en la calle Estado son un reflejo de una historia más amplia y antigua que la calle misma, son colores que culturalmente vienen viajando desde la capital y más allá, incluso desde Europa.

Pero también están los colores que se han adoptado recientemente, a partir de cartas de colores y pinturas disponibles en ferreterías y tiendas de pintura. Y las combinaciones de todos ellos son expresión propia de sus habitantes, patrimonio existente y latente.

A la pregunta inicial sobre si es pertinente crear una normativa que reduzca el uso libre de colores y la evolución de estos en el tiempo, no podemos dar una respuesta categórica. Probablemente en algunos casos y sectores de la ciudad sí, sobretodo aquellos turísticos, que apuestan económicamente a una imagen urbana.

Este proyecto, que partió pensado como una normativa estricta basada en códigos de colores, inesperadamente se abrió hacia una variedad de matices que si bien no responden en un cien por ciento a la norma, quedan ligados a ella a partir de los colores básicos. Esto permite que la normativa siga funcionando y que los vecinos tengan más libertad de elección. Esto responde a la pregunta inicial entonces. Este proyecto consiguió armonizar una orientación normada claramente con el espacio necesario para que sus protagonistas puedan seguir expresando su individualidad y construyendo su patrimonio.

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Multispectral Imaging System For Detection Of Small Vertebrate Fossils

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Abstract

Paleontology studies the evolution of life on Earth, ancient plants and animals, based on the fossil record. One of the main applications of fossils is dating sedimentary layers, which is nowadays made through the detection and posterior identification of tiny dental or skeletal remains of small mammals included in the sediment. Unfortunately, the process of separation of fossils from sediment is carried out only by hand and it is mainly based on morphological features, which leads to a remarkable waste of time and its subsequent economic impact. For this reason, this study proposes a new tool based on a multispectral system for the identification of fossil remains of small vertebrates based on the analysis of spectral characteristics. Specifically, a multispectral system with a CCD camera attached to a liquid crystal tunable filter was used in combination with daylight and ultraviolet light sources in order to discriminate the microfossils from the sediment. In this preliminary study, it is shown that the reflectance of bones and teeth is higher than the sediment, especially at wavelengths above 600nm. Moreover, a higher fluorescent emission of the paleontological remains is also observed around 550 nm. Therefore, these spectral differences can be successfully used by multispectral imaging systems to enhance the contrast between fossils and sediments, making easier their spatial detection and posterior separation.

Introduction

A large number of paleontological excavations are being carried out every year all over the world. The study of fossils sheds new light on how life was in the past. One of the key aspects in the analysis of fossils is dating sedimentary layers, which in most Cenozoic sediments is made through the taxonomic identification of dental or skeletal remains of small mammals. Such tiny fossils included in the sediment are crucial in order to later establish stratigraphic correlations and determine the age of geological layers with high accuracy (López Martínez 1992 [345:365]).

Unfortunately, the task of separation of fossils from sediment is currently done completely manually and according to external morphological criteria, which leads to a

waste of time with the subsequent significant economic impact. Moreover, a previous chemical treatment and/or a process of wet sieving with high-pressure water is also necessary to obtain a first separation of the fossils of bones and teeth from sand and gravel. The particles obtained with this technique are 2 mm in size approximately. Afterwards a trained specialist will further classify these particles with an exhaustive visual recognition process and the help of a binocular microscope (Daams 1988 [3:18]) (Figure 1).

The sieving system, which was developed in the mid-1950s by specialist paleontologists in microfossils, remains practically unchanged since its origin. Actually, it was inspired by the gold-seekers method used in United States in the 19th century. Only the incorporation of a variety of mesh sizes in the nets by the 1970s improved this technique, which allowed reducing the separation time of the material and diminishing its loss. The consequence of this methodological improvement was a considerable advance in the number of paleontological treatable sites, but it was not accompanied by a progress in detection techniques and physical separation of the small fossils (Daams 1988 [3:18]). Consequently, nowadays the visual recognition process and manual separation is still limiting the process because of the high amount of time and human resources needed.

a)

b)

Figure 1. a) Wet sieving process of paleontological samples using Freudenthal's technique. b) Visual recognition of teeth and bones using a binocular microscope.

In order to improve the former procedure, some preliminary attempts have been made using properties of fluorescence of fossils, which they exhibit when exposed to ultraviolet light (UV). In some cases this might help in distinguishing bones and teeth from other components like sand and gravel (Croft 2004 [795-800]). Nevertheless, this method cannot be used in a generalized form as properties of fluorescence depend on the type of fossils analyzed and there are also limits of light exposure linked to the conservation of paleontological remains.

On the other hand, there is a lack of information regarding the spectral features of different types of fossils and this opens new fields of research which might be useful to overcome some of the former limitations. One of the major difficulties that arise from this study is to accurately measure the spectral properties of samples to be analyzed as they are

below 2 mm in size and not uniform at all. Therefore, for this purpose the use of standard instrumentation is not very advisable.

In this context, multispectral imaging systems, which use a spectral sampling technique together with a digital imaging sensor, can provide a better insight in this matter. There are several spectral sampling techniques such as single point spectrometers with 2-D scanning systems (Bonifazzi 2008), digital cameras combined with line-scan spectrographs (Barbin 2012 [30-42]), color filter wheels (Vilaseca 2006 [4241-4253]), and tunable filters of liquid crystal or acousto-optic technology (Harderberg 2002 [2532], Tran 2005 [735-752]). Multispectral imaging is a rather new field of research with many applications such as remote sensing (Weng 2011 [610]), color imaging (Shresta 2011), biometrics and medicine (Everdell 2010, Bouchard 2009 [15670-15678], Vilaseca 2008 [5622-5630], Basiri 2010, Paquit 2009), cultural heritage and art work studies (Kubik 2007 [199-529], Padoan 2008 [25-30], Marengo 2011 [6609-6618], Herrera-Ramírez 2014 [3131-3141]). However, up to our knowledge it has not yet been used in paleontology.

For all these reasons the main objective of this project is to study the feasibility of using a new method based on the spectral features measured by means of a multispectral imaging system to separate paleontological remains from sediment. The multispectral system used in this study consists of a monochromatic CCD camera and a liquid crystal tunable filter (LCTF) that allows us to obtain a set of images of the microfossils through many spectral bands. This might help in decreasing the time needed and reducing the important economic impact that exists at present.

Method

Paleontological remains found in Abocador de Can Mata C5-D1 (Hostalets de Pierola, Barcelona - Catalonia, Spain) of 11.6 million years were analyzed in this study. These fossils are only a small representation of all those recovered after water-screening a total amount of about 10 tons of sediment.

As formerly mentioned, a multispectral imaging system comprising a 12 bit-depth monochromatic camera (QImaging QICAM Fast 1394) with a LCTF (Varispec filter model #VIS-07-HC-20-1012) was used to acquire spectral images of fossils (bones and teeth) and sediment (sand and gravel) under daylight (D65) (SpectraLight III overhead luminaire). The system allowed obtaining images in 33 different spectral bands (from 400 nm to 720 nm with a 10 nm-step). Each spectral image was obtained by calibrating the exposure time in order to optimize the dynamic range of the camera.

Samples including only microfossils (bones and teeth) or sand-gravel, which were firstly separated by a trained paleontologist, were captured. These individual samples were also characterized by means of a commercial spectrometer (Instrument Systems® Spectro 320 Scanning) with a telescopic optical probe for radiance and luminance measurements (Top100 accessory).

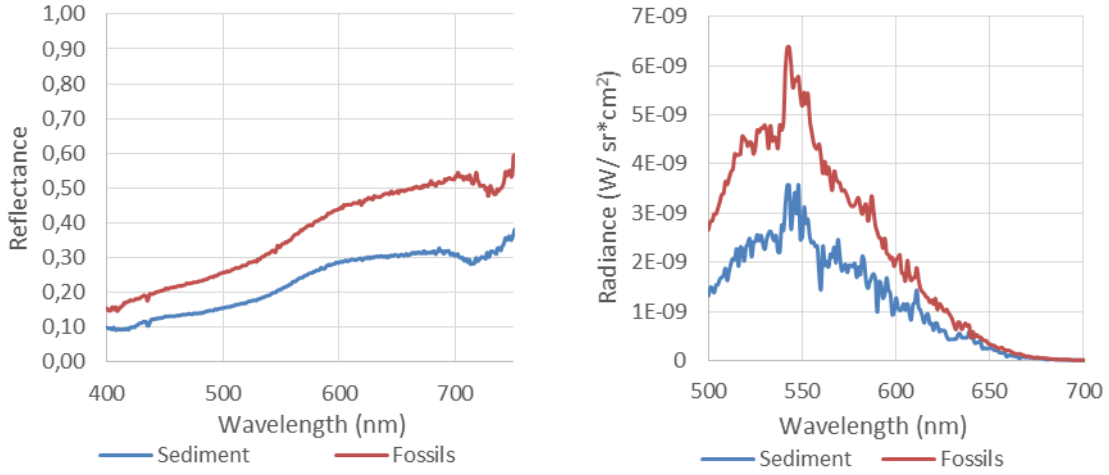
These images and spectral measurements allowed us to know if there were any spectral differences between the microfossils and the sand-gravel, highlighting any wavelength peak at a specific location that could help us to differentiate between them.

After that, images from samples containing a mixture of microfossils and sand-gravel were also taken under D65 and UV light, as a means of studying different strategies to allow a fast and automated detection and later separation.

Results

Figure 2(a) shows the mean spectral reflectances of the microfossils and the sand–gravel samples in the visible range of the electromagnetic spectrum. Figure 2(b) shows the fluorescence emission of the same samples measured when they are illuminated with UV light. As it can be seen, in general bones and teeth have a higher reflectance values and this difference increases from 600 nm on. Despite the fact that microfossils have higher reflectance than the sand and gravel at longer wavelengths, there are not specific wavelength peaks that permit distinguishing between them. On the other hand, microfossils also show a more marked fluorescence rather than sand-gravel samples, basically around 550 nm.

The increased difference in reflectance at long wavelengths can be also observed in Figure 3, where some of the spectral images taken with the multispectral system under D65 illumination are provided.



a) b)

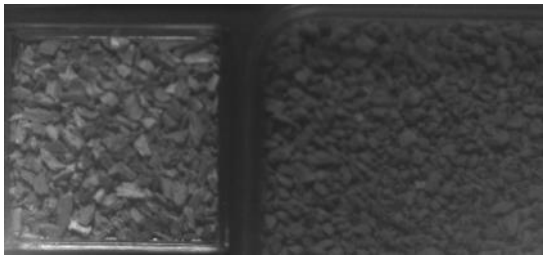
*Figure 2. a) Reflectance of sand and bones-teeth samples. b) Emission spectra (Radiance in W/sr*cm^2) of sand and bones-teeth under ultraviolet light.*

As can be seen, more marked luminous differences between samples are obtained in spectral bands higher than 600 nm, making them more suitable to detect the fossil remains. Another point to highlight is that the color sRGB image does not provide a so marked difference between samples as the spectral images at long wavelengths do. Taking into

account that the sRGB image is similar to what the naked eye sees, it can be suggested that the use of spectral images at specific wavelengths could make much easier the detection and later separation of samples.

As stated in the methodology section, images of the paleontological remains including mixed samples, i.e. with microfossils and sand-gravel together, were also photographed. Figure 4 provides sRGB images under D65 and UV illumination conditions. The UV source was used to enhance the contrast between teeth and bones with respect to the sediment, due to their different spectral features in terms of fluorescence.

As it is shown, it is almost impossible to differentiate between samples by using the daylight image while bones and teeth are highlighted and easier to discriminate with UV light. Making use of the green component of the sRGB image under UV light, the bones and teeth are more contrasted as they present a higher fluorescence peak at 550 nm approximately. Finally, a posterior image processing procedure applied to this green component also provides a greyscale image in which a segmentation algorithm is carried out. The results obtained suggest that this would be a very helpful procedure to detect the bones and teeth and to later separate them from the sand and gravel.



400nm

450nm

500nm

550nm

600nm

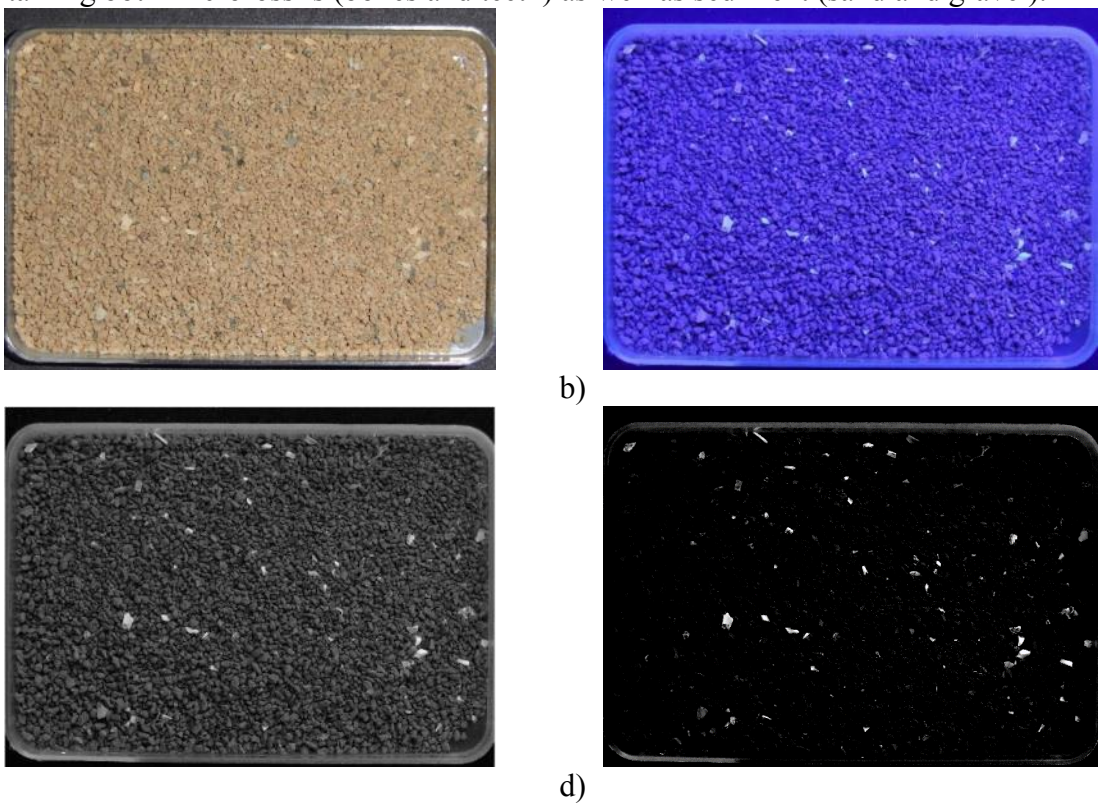
650nm

700nm sRGB Image

Figure 3. Examples of images of the paleontological sample obtained with the multispectral system under daylight light. A simulated sRGB image is also provided. The left sample correspond to microfossils (bones-teeth) and the right sample to sand and gravel. It is easy to perceive that luminous differences between samples increase with wavelength and that a sRGB image does not allow a rather good discrimination.

Conclusion

In this study, the feasibility of using a multispectral imaging system was tested as a means of detecting paleontological remains such as microfossils from sediment. For this purpose, a multispectral imaging system consisting of a digital CCD camera and a LCTF were used. Daylight and UV light sources from an overhead luminaire were used to light samples containing both microfossils (bones and teeth) as well as sediment (sand and gravel).



a) b)

c) d)

Figure 4. Images of paleontological remains without separation of bones-teeth and sand-gravel. a) sRGB image illuminated with a daylight source. b) sRGB image illuminated with

UV source. c) Green component of the image under UV light. d) Greyscale segmentation of the green image (c).

The results suggest that both kinds of samples have a different spectral reflectance in the visible range, mainly above 600 nm where bones and teeth have higher values. The fluorescence emission of microfossils is also higher than the sediment, especially around 550nm. Furthermore, a segmentation algorithm is used to highlight fossils from sediments when the green component of the sRGB image under UV light is considered.

Accordingly, we show that these differences can be successfully used by multispectral imaging systems to enhance the contrast between fossils and sediments, making easier their spatial detection and posterior separation. Therefore, using spectral information besides morphological criteria, would lead to a significant decrease in time and economic costs.

Nevertheless, further research is still needed in order to establish which type of paleontological remains can be separated by this method and studying the specific spectral features of samples coming from different paleontological excavations.

This new method represents a clear innovation in the field of paleontology, and it will be very helpful to overcome limitations of currently used techniques for fossil recovery.

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Evaluation Research on Difference Between Color Appearance for Each Fabric Under Lighting ith Variable Color Temperature

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Abstract

In apparel shops, clothing products are displayed under various lighting color setups. These lighting setups, according to each concept of stores or brands, are much highly affected. Under these circumstances, what to buy among displayed clothing products is chosen through the comparison within images. Consumers are considered that they make their choices with steady and stable comparison between several items. With more details, lighting color for clothing items is changeable along the zone where-else clothings are displayed. Also, based on the clothing image under these lighting setup, the situation for consumers to think about which clothing items are proper to choose is the one good comparison example. For our experiment, Pieces of flat-surface cotton broad cloths of 10 sum colors; RED, YELLOW, GREEN, BLUE, PURPLE in both vivid and pale tones were used as the experimental samples.

Two types of LED lamps, a white LED with a color temperature of 5000K and a yellowish-color LED with a color temperature of 2800K, were used as the illumination in the experiments. The experimental procedure is as follows. First, the colors of the cloth samples are determined by visual colorimetry using the Munsell color chips under the white illumination with a color temperature of 5000K as the standard. Next, the cloth samples are placed under the yellowish-color illumination with a color temperature of 2800K to carry out color matching of the appearances with the Munsell color chips under the standard illumination. The tendencies of color changes due to the illumination are studied by the differences in color values obtained in this way. The selection of 13 adjectives to be used for the sensory evaluation of the color impressions have been shown, and it has been clarified that the adjectives are appropriate for the use to the impression evaluation by the SD method. Subjects for the experiment were 30 women of age of twenties with normal vision.

In this researched manner, it is highly considered that to interpret the colors of clothing products under lighting setup and evaluate these color appearance bears so much important meaning. The estimated data values, calculating CIECAM 02 and its parameter from either the experimental Munsell color chart and actual measurement (KONICA-MINOLTA CM 3600d) for fabrics or the actual measurement of LED light spectral distribution(TOPCON SR-3AR), were interpreted through the contrast and comparison method applicable for the output data values estimated by the experiment of the visual color matching.

Summary

In apparel shops, clothing products are displayed under various lighting color setups. Under this circumstance, consumers choose apparel products for purchase while comparing more than two color images from products. In this experiment, using two color types of LED lamps, it was aimed at to quantitatively evaluate relative color appearance through sequential method while using the Mansell color chart, to conduct color appearance assessment under identical experiment conditions and finally to detect correlations of these with emotion assessment. As a result, it is considered that color matching calculation values under the experiment condition set by this study are the positive chromatic adaptation result to basic lighting, and the degree of chromatic adaptation appeared higher than the CIECAM02 prediction values. Also, the correlation between color matching evaluation values and ΔM values was found from the emotion assessment, with exception such as RED.

Introduction

Generally, there are various forms of lightings for fashion shops. Under these lighting conditions, consumers choose products while thinking of color appearance from clothes. Especially, aiming at highly effective displaying, lightings for fashion shops have delicately and frequently have used lighting methods with varied color temperature and have designed a lot more different scenes for lighting including nights as well as days. With this regard, foundation of quantification method for color appearance assessment under each lighting condition is highly important to build lightings for shops in KANSEI (sensitivity) engineering way. On the background above, in this study, one observation method called quantification of chromatic adaptation and color appearance, which is for lighting of show window displays, was examined. So was emotion assessment experiment on color appearance. These steps were compared and identified with quantitative results on color appearance and later confirmation and analysis were conducted in terms of sensitivity engineering. In more detailed, two LED lamps with different color temperature were chosen and so were 5 colors of cotton broad fabric in 2 different tones which amounted to 10 colors. These were examined by color matching experiment conducted by sequential viewing method.

Experiment

Sample and measurement of the color matching experiment

As experimental samples, 10 colored fabrics that are Red, Yellow, Green, Blue, Purple in two tones including Vivid and Pale, made of No.40, 100% cotton broad (Inc. Kurabo Japan), commonly used in apparel industry, and least affected by lighting, are used.

Two wooden boxes of the same size, 980mm in height, 680mm in width and 600mm in depth, are placed side by side in an experimental booth (Figure 1). The inside surface of each box is covered by grey cloth (N6.0) of the same kind as

experimental samples. The outside of the boxes are covered by matte cloth of grey color. Furthermore, the whole experimental booth is covered by a blackout curtain to block off the light from outside.

Two kinds of LED lamps (See Figure 2) are followings, one is neutral white of color temperature 5000K and the other is incandescent lamp color (yellowish color) of color temperature 2800K. These lamps are mounted at the ceiling of each box to create different illuminating environments. The illuminant on the floor of each box is set up to be the same, which is approximately 1000 lx.

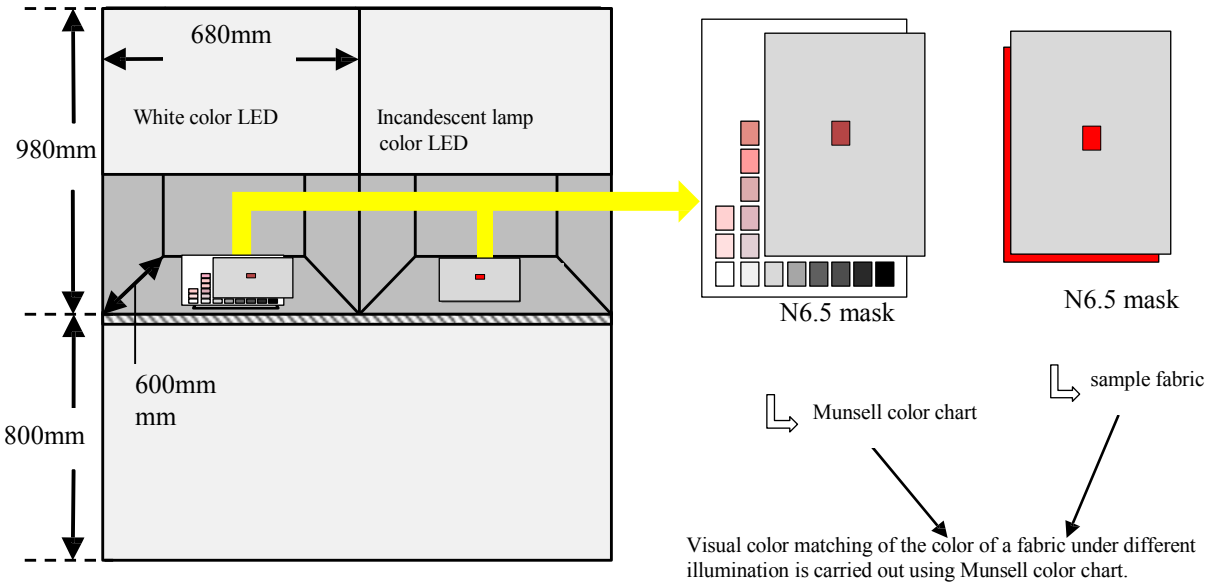


Figure 1. Experimental booth for visual color matching

Method of the experiment is listed below:
For each sample fabric, perform the following steps to determine the change of the apparent color of the fabric under different illuminations.

Step1: Compare the color of a sample fabric with the Munsell color chart under the white color illumination (W-LED) to determine the object color of the fabric itself.

Step2: Move the fabric used in Step1 into the other box illuminated by the incandescent lamp color illumination (Y-LED), and compare the color of the fabric with the Munsell color chart in the former box under the W-LED to determine the apparent color of the fabric under the Y-LED.

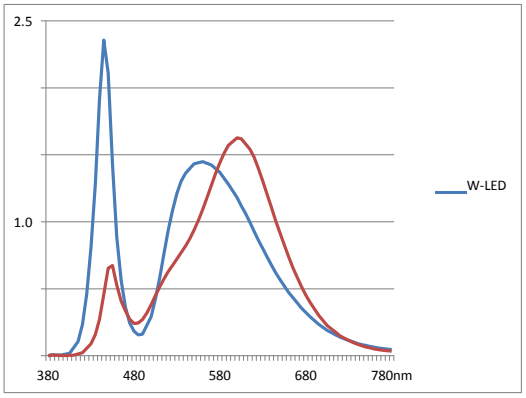


Figure 2. Relative spectrum distribution of W and Y-LED

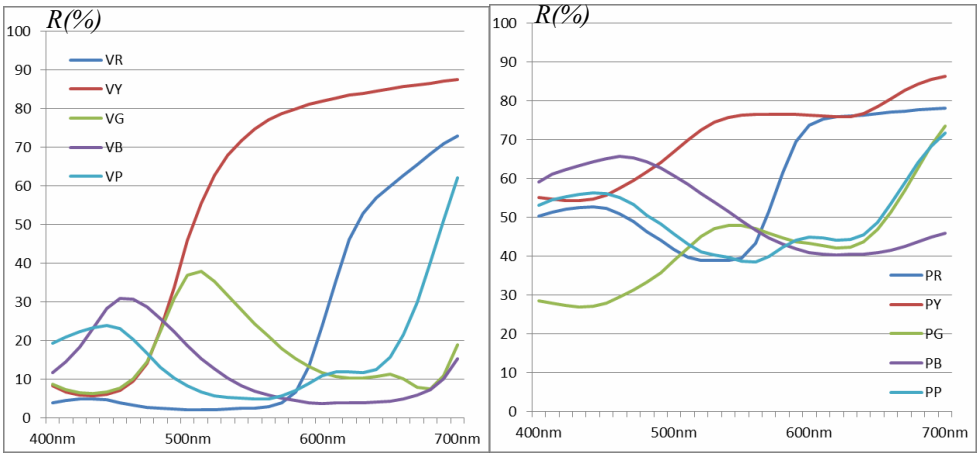
Result

Sample and measurement of the color matching experiment

Figure 2. and Figure 3. represent relative spectrum distribution of LED lighting and spectral reflectance of fabric, respectively.

SR-1 made by the company TOPCON was used for the estimation of relative spectrum distribution of lighting; and CM 3600d made by Konica-Minolta for the estimation of spectral reflectance of fabric.

Also, for the color matching experiment, the answers stated by the experiment subjects were collected after they were taken consideration of in terms of the Munsell value of JIS standard color chart and these were averaged finally to be plotted as shown in tables 1a. and 1b..



a. Vivid Color b. Pale Color

Figure 3. Spectral reflectance profile of fabrics

Table 1a. The color matching result of pale color

Fabric Color Chart		W-LED W-LED			Y-LED W-LED	
R	0.83R	7.93	6.07	7.33R	7.50	7.07
Y	8.16Y	9.00	2.10	6.17Y	8.90	3.83
G	1.83GY	7.80	3.27	2.83GY	7.33	5.67
B	0.83PB	7.80	4.03	1.0PB	7.40	3.87
P	3.9P	7.63	4.23	8.17P	7.40	3.87

Table 1b. The color matching result of vivid color

Fabric Color Chart		W-LED W-LED			Y-LED W-LED	
R	6R	4.13	14.00	6.67R	4.03	13.20
Y	6.83Y	8.53	10.60	5.83Y	8.07	12.67
G	1.67G	5.52	10.67	0.67G	6.00	9.87
B	4PB	3.57	11.73	3PB	3.37	10.27
P	4.83P	3.41	10.13	8P	3.43	10.80

For the next step, to assess discrepancies in color matching experiment values and also chromatic adaptation in observing process, spectral reflectance of JIS standard color chart was calculated. Also, to make this calculated number be identical with values by color matching, another spectral reflectance of the color matching result was calculated by interpolation calculation out of nearby 8 points of color chart. Furthermore, calculation and assessment of CIE chromaticity diagram were implemented. CM2600d made by Konica-Minolta was used for the measurement of JIS color chart.

From this result, in JIS standard color chart color-matched with fabric, each profile of spectral reflectance was almost identical. Besides, both fabric and color chart, which ought to undergo through color matching, showed 5.5 of average ΔE^*_{ab} for pale color and 7.5 for vivid color respectively. It is inevitably through that this study almost corresponds to its own exactness based on average.

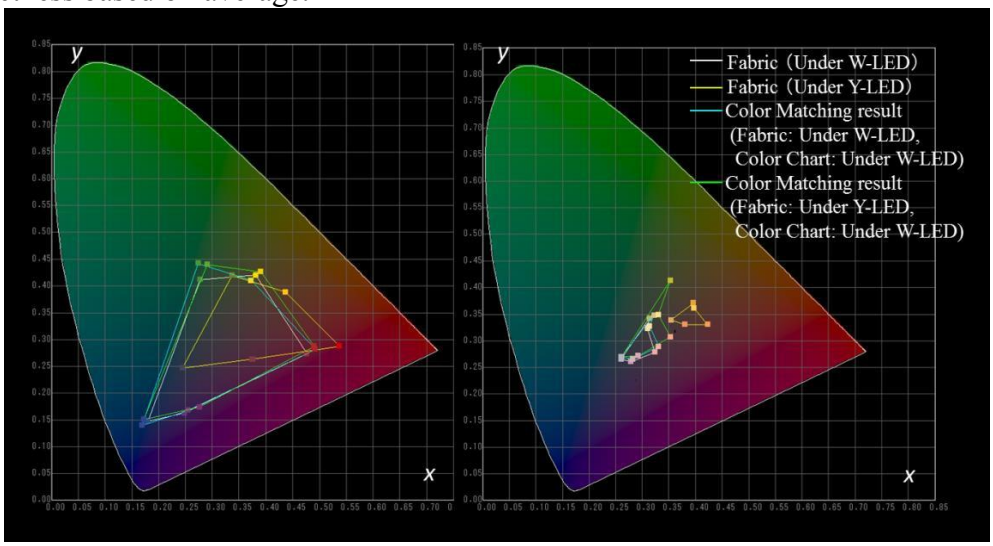


Figure 4. CIE chromaticity diagram (left: vivid color, right: pale color)

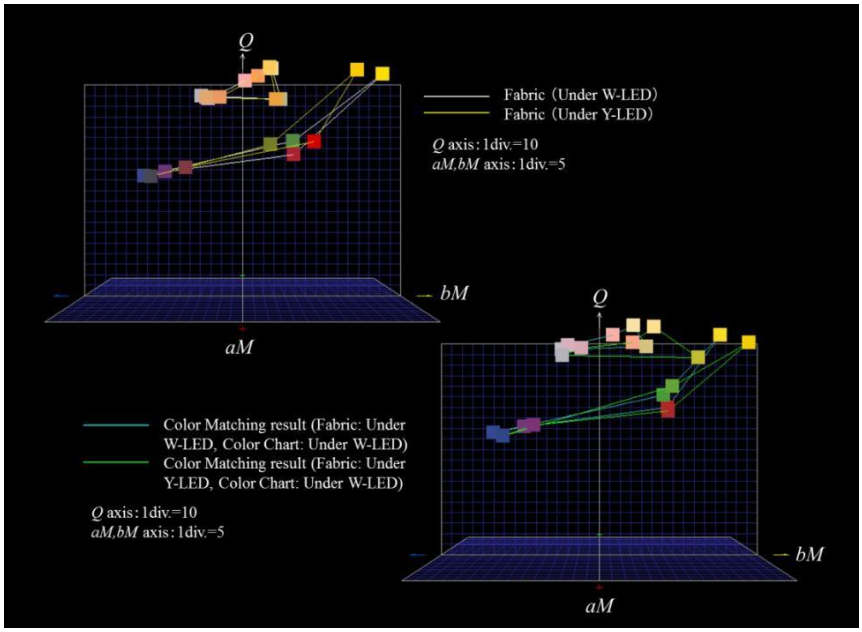


Figure 5. CIECAM02 3-Dimentional plot of Q-aM-bM

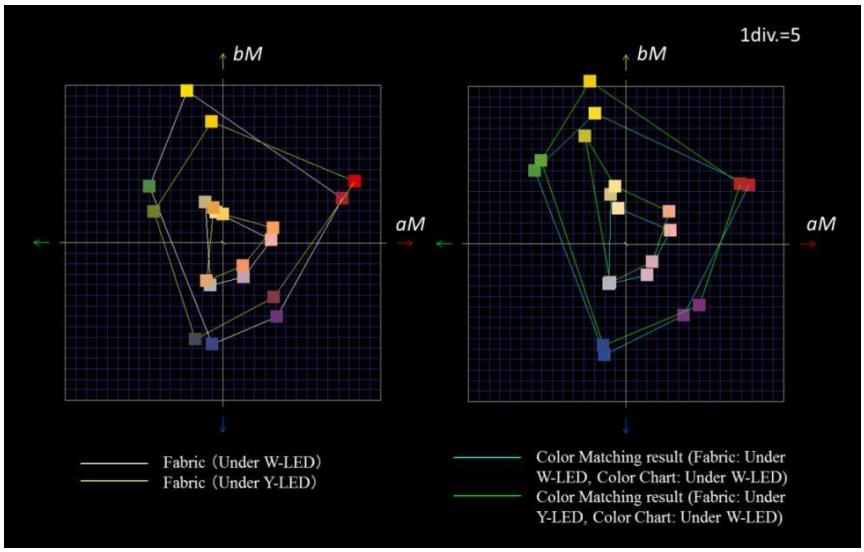


Figure 6. CIECAM02 plot of aM-bM

On CIE Chromaticity Diagram is the plot of the tristimulus value of 4 constituents which are tristimulus value of fabric under W-LED and Y-LED lightings, the result by color matching of both fabric and color chart under W-LED, and the result by color matching of fabric under Y-LED and color chart under W-LED separately (Figure 4).

The huge differences of these plots on CIE chromaticity diagram range from fabrics under W-LED to the same ones under Y-LED.

In addition, the result by color matching of both fabric and color chart under W-LED is almost identical with the profile of fabric under W-LED.

However, the subsequent result from color matching of fabric under Y-LED and color chart under W-LED is almost rather identical with the plot result of fabric under W-LED, than with under Y-LED.

This is the reason why it is thought that chromatic adaptation emerges from lighting setup with color chart under the described conditions of the experiment.

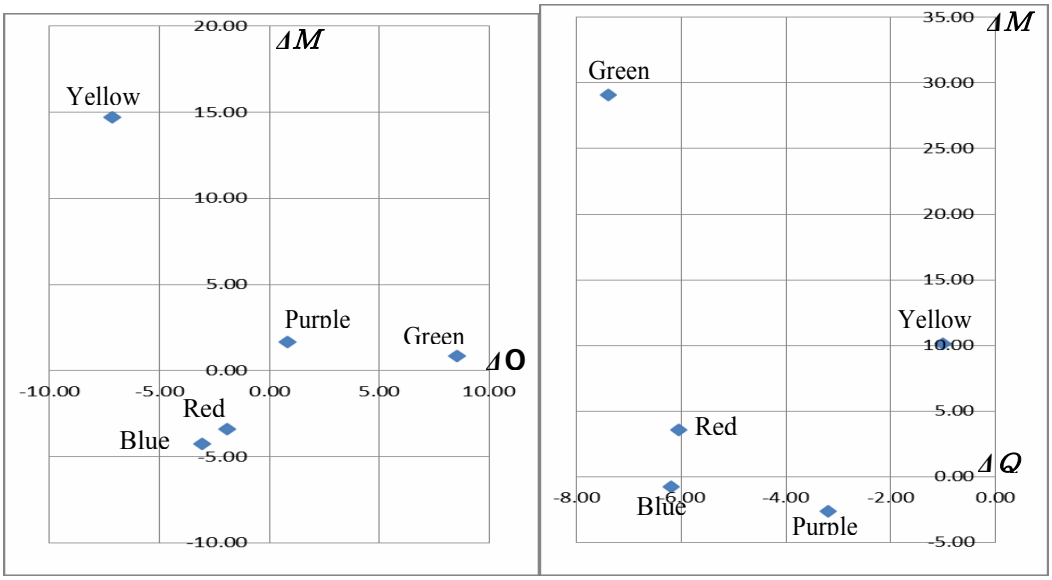
To verify this result, the experimentation was reversely conducted, the same specimen has been once more switched to under W-LED and the color chart has been moved to under Y-LED. In this way, the result of color matching was almost rather identical with the plot result of Y-LED than the plot of fabric under W-LED. In addition, it is highly persuasive that the experimental conditions in this study allowed chromatic adaptation to easily appear based on following considerations;

First, in this study, the predicted value data in prior showed great harmony with the calculated value data.

Second, as the color rendering of the used LED lighting was highly quantified, it is tightly in color appearance prediction.

Lastly, the spectral distribution composition of used LED lighting ranged in the color temperature by light source color between incandescent and natural colors.

For this reason, with the deep thought of chromatic adaptation, color appearance simulation in CIECAM02 was testified. To predict color appearance of fabric under each lighting, the plot of *Q-aM-bM* of CIECAM02 was processed. Also, the same plot for calculated value of color matching result was done (Figure 5 and 6). This calculated value of color matching nearly approaches forms of basic lighting of color chart, and this suggests even more apparent chromatic adaptation than the prediction of CIECAM02 described by shift from W-LED which calculates from spectral reflection rate of fabric to Y-LED.



a. Vivid Color *b. Pale Color*

Figure 7. CIECAM02 ΔQ- ΔM between step 1 and step 2 of color matching experiment

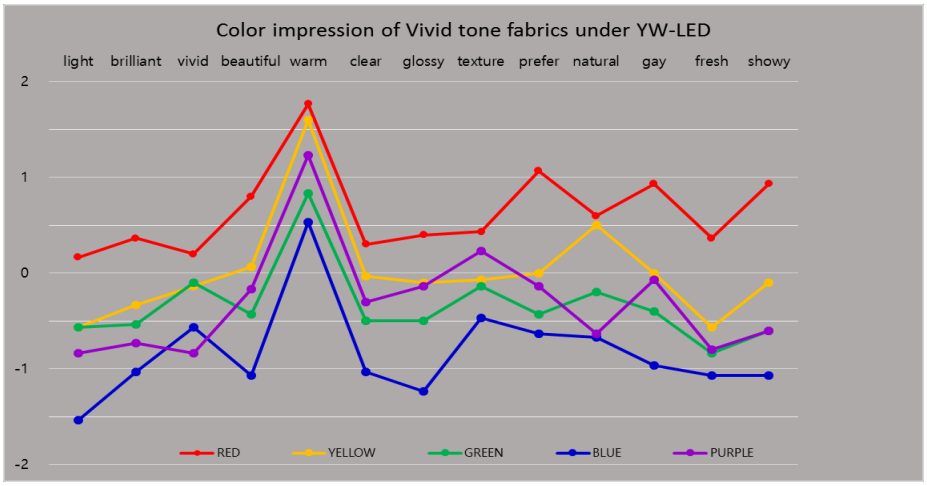


Figure 8a. Color impression of Vivid Color fabrics

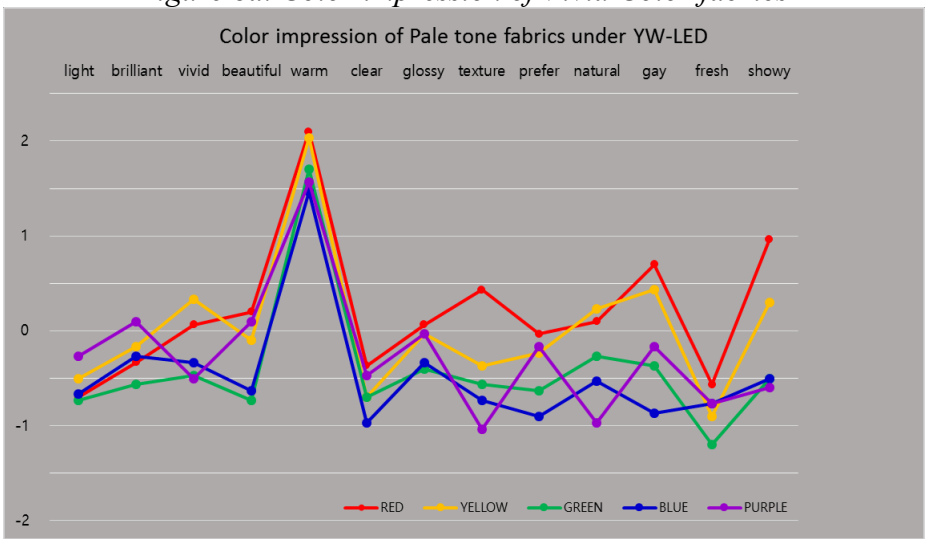


Figure 8b. Color impression of Pale Color fabrics

For the even more detailed confirmation, Δvalue from W-LED to Y-LED was calculated based on variables such as brightness *Q*, colorfulness *M*, *aM* and *bM*. Relationship of colorfulness *M* in vivid color shows decrease in colorfulness *M* except for Red, when the calculated value from spectral reflectance profile is shifted from W-LED to Y-LED. However, in the calculated values of color matching, only Red and Blue slightly decrease, while others mostly increase. Especially, Yellow shows great increase in colorfulness *M*.

Meanwhile, for brightness *Q* of Yellow, even though it had once been predicted not to change so as to be '0', the calculation of it decreased. Identically for pale color, although colorfulness *M* had decreased mostly in others, the calculation of it mostly increased.

Yellow and Green did apparently increase. Meanwhile, brightness *Q*, when it was compared to the predicted value, decreased.

The output of the color appearance assessment for actual colorfulness of fabric in vivid tone in Figure 9a. was compared to the experimental calculated value result (Figure 8) from color matching. This suggests the overall correlation between the "increase-decrease"

trend of colorfulness and the assessment profile by the SD method. Simply, Red just strongly affects emotion, so this were characteristically resulted in again out of this study.

In this study result, there was shown the even more forceful properties of the discussed results so far when it comes to stimulation by pale-toned fabric. Emotion effect under the totally same lighting conditions which were identical with the ones in the color matching experiment above was checked by implementing color appearance assessment. The subjects here were 30 women in their twenties with normal color vision.

The subjects were seated in front of the center of the booth, as they assessed, using the 7-point-Likert scale method with 13 color appearance terms, relative color appearance under Y-LED lighting having the fabric with same color as the one in the left booth under W-LED lighting lit up, and their standard from the booth under W-LED lighting was the color appearance from each fabric ranging from Red, Yellow, Green, Blue and to Purple in both vivid and pale tones which amounted to 10 colors. This color appearance suggested by the sequential method used above was designed to be observed and assessed by 30 women in their twenties with normal color vision. Each profile of an individual result on color appearance assessment is shown in Figure 8.

Conclusion

In fashion shops with various lighting setups, consumers are to observe and assess colors and images of apparel products by using free sequencial viewing method. This is the frequently shown in their behaviors of apparel choice. In this study, based on this practical behavior feature, calculated values from both color matching of fabric and the Munsell color chart under basic W-LED lighting and once again fabric under Y-LED with the Munsell color chart under W-LED were compared to each other and then analyzed to try quantitative evaluation for practical color appearance differences. In terms of this study result which showed high dependance of chromatic adaptation, to detect relative differences in color appearance under different lightings by many-sided visual colorimetry method including general bipartite viewing method, simultaneous perception or successive viewing method is consider as another subject for further studies to contribute to quantitative evaluation of visual colorimetry of color appearance for actual apparel.

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¿Qué colores prefieren los niños para expresar la violencia? Estudio del caso Buenos Aires (Argentina)

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Resumen

El trabajo se enmarca en el proyecto: "Retórica de la violencia gráfica infantil. Análisis semiótico de dibujos de niños escolares", en la Universidad de Buenos Aires y con investigadores de UNAM. Se expondrán resultados de la investigación en escuelas de Buenos Aires. Se focalizará el manejo del color en la representación de la violencia y no violencia en un corpus de 200 dibujos. La muestra abarca 100 sujetos: niños escolares de 11 años, a quienes se les solicitan 2 dibujos, uno violento y otro no violento.

Dentro de los objetivos de la investigación, se procederá a identificar e inventariar los colores usados por los niños para hacer visible la violencia y la no violencia. Se relacionarán los colores con los objetos, símbolos y escenas representadas, y con el cuestionario respondido por mismos niños. Nos preguntaremos: ¿Cómo representan la violencia? ¿Qué colores utilizan para representarla? ¿Predomina un manejo realista del uso del color en los personajes y objetos dibujados, o hay disrupciones retóricas, que manifiestan de modo simbólico el color de lo violento? Según lo observado, el negro para expresar la muerte, o la violencia del color rojo para representar la sangre de heridas son constancias en los dibujos; signos cromáticos codificados en la cultura. Sin embargo, los sentidos atribuidos tanto a esos como a otros colores deben recrearse en el análisis interpretativo de cada caso, y en función de la iconografía y el relato escenificado para alcanzar la plenitud de su sentido. El dibujo puede ser un elemento de diagnóstico para determinar el grado de violencia en el que vive el niño en su vida cotidiana o en su entorno social, mediatizada por las redes de información.

Paralelamente, en las expresiones gráficas de los niños podrán rastrearse las huellas de una codificación: figuras, trazos y colores expresan formas simbólicas con las que se reproduce la violencia en cada cultura.

Palabras clave: dibujos, infancia, violencia, no violencia, sociedad, cultura

Fundamentos y motivaciones

El trabajo se enmarca en el proyecto: "*Retórica de la violencia gráfica infantil. Análisis semiótico de dibujos de niños escolares*", en la Universidad de Buenos Aires, a partir de un proyecto diseñado por la Dra Georgina Ortiz, y actualmente desarrollado por investigadores

de UNAM (México) y de la UBA (Argentina). Nuestra intención es reproducir las condiciones y metodología de la investigación para que sea posible establecer correlaciones de modo comparativo.

Se expondrán resultados de la investigación en escuelas de Buenos Aires. Se focalizará el manejo del color en la representación de la violencia y no violencia en un corpus de 200 dibujos en cada ciudad, aproximadamente. La muestra de Buenos Aires abarca 100 sujetos: niños escolares de 11 años, a quienes se les solicitan 2 dibujos, uno violento y otro no violento. Dentro de los objetivos de la investigación, se procederá a identificar e inventariar los colores usados por los niños para hacer visible la violencia y la no violencia. Se relacionarán los colores con los objetos, símbolos y escenas representadas, y con el cuestionario respondido por mismos niños. Nos preguntamos: ¿Cómo representan la violencia? ¿Qué colores utilizan para representarla? ¿Predomina un manejo realista del uso del color en los personajes y objetos dibujados, o hay disrupciones retóricas, que manifiestan de modo simbólico el color de lo violento? Según lo observado, el negro para expresar la muerte, o la violencia del color rojo para representar la sangre de heridas son constancias en los dibujos; signos cromáticos codificados en la cultura. Sin embargo, los sentidos atribuidos tanto a esos como a otros colores deben recrearse en el análisis interpretativo de cada caso, y en función de la iconografía y el relato escenificado para alcanzar la plenitud de su sentido. El dibujo puede ser un elemento de diagnóstico para determinar el grado de violencia en el que vive el niño en su vida cotidiana o en su entorno social, mediatizada por las redes de información. Paralelamente, en las expresiones gráficas de los niños podrán rastrearse las huellas de una codificación: figuras, trazos y colores expresan formas simbólicas con las que se reproduce la violencia en cada cultura.

Nuestra intención es reproducir las condiciones y metodología de la investigación para que sea posible establecer correlaciones de modo comparativo.

Dentro de este amplio proyecto el color y la producción gráfica son ejes del análisis: el uso del color con una función retórico-persuasiva y en relación a prácticas estéticas. Entendiendo que el color puede considerarse como elemento privilegiado para propiciar la argumentación retórica en una imagen visual, la investigación se orientará hacia la indagación y el estudio del modo en que determinadas premisas sociales, la memoria cultural y la ideología condicionan el uso del color a nivel argumentativo. A tal fin, se retomarán marcos de referencia que suponen la combinación de elementos de diferentes campos disciplinarios: sociología, antropología, cultural, semiótica, comunicación e historia del arte (Barthes 1982, Sontag 2005, Ortiz 2011). En este encuadre epistemológico se propone llevar a cabo la investigación *"Visión de la violencia de los niñ@s de primaria de México y Argentina, a través del uso del color y la representación gráfica"*.

Los objetivos de esta investigación apuntan a indagar cómo perciben la violencia los niños escolares de 11 años en dos grandes centros urbanos como Buenos Aires y la ciudad de México, y si hay correspondencias en ambos grupos. El estudio incluye una interpretación acerca del modo en que figuras, trazos y colores expresan formas simbólicas, marcas culturales.

Métodos y abordajes

La Psicología Social y la Semiótica Visual son las disciplinas desde las cuales abordamos el objeto de estudio, con una metodología híbrida cualitativa y cuantitativa (López y Ortiz 2012).

El procedimiento para la obtención del corpus de análisis incluye la selección de la población: 100 niños y niñas escolares, nivel primario (estatal y privado) de entre 10 a 12 años. Los niños y niñas respondieron un cuestionario, realizaron 2 dibujos (con y sin violencia) y redactaron un relato sobre los dibujos. El cuestionario indaga:

- Datos ambientales y actitudinales (gustos, juegos físicos, grupales, electrónicos y programas favoritos de TV).
- Significados de los colores para ese grupo etario.

Cada niño produce 2 dibujos uno *con violencia* y otro *sin violencia*; conceptos no explicados por los investigadores, con la intención de explorar alcances, definiciones y características que les adjudican los niños, a través de su expresión gráfica.

En la investigación propuesta la perspectiva desde donde se focalizará el objeto permitirá ampliar la mirada sobre cómo perciben los niños la violencia. Los dibujos infantiles se abordarán con herramientas analíticas de la semiótica y retórica visual. En principio, hay que reconocer que no hay un modelo único de análisis ante la representación visual. Desde las perspectivas más estructuralistas (Barthes 1961 y 1964) hasta el abordaje del enunciado visual como discurso social (Benveniste 1966 y 1970, Verón 1985 y 1993) se han seleccionado aportes de distintas corrientes teóricas en un modelo ecléctico, diseñado para capturar los rasgos relevantes de la imagen visual, según las hipótesis que guían la investigación.

Focalizando el color dentro del conjunto de variables involucradas, se analizarán los significados abstractos y representados referidos por los escolares en sus cuestionarios, y la aparición de los colores en los dibujos violentos y no violentos. En la primera hoja del cuestionario se los invita a asociar 11 colores básicos (rojo, rosa, naranja, amarillo, verde, azul, morado, blanco, negro, gris, naranja) a significados, según un análisis semántico del color (Ortiz 2011) Responden según sus conocimientos mediante asociaciones metonímicas, por ejemplo: “verde: hoja” o con mayor grado de abstracción metafórica simbolizadora, por caso, “verde: ecología” o “verde: esperanza”.

Concluidos los dibujos, se les entrega la última parte del cuestionario, donde deben completar un gráfico indicando cómo han usado esos mismos 11 colores. No hay estricta coincidencia entre los significados abstractos, con los sentidos que se producen contextualmente cuando usan los colores. Por ejemplo, el color rojo suele asociarse al amor y la alegría, sin embargo es el más usado en la sangre de las heridas para enfatizar el dramatismo de los dibujos violentos, con una connotación negativa.

Hipótesis general sobre paletas violentas versus no violentas

Una hipótesis preliminar, a partir de los 200 dibujos y tratando de indagar si es posible generalizar un uso diferencial del color en paletas violentas diferenciadas de otras no violentas, nos llevó a asociar los *colores negro y rojo* con la representación de la *violencia* y los *colores fríos* (verdes y azules) con la *no violencia*.

En particular, en este escrito analizaremos la primera, de qué modo los colores rojo y negro aparecen en los dibujos, asociados a acciones, personajes y escenas específicas como modo de generar o enfatizar la sensación de violencia en la gráfica, como efecto retórico. En la Figura 1, el niño elige en el dibujo violento representar al diablo como personificación del mal. La violencia tiñe de rojo el paisaje, lo vuelve irreal, infernal. Tierra y cielo casi desaparecen. Apenas puede verse una línea superior azul y un reflejo verde en la base, lo permite inferir que se trata de una operación intencional. Ese desequilibrio en la

composición transmite dinamismo, alerta, tensión.

Figura 1. Elección del color rojo para figura y fondo, en dibujo violento: dinamismo, alerta y tensión.

Tradicionalmente la dupla rojo y negro se usan en distintas situaciones y contextos en la cultura. Su significación es bipolar, puede ser tanto positiva como negativa, y su lectura dependerá del sentido que adquiera en el enunciado en particular en el que se encuentra, del género enunciativo y del contexto situacional (Caivano y López 2005).

En la Argentina los medios consagran la difusión de hechos violentos al canal de las noticias, *Crónica*, que transmite las 24 horas y alerta alarmando con su famosa *placa roja*. Muchos de los niños afirmaron ver habitualmente este canal, que no transmite contenido infantil sino información, especialmente de hechos policiales. Por este tipo de influencia, el rojo se asociaría en los niños con un estado de alerta, significación cristalizada en medios urbanos por el código del semáforo, entre otros.Sin embargo, el rojo resultaba frecuente en escenas no violentas (Figura 2), aunque adquiere otros sentidos. En general salpica detalles que avivan la escena o generan puntos de atención. En este caso, las formas (corazones, flores, mariposas) cargan de sentidos positivos al color rojo, neutralizando su peligrosidad.

Figura 2. Uso del color rojo en dibujos no violentos. Asociado a ciertas formas genera puntos de interés emotivo y estético.

Por otro lado, hay algunos dibujos violentos que presentan una escena similar a las no violentas, cuando irrumpe la violencia se identifica con elementos rojizos del paisaje (Figura 3). La naturaleza se animiza: sol y cielo adquieren emotividad. La escena no pretende ser realista, reflejando la naturaleza, sino que va más allá, expresando la empatía del medio con la emoción del sujeto.

Comparando el sol rojo que significa violencia (Figura 3) con los dos dibujos no violentos (Figura 2), se observa cómo el paisaje natural, asociado a la vida amable y pacífica, puede resignificarse y tornarse agresivo. El niño se apropia de la naturaleza, se aparta del realismo para connotar su representación gráfica.

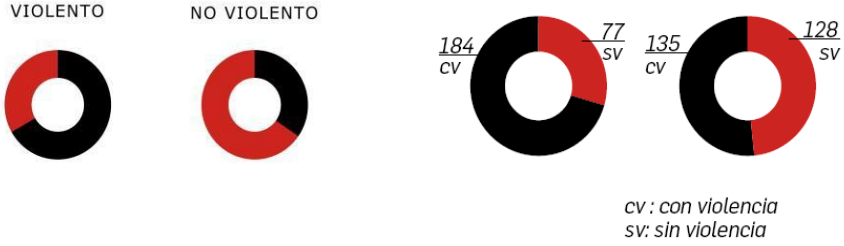
Figura 3. Identificación empática entre el medio y la emoción del sujeto en dibujos violentos: el color rojo como factor de tensión en la escena.

Comparando el sol rojo que significa violencia (Figura 3) con los dos dibujos no violentos (Figura 2), se observa cómo el paisaje natural, asociado a la vida amable y pacífica, puede resignificarse y tornarse agresivo. El niño se apropia de la naturaleza, se aparta del realismo para connotar su representación gráfica. En los dibujos seleccionados, el uso del color rojo es el elemento privilegiado para resignificar la escena.

Uso específico de rojo y negro: análisis de resultados

El uso del rojo en dibujos violentos parecía una evidencia, sin embargo, al cuantificar la frecuencia de su aparición en el análisis de los dibujos arrojó un resultado inesperado. Analizando comparativamente y siendo el rojo uno de los colores preferidos, se halló mayor presencia del rojo en los dibujos no violentos. En cambio, el negro es el color predominante, característico de los dibujos violentos (Figura 4).

Figura 4. Cantidades comparativas en el uso de rojo respecto del negro en dibujos

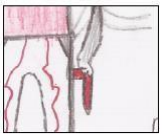


violentos y no violentos

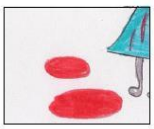
Discusión: ¿Qué hipótesis generamos para explicar estos resultados?

El color en su forma

Una primera aproximación al análisis de la imagen, correlacionando forma y color, habilitaría una lectura semántica de la forma coloreada. De este modo, para el corpus investigado, la asociación entre forma y color resulta altamente relevante para acceder al sentido. En los dibujos violentos las formas pintadas en rojo se asocian con predominancia a objetos alertantes, peligrosos: armas, sangre, fuego, guantes de box. Los detalles rojos en dibujos violentos suman dramatismo a las escenas, que tienden al expresionismo (Figura 5).



detalle 502 cv



detalle 915 cv

Con violencia

ELEMENTO/ ESCUELA	500-510	600-628	700-717	900-952	totales
ARMA	1	1		2	4
CHARCO DE SANGRE	4	2	1	2	9
FUEGO		1			1
TRANSPORTE		1		1	2
GUANTES DE BOX			1		1
FLORES			1		1
total elementos					18

Figura 5. Detalle de las figuras coloreadas de rojo en dibujos violentos.

El rojo, sin embargo, tiene mayor frecuencia en los dibujos no violentos. Genera puntos de interés, pero no tensión afectiva, explotando significados positivos latentes, ya codificados en el universo gráfico infantil (estampas, dibujos animados, ilustración). Son sentidos que se activan, porque el color aparece asociado a formas con significado positivo, por ejemplo, los corazones, amor, flores, globos que representan amor, amistad y alegría (Figura 6).

501 sv

Sin violencia

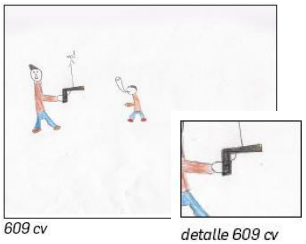
ELEMENTO/ ESCUELA	500-510	600-628	700-717	900-952	totales
CORAZÓN	5	6	8	7	26
NUBES		1			1
GLOBO			1		1
SIMBOLO DE LA PAZ			1		1
FLORES	1	1		1	3
total elementos					32

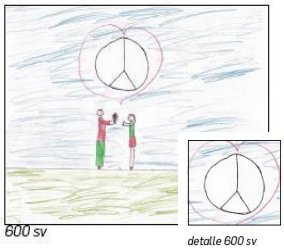
Figura 6. Detalle de las figuras coloreadas de rojo en dibujos no violentos.

En dibujos violentos, las armas dibujadas en color negro marcan alto contraste sobre el blanco del papel. Generan puntos de tensión en la escena.

En cambio, los dibujos no violentos usan negro para aves, gatos, edificios, transporte, sogas, estrellas, todos objetos de la vida cotidiana que no representan ningún peligro. Además están trazados en líneas simples, no aparecen remarcados. Se integran en la escena armoniosamente sin alertar la atención (Figura 7).

Figura 7. Detalle en negro en dibujos violentos y no violentos.





Es muy claro el predominio del uso intencional del color negro en dibujos violentos. Su ausencia en los dibujos no violentos también es significativa; sobre todo considerando que el grafito negro es el lápiz con que los niños dibujan y, en ese sentido, funciona como un color *no marcado,* no como un color producto de una real elección del niño (Figura 8).

Figura 8. Figuras en negro para dibujos violentos y no violentos.

Con violencia

ELEMENTO/ ESCUELA	500-510	600-628	700-717	900-952	totales
ARMA	1	7	1	20	29
ESCUDO DE POLICIA	1				1
DINERO		1			1
OTROS				5	5
total elementos					36

Sin violencia

ELEMENTO/ ESCUELA	500-510	600-628	700-717	900-952	totales
ESTRELLAS	1				1
SOGA	1		1		2
SIMBOLO DE LA PAZ		1			1
AVES				6	6
MUEBLES				4	4
GATOS		1			1
EDIFICIO				1	1
TRANSPORTE	1				1
total elementos					17

El color: significados abstractos y su significado en la representación

El análisis de los significados atribuidos a los colores en abstracto, que consignaron en el cuestionario que acompaña a los dibujos, aclara por qué los niños asocian el negro a la violencia.

El rojo, según las respuestas de ese mismo grupo, en cambio, es ambivalente. Presenta tanto significados positivos: *amor, pasión, corazón* como negativos: *sangre, violencia, enojo* (Figura 9).

Figura 9. Significados abstracto (izquierda) y representado (derecha), atribuidos al color rojo.

SIGNIFICADO ABSTRACTO

ROJO	
sangre	49
amor	27
pasion	7
violencia	6
fuego	4
enojo	3
corazon	2

SIGNIFICADO REPRESENTADO

Con violencia

sangre	64
muerte	4
color de ropa	4
odio	2
fuego	2
dolor	2
violencia	1

Sin violencia

amor	20
corazon	15
color de la ropa	12
descrip. de objetos	9
pasion	4
paz	3
amistad	1

En cambio, ninguno de ellos ha atribuido significados positivos al negro, por el contrario, lo han asociado con la oscuridad, maldad, muerte, tristeza, dolor, enojo, lo feo (Figura 10). Esta interpretación marca un nodo diferencial respecto de la interpretación de lectores adultos para quienes el negro podría significar elegancia, sobriedad o un producto para un público de alto poder adquisitivo, sólo citemos la famosa *black card*, por caso.

Figura 10. Significados abstracto (izquierda) y representado (derecha), atribuidos al color negro.

NEGRO

oscuridad	32
maldad	9
muerte	7
tristeza	6
armas	4
dolor	3
enojo	1
feo	1

descrip. de objetos dibujados	13
maldad	5
armas	4
color de ropa	3
violencia	2
cuchillo	1
muerte	1

descrip. de objetos dibujados	18
color de ropa	6
oscuridad	6
muerte	4
pelo	3
armas	2
traición	1

¿Qué conclusiones deberíamos esperar?

Las observaciones surgidas del análisis de los datos se verán ampliadas teniendo en cuenta otras variables significativas para nuestra investigación. Las conclusiones a las que arribaremos estarán guiadas por nuevas preguntas formuladas a este corpus de dibujos, cuya información excede consideraciones sobre el color. El color será analizado desde otros aspectos parciales:

- color de vestimentas y sus partes
- color en accesorios
- color en relación con los roles en el relato (agresor o agredido)
- color de rostros y sus partes
- color en los objetos
- color en escenarios
- colores de fondo

Estas variables deberán correlacionarse con otras más generales, por ejemplo: “violento - no violento”, “dibujo de niña - dibujo de niño”, “tipo de escuela”, que articulan el diseño general de la investigación. Y además habilita un análisis comparativo entre las dos ciudades en donde se realiza este estudio (Buenos Aires y México), y facilita replicar este diseño en otras poblaciones, en un futuro.

A modo de ejemplo y corroboración

Sosteniendo nuestra conclusión preliminar, que subraya un uso predominante del color rojo con significaciones positivas en dibujos no violentos y del negro con significaciones de valor negativa en los dibujos violentos, pondremos a prueba estas afirmaciones en un área específica y más densa en información. Tomando una de las variables, el color de la vestimenta en relación con los roles (agresor o victimario - agredido o víctima) en dibujos violentos se podrá analizar la tendencia general en un segmento, en una particularización.

Se busca vincular el color de la ropa con los conceptos abstractos que los niños manifiestan acerca de los colores. Y además buscar en la ropa rasgos de clase social, tribu

urbana o profesión que el niño pueda llegar a vincular con alguno de los roles del relato narrado en los dibujos, como se aprecia en la Figura 11 (por ejemplo, relacionar el uniforme de la policía con la violencia). Los estereotipos sociales reproducidos por los medios son el universo que alimenta esas representaciones infantiles.

Figura 11. Colores de ropa seleccionados para agresores en dibujos violentos.

En la Tabla 1 se presenta un análisis de los colores de vestimenta usados para cada uno de los roles antagónicos en el relato violento.

Tabla 1. Análisis comparativo del uso de colores en vestimenta de agresores y agredidos.

COLOR ROP	ROJO	ROSA	NARANJA	AMARILLO	VERDE	AZUL	MORADO	BLANCO	NEGRO	GRIS	CAFÉ
AGRESORES	11	2	9	11	21	22	7	9	19	6	14
AGREDIDOS	9	15	14	12	20	18	10	10	4	7	3

De este análisis parcializado, se desprende que el uso de rojo no arroja un resultado interesante ni por su frecuencia ni por una eventual diferencia entre agresores y agredidos. Amplía también las hipótesis de trabajo: notamos que es casi inexistente la selección de vestimenta rosada para los agresores, que sí se usa para las víctimas -que en su mayoría representan niñas o mujeres y, por extensión, al universo femenino.

La mayoría de los colores (naranja, verde, amarillo, azul, blanco, gris) no se usan para distinguir los roles que cada personaje juega en la escena violenta. En cambio es significativa la distinción entre agresores y agredidos, cuando se selecciona el color negro para la vestimenta de los personajes.

La elección del negro para la ropa de los victimarios o agresores corrobora la tendencia general, el negro, que para los niños de este grupo etario conlleva significados negativos, y es vector de violencia activa.

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Feelipa, Color Code for Visually Impaired People

Filipa Nogueira Pires

Abstract

Color is in everything that surrounds us, from landscapes, to furniture, appliances and machines, clothing, traditions and people. Colors convey us sensations, feelings, and information. Of its intrinsic characteristics, color is an interpretation of a sensation received by brain; it is an effect of light; it is the property of the surface of an object; it does not depend only on external factors, since it is a part of our conscious, unconscious and subconscious, and may influence our behavior.
However, there are people who cannot make the full or correct apprehension of color, such as the blind, color blind or visually impaired. This issue has been the subject of several investigations in recent years, in various scientific areas. Nevertheless, a color code that allowed anyone, carrier of any kind of visual impairment, to identify, recognize and use colors, had never been developed until now.
The main objective of this research project focused on the creation of a color code where colors are associated to basic geometric shapes, which are part of the general knowledge of every individual. The result was Feelipa Color Code. Through relief, the code allows anyone to identify and read the chromatic properties of objects, regardless of their visual limitations, making that person able to see/feel colors. Therefore, it is an inclusive and universal color code.
This study was supported by a user-centered and participatory design methodology, by resorting to sample groups. The code went through a phase of evaluation and validation by different users, who recognized not only that the code allows for easy identification of colors, but also that it is a real asset to a more independent and inclusive life for all. Feelipa is a unique color code that has the ability to be applied in countless types of media, across various sectors.

Introduction

This communication stems from the Master in Design research project, specifically in Product Design, developed at Faculty of Architecture of the Technical University of Lisbon, with an analysis group of visually impaired people, specifically children aged between eight and ten years old.

Color is one of the elements that identifies best everything that surrounds us, which makes it very important in our daily lives and culture. Although people with visual impairments cannot get access to this feature of the world, color is nonetheless important for their integration in society.

To substantiate the purpose of research, we used a mixed methodology. Through a non-interventionist approach, bibliographic data collected from the following disciplines was synthesized: Design, Individuals with Visual Impairments, Color, and Chromatic Codes.

Sustained on literary criticism, a second, non-interventionist moment followed: Field Study, using methods of direct observation, interviews and surveys via questionnaires.
Finally, in a third moment, an interventionist methodology (active research) was implemented, focused on a case study with a sample group and a control group.

This investigation was intended to aid the knowledge and recognition of colors by people with visual impairments, in a way that is effective, creative and playful, facilitating their integration into society and giving them greater autonomy.

For a better understanding of how design can enhance the acquisition of knowledge and recognition of colors by people with visual impairments, especially in children, breaking some barriers and providing greater autonomy and quality of life, it was necessary to further examine certain knowledge fields to support the entire investigation and help define the micro and the macro surroundings.

The use of inclusive design was considered imperative, developing a holistic investigation that could lead to a usable product for all, reducing the barrier between people with visual impairment and society in general.

1. Theoretical Contextualization

"Play is the salt of civilization".
(Gusdorf s.d. *apud* Bandet & Sarazanas, 1975, p.24).

Since we chose children with visual impairments as target for the empirical part of the investigation, their surroundings and way of learning, primarily done through toys, was taken into account.

According to the World Health Organization[1], and attending the problem of visual impairment in the world, the following figures are presented:
• Worldwide, 180 million people have some degree of visual impairment. Of this total, between 40 million and 45 million people are blind; the other 135 million suffer severe vision limitations;
• Every 5 seconds, 1 person in the world becomes blind;
• By 2020, the number of visually impaired people in the world can double.

The degrees of vision cover a wide range of possibilities, comprised between total blindness, to perfect vision, also called sighted. The term "visual impairment" refers to the spectrum ranging from blindness to low vision.

As some experts refer, subnormal vision or low vision means the change of functional capacity as a result of factors such as significant decrease in visual acuity. In practical terms, this type of vision is reflected in the inability to clearly see the fingers of a hand at a distance of three meters in daylight, since there are only a few residues of vision.
The impact of visual impairment, congenital or acquired, on the individual and psychological development, varies widely among individuals, as well as the degree of disability.

[1] Estimate at 1999 - World Health Organization (WHO, 2005).

There are varying degrees of blindness, to mention a few (Gill, 2000; Barker, Barrick, & Wilson, 1995):
- Retinopathy of prematurity: caused by the immaturity of the retina, due to premature labor or excess oxygen in the incubator;
- Congenital Cataract: as a result of rubella or other infections in pregnancy;
- Injury in central area, more common in older people, who have difficulties in seeing details, recognize people and differentiate colors;
- Macula degeneration, central vision loss;
- Injury in a suburb area, such as glaucoma;
- Retina degenerations and cortical visual impairment;
- The combination of two lesions may also occur, producing a type of fragmented vision or with spots, sometimes associated with retinal problems or diabetes;
- Tunnel vision, which is central zone vision only.

However, there are many more problems associated with visual impairment, such as low vision, preventing individuals from having a clear image of the surroundings or a focused object. Between the two extremes of visual capacity, there are pathological situations such as myopia, strabismus, astigmatism, and amblyopia, among others.

Referring to the infant universe, approximately one in each thousand children aged 0-16 years is visually impaired. This represents 50 children on an average population of 250,000[2]. Lowenfeld (1989) and Diatkine (1997) state that the "world" of the blind child is the one he achieves with his open arms, and suggest the need for other people to help expand that world.

It is easily understandable that the lack of vision will be reflected on all of the child's development, particularly at the cognitive level, in the capacity for imitation, integration, and even at the motor level. For that reason, it is essential that the child is encouraged to tackle these obstacles from an early age, as to find a way to work around them.

Beyond family, school and society can and should contribute in helping to tackle the obstacles posed by the disability. The school has a key role for the inclusiveness of children with visual impairment (blind or with low vision), especially by breaking prejudices.
Learning is here understood as the human capacity to receive, collaborate, organize new information and, from this transformed knowledge, act differently from what was done before. We learn from other human beings and/or from things around them (Masini, 1993).

The education system is not, in its majority, tailored to the needs of these children. Schools should adjust themselves and offer a learning system that works with the biological, psychological and social characteristics of children. It is known that, in general, in basic education, play is rarely accepted in classrooms, and the few moments of leisure activity are remitted to the playground, outside the classroom, and even in these few moments, adults prefer that the playfulness remains calm (Pereira, 2000 apud Pessanha, 1997).

[2] The Royal College of Ophthalmologists & the British Pediatric Association. (1994). Ophthalmic services for children. A report of a joint working party. Services for children who are partially sighted or blind. R. C. Ophth. BPA. London. pp. 13-14.

Pais (1991) noted that play is a universal language and that it facilitates group experiences. He considers that, through this activity, it is possible build a communication that may decrease the difference between the statutes and codes of the different individuals involved.

For children aged between eight and ten years old — a segment that is represented in the control and sample groups treated in this research —, the children's main activity is study. School is a place of learning and socialization, fundamental to the children's routine. This applies to all children, both sighted as blind, or with low vision. Reading and writing have a fundamental role in our society, being regarded as indispensable skills, even for those who are unable to see, which use other techniques, such as Braille[3].

However, the issue of color for people with visual impairment is more difficult to circumvent.

"Color is not the property of objects, spaces, or surfaces; it is the sensation caused by certain qualities of light that the eye recognizes and the brain interprets"(Mahnke, 1996, p.2).

"Our eyes are attracted to colour to such an extent that the colour of an object is perceived before the details imparted by its shapes and lines" (Feisner, 2000, p.2)

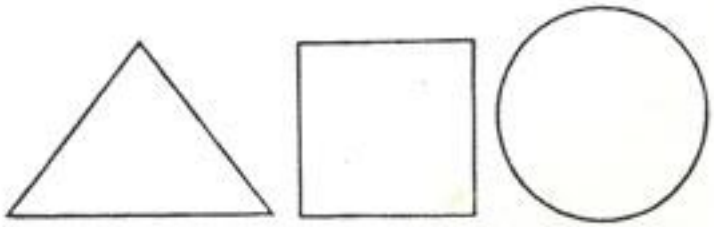
Able to understand and store lots of information, the human brain has acquired knowledge over time, which is often encoded.

There are currently several codes that convey different messages, regardless of geographical location, culture or beliefs of each individual. Generally, these codes have common elements such as the shape and color, as for example the existing traffic signs in road traffic, the existing symbols on clothing for the care and maintenance of textiles, the symbols in household appliances, among others. However, being based on shape and color, they eventually exclude a segment of the population — people with visual impairments, whether blind, with low vision, color blind, among other visual damage.

3. Project Development – Empirical Phase

When called by Gropius (1883 - 1969) for the Bauhaus in 1923, where he directed the section of wall painting, Wassily Kandinsky (1866 - 1944) developed an association for colors. As referred by Rodrigues (1989), in 1923 Kandinsky distributed a questionnaire at the Bauhaus, asking respondents to fill a square, triangle and circle with the primary colors: red, yellow and blue. Kandinsky hoped to discover a universal correspondence between shape and color, based on the equation red = square, yellow = triangle, blue = circle.
Kandinsky achieved remarkable success with his questionnaire, the equation of the yellow triangle, red square and blue circle would inspire several projects at the Bauhaus in the early 1920s.

[3] The first known attempt to develop a system of reading for visually impaired people occurred in 1580, when letters of the Roman alphabet were engraved in bas-relief on small pieces of wood. In 1825, Louis Braille invented an efficient system of reading and writing for the blind, which persists to this day and is used worldwide.



Fachgebiet (Beruf): .....
Geschlecht: .....
Staatsangehörigkeit: ....

Zu Untersuchungszwecken bittet die Werkstatt für Wandmalerei des Bauhauses Weimar, folgende Aufgaben zu lösen:

1. Füllen Sie diese drei Formen mit den drei Farben Gelb, Rot und Blau aus. Die Farbe sollte die jeweilige Form ganz ausfüllen.
2. Geben Sie, wenn möglich, eine Erklärung für Ihre Farbverteilung.

Erklärung:

Figure 1. W. Kandinshy: Questionnaire for the Bauhaus students, regarding the relation between shape and color (Rodrigues, 1989).

Although it is not a color code, but rather a study, the proposal carried out by Kandinsky shows a possible correlation between these two variables that could assist people with visual disabilities.

Following the study of Kandinsky and with the support of direct observation, interviews and questionnaires to educators, parents and children with visual impairments, this research project was carried out.

Children between eight and ten years old from the Helen Keller Centre[4] in Lisbon, Portugal, were chosen for this study. All of these individuals suffered from total or partial visual impairment. After months of observation and interaction with the children, faced with the possible existence of a color code that would help in the recognition of colors, all individuals immediately showed great interest and enthusiasm, preferring the integration of geometric shapes rather than simple lines.

It should be noted that people with visual impairment have adopted personal methods of color recognition in response to their daily needs. An example of this adaptation is the use of labels written in Braille on clothes. However, for this application, it is always necessary to resort to another person for placing the label on the right piece of clothing.

Based on the studies, it was concluded that it would be of great value to develop a color code, called *Feelipa*.

[4] School dedicated to the integration of students with visual impairments and other educational needs http://www.centrohelenkeller.pt/

To respond to the research objectives, it was decided that the code should have the following characteristics:

- Be universal and easy to learn;
- Be easily recognizable, regardless of its size;
- Always presented in relief, for easy and proper touch recognition[5];
- To have a logical functioning, associating colors to basic geometric shapes.

In this sense, it can be considered that the code is easy to learn by the use of geometric shapes that are universal symbols, and therefore can be recognized anywhere in the world regardless of the language spoken. These geometric shapes are known to all individuals from the first years of life, and easily identified even by people with visual disabilities. The use of geometric shapes is also sustained in the study done by Kandinsky, which was previously referred.

4. Color Code - *Feelipa*

For a better understanding of *Feelipa Color Code*, a detailed description, aided by images, is supplied below.

Primary Colors

The principle of this code is based on the association of the geometric shapes, square, triangle and circle, to the colors, red, yellow, and blue. With this association, we obtain the primary colors of the color code. As you will verify in the rest of the description, it is only necessary to memorize the primary colors to logically understand the complete color palette.

Figure 2. Primary colors, red, yellow and blue.

Secondary Colors

The secondary colors are achieved through the direct agglutination of the primary colors that are at the basis of their formation, making the code a logical system. Thus, if we combine the circle (blue) the triangle (yellow), we will have a compound shape that represents green. Joining the square (red) with the triangle (yellow), there arises another compound shape that identifies orange. Finally, if we to join the circle (blue) with the square (red), we obtain a compound shape that represents purple. This is the same reasoning behind the mixture of color pigments, which reinforces the simple logic of the color code.

[5] Information provided by ACAPO - Association for the blind and partially sighted Portugal. <http://www.acapo.pt/>

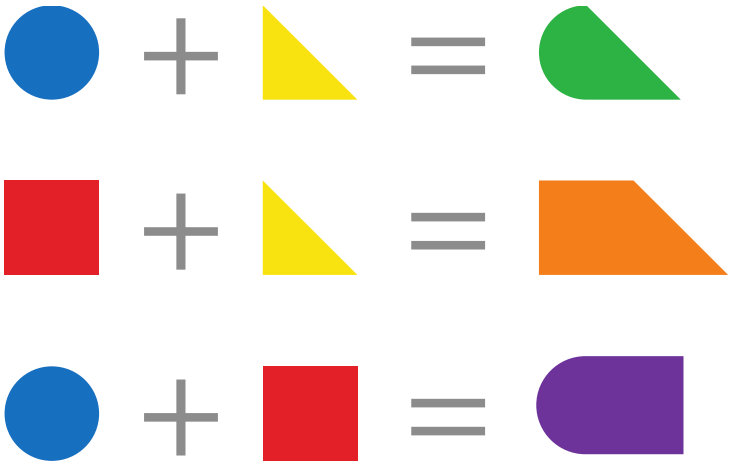


Figure 3. Secondary colors, green, orange and purple.

Tertiary Color

The tertiary color brown follows the same logic, which results from the combination of two secondary colors, and for that reason represented by the union of two compound shapes.

Figure 4. Tertiaty color, brown.
Achromatic

Regarding black, gray and white, because they have different characteristics, they are not represented by geometric shapes, but by straight horizontal lines with enough thickness to be recognized by touch. Black is identified with three lines, gray with two and white with only one straight horizontal line.

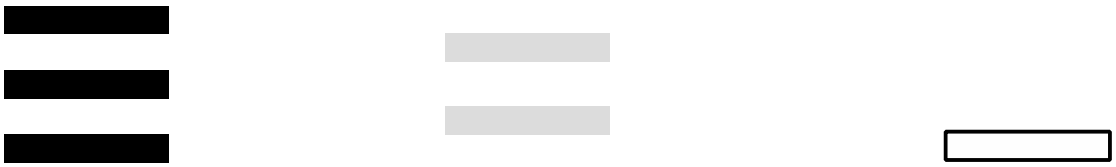


Figure 5. Black, gray and wihite.

Shades and tints

For a greater enrichment of *Feelipa Color Code*, the tints and the shades were also developed, so that the full palette is more complete and with a greater number of variants of colors.
In this sense, to obtain the tints, the geometric shape of the base color and the line that represents the color white are used. Once we blend white to a color, that same color gains a brighter tone. As shown in the figure below, the line that represents white is always outside

the geometric shape of the base color, so there is never an incorrect reading, regardless of its orientation.

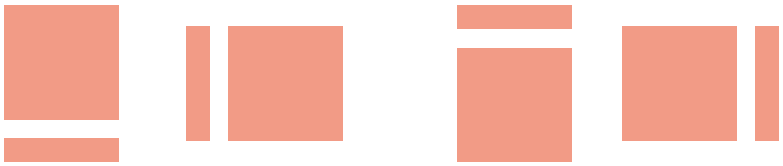


Figure 6. Tints, pink or light red.

With the shades, the reasoning is the same. Now introducing black inside the geometric shape. Like the tints, also in the dark tones the color is recognizable regardless of its orientation, because the lines are always within the geometric shape.

Figure 7. Shades, dark red.

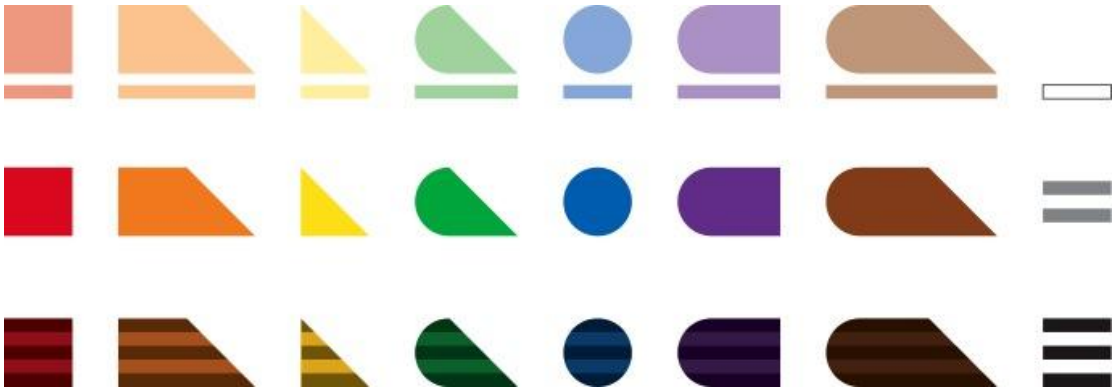


Figure 8. Complete color palette.

5. Code Applications

So we can have a better perception of the codes' value, three example applications were developed. Whether in the infant's sphere, or on many other objects and services within various age ranges, this code is an effective contribution for society in different supports and contexts.

Because the individuals of the sample group were in the third and fourth grade, a content analysis of their syllabus was performed, in various study areas, to select the one that best reflects the relevancy of the application of the *Feelipa* code in the associated content. Of this analysis, several hypothesis were found, but one subject was chosen: Geography, more specifically, the *Recognition of National Symbols* (third grade) and *Portugal in Europe and the World* (forth grade).

5.1 The Flags

Based on the syllabus, the flags of the world were considered to be a good choice, because of their rectangular, bi-dimensional shape, recognizable colors and other graphic elements.

With the implementation of the *Feelipa* code in the flags, it's possible to identify several constituent colors of each one of them.

With that said, puzzles were developed in the shape of boards so that the code could be validated within the sample group and, later, within the control group. The boards include a legend that indicates each country in Braille and also in normal writing. Inside the board, in low relief, are the colors of each flag represented by the cut pieces and the code. You can also find the code, in relief, on the surface of each puzzle piece to enable the color recognition.

Throughout the research, ten flag puzzles were developed:

- Portugal;
- European Union;
- France;
- Italy;
- Germany;
- Netherlands;
- Luxembourg;
- Switzerland;
- Japan;
- Finland.

Figure 9. Flags.

The selection of the countries wasn't random. The Portuguese and European Union flags would always have to be present in this research. Not only because they are the representing flags of this research's origin, but also because they are directly integrated in the syllabus mentioned before. France, Italy, Germany, Netherlands and Luxembourg flags were chosen because of their graphical stripe representation (vertical or horizontal) and for not containing any graphical differentiators. This allows the recognition to be made only by color, therefore the *Feelipa* code applied to each surface of the constituent pieces.

Switzerland and Japan were selected to show how the puzzle would work when there is only a glance of color in a surrounding space. Lastly, the Finish flag was developed to see if the difficulty of the puzzle would increase given its complexity.

5.2 The tags

Another developed application for the code was the tag. The relevance of this application is due to the fact that, daily, we encounter a need to choose the clothes we want to wear. For the visually impaired, and mainly blind people, this task requires the help of a third person, without vision problems.

Being one of our main goals to increase the visually impaired autonomy, the code's application to an everyday object is considered of extremely high importance. The tag application was also chosen because it presents the minimum size possible for the code to be recognizable by touch.

It should be noted that the implementation of the code is possible in other types of tags, as long as they are always in relief. Jars, bottles, paperboards, among other supports and materials that already have labels with the content and composing identification, would only see this new information added, the constituent color.

5.3 The toppers

Since Prehistory, we have registered our life's experiences and the surrounding world through graphical representation, drawing and colors. In this sense, it was very important to boost this artistic expression within the visually impaired by developing toppers for pencils and pens so they can identify, through the code in the topper, the color in which they are painting and/or writing.

Pencils and pens are objects of our daily lives in every age group and color is fundamental for their correct use. Although, given the small dimensions of their tip, it wouldn't be viable to apply the *Feelipa* code directly onto it. Firstly, it wouldn't be noticeable when touched and secondly, very hard to practically manufacture throughout all pencil and pen brands.

Therefore, the utilization of the silicon toppers is suggested, so that it can be applied on either pens or pencils with different thicknesses or profiles – given that it's an adaptable material.

Figure 10. Toppers.

With the use of this application, more autonomy is conceded to visually impaired people, given that they don't have to resort to a third party every time they want to paint or write something in a specific color.

It is also important to emphasize the fact that, this application constitutes a new object in the market because it cannot be directly incorporated in the main support. This shows the color code's adaptability through an external application in a situation where its minimum size is not supported.

This phase was determinant for the investigation project. The validation accomplished with the sample and control group seeks the verification of everything that was treated and developed at theoretical and practical level. To reach this goal, a largely widespread and recognized technique by the scientific community was used: usability testing.

"Usability testing (...) employs techniques to collect empirical data while observing representative end users using the product to perform realistic tasks" (Rubin & Chisnell, 2008, p.19).

This technique or method allowed to evaluate the code given its:

- Efficiency;
- Effectiveness;
- Satisfaction;
- Accessibility;
- Utility;

The samples of the usability testing were divided into two participants groups: nine individuals with visual disability (sample group) and nine without any type of disability (control group). For a greater equality of circumstances, the second group was rated according to the same visual conditions as the first, achieved through the use of eye patches.

The utilization of these nine new individuals was given to the fact that we intended to validate not only the code with visually impaired people, but also understand if they would have more of less difficulties learning and building the puzzles than the nine initial individuals with impaired vision. Therefore, reinforcing the simplicity and universality of the code.

The tests were made in the same environment than the explanatory interviews, which means they were taken in the classrooms of the individuals. This created a more comforting situation for them.

All of the sessions started with the presentation of the code, using a wooden board with the respective legend of the colors/shapes. Next, the puzzles were introduced individually, followed by simultaneous pairs, increasing the difficulty of the construction. For each piece that was placed in the right place, the individuals were asked to identify the geometric shape and its corresponding color. After the conclusion of the puzzles, the individuals were again confronted with the introductory wooden board, so they could again identify the shapes/colors through a random imposition of hands conducted by the researcher.

Based on the obtained results, and comparing the two groups, we can conclude: regarding the individuals with impaired vision, all of them had a total understanding of the primary colors. This was reflected in the results with an average of 8 seconds when associating the geometric shapes with the colors.
In parallel, the second group, the individuals with sight, who understood the primary colors, presented an average of 11 seconds.

The secondary colors were not fully understood by the visually impaired individuals, while full sighted individuals understood them perfectly. Even so, the situation was the same as with the primary colors. While individuals with visual impairment had numbers vary within 10 and 20 seconds, the control group had its values between 20 and 50 seconds.

This difference of values is given to the fact that visually impaired children are more used to touch recognition than other children that, normally, have a more visual approach to a new object or situation.

The receptivity and understanding of the code was evaluated with an average of 4,2, for the visually impaired, and 4,1 for the control group. In a scale where zero is “very hard” and five is “very easy”. Even though the difference is not significant, the individuals with sight claim to have had more difficulty than the visually impaired.

When building the puzzles, the visually impaired individuals built them correctly, with one or other mistake, but always recognizing the colors of each country and showing great enthusiasm along the way.

Regarding the construction of the puzzles, we can conclude that even with little flaws, the Individuals with visual impairment built puzzles correctly, always recognizing the constituent colors of each country, showing great enthusiasm for it.

In turn, with the sighted individuals, a smaller number of errors have been witnessed in all of the puzzles. However, there was a significant increase in errors when building the Finnish flag, the puzzle with the greatest number of parts. Comparing to the visually impaired individuals, this shows that there is less control of the board and puzzle pieces by

the sighted individuals. The individuals with visual impairment are in better control of their area of action, and memorize the elements and their location the best, even when the complexity is increased.

After analyzing the results obtained with the usability testing, we can conclude that the *Feelipa* code achieved a higher than expected receptivity and understanding. It was found to be easily apprehended, which generated a progressive comfort with it, so much in individuals with visual impairment as in sighted individuals.

In order to perceive the impact, feasibility and acceptability of the code by the individuals, after three months of validation and subsequent interaction with the code, the nine individuals were again addressed. It was intended to understand if some knowledge had been stored — explicit memory, ie, a conscious and voluntary recall of information received, which is easily brought to mind with a preposition or image (Association of Neuro-Psychiatry Archives, 2011). This effect was verified, since all individuals were able to remember the code, correctly identifying all associations of colors to geometric shapes.

7. Conclusion

With the presented applications, it was possible to validate the code, and with its potentialities and plurality of applications, it was possible to materialize the independence, inclusion and autonomy that *Feelipa* can confer on the lives of people with visual impairment, both children and adults.

We can easily imagine its adaptation to numerous situations, particularly in signage, whether on public transportation, hospitals, textile, furniture, utensils or decoration. Also in the fine arts field, in pencils, pens and paints. An even on faucets or other objects related to temperature, associating, for example, the hot and cold to red and blue, respectively. The code can be applied in its own teaching methodology in learning colors, as it is already being explored and developed in partnership with the Helen Keller Center.

In summary, wherever color is located and is irrelevant from the identification and/or action point of view, *Feelipa* is likely to be applied.

Based on everything that has been developed in this research, it is believed that it is possible to arouse interest for further paths of research with the visually impaired, in order to create or adapt existing products for a better quality of life and autonomy.

It should also be noted that *Feelipa* has been registered and is intended that all of its end-users have free access to it. In order to facilitate this urge, the author founded her own company to not only develop objects with the code, but also to adapt existing products. Another goal is to partner with other companies and institutions that have an interest to integrate the code into their products or services, making their brands more inclusive and with a greater bond of social responsibility.

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Study on Brain Waves in Color Spaces in line with Personality Types

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Abstract

This study is aimed at comparatively analyzing the characteristics of brain waves in color spaces with a life-size mock-up by personality type, using MBTI that can explain the individual differences in preferences; MBTI is a personality type test used most extensively that helps identify personality types. To accomplish the objectives, the characteristics of brain waves in color spaces were examined in line with personality types of adults in their 20s-30s.
Through this study, I have seen that personality type influences brainwave.

1. Introduction

1.1 Background and Purpose of the Study

Recently, rapid development of brain science witnesses a lot of studies that use brainwave in various areas, especially education and academic achievement. Such research orientation is also found with the studies on the personality traits. Brainwave is detected at the scalp electrodes and serves as the indicator of brain activities, being the representative vital sign that is applicable to all humans. Personality is the process that serves as the agent for an individual in maintaining, instructing, and presenting his or her behavior while controlling the ability to self-adjust by figuring out preceding or following internal and external factors. The definition mainly focuses on 'individual differences', and various measurement methods are being used to assess personality.

Lately, with computer and scientific development, studies are conducted on brainwave measurement by personality, whereas studies designed to measure brainwave on full-sized mock-up in color environment are insufficient. Hence, by using MBTI test which is most widely used as a personality type test and can explain individual differences according to preferences and orientations, I am going to perform a comparative analysis of the brainwave characteristics by personality type in actual-sized mock-up color environment.

1.2. Method and scope of the study

Targeting adults in their 20s and 30s, this study measured and examined the brainwave in color environment by personality type. The study proceeded as shown in figure 1.

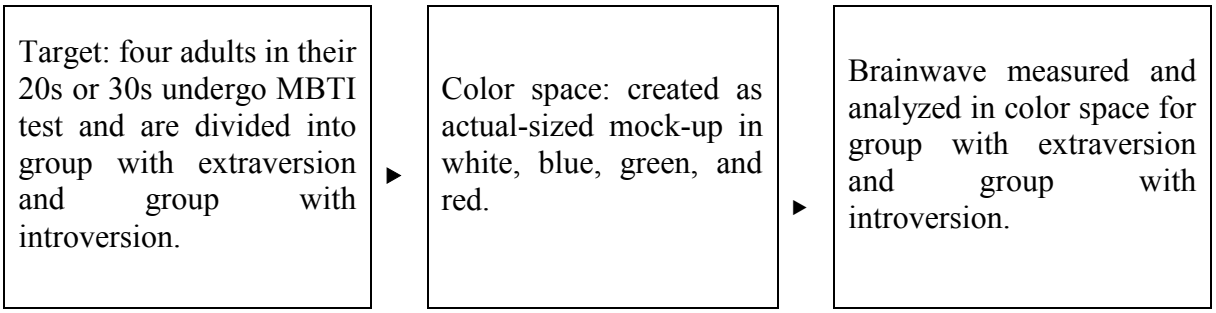

Figure 1. Method of the study implementation

2. Specifics Of The Study

2.1 Research method

2.1.1 Experiment environment

For the study, MBTI test was performed in the lab of "C" school. The subjects underwent the personality type test, using computers.

The space for brainwave experiment was divided into four rooms respectively with a size of 1500㎜×1500㎜×2400㎜. The lighting fixture had the size of 600㎜×600㎜, using Standard Illuminant D65 with the illuminance of 100lx. The experiment spaces were painted respectively in white (N9.5, S0500-N), blue (7.5BG 5/8, S2555-B30G), green (7.5G 5/8, S2555-G), and red (5R 4/14, S2070-R), in order to reduce the visual errors in texture or seams potentially created from the finishing with paper etc. By minimizing factors that interfere with the measurement for the experiment (such as noise and light), I created an environment that would ensure a stable experiment. Also, to prevent drowsiness in brainwave measurement, I took measures to keep measurement errors minimized including ventilation during the subjects' adaptation to the white space, which was the reference space.

2.1.2 Experiment method

In conducting MBTI test, I gave the subjects a sufficient amount of time to read and understand the instructions related to the test before the experiment went ahead.

For the brainwave measuring test, I had the subjects sit comfortably on the chair placed in the center of the white room before I applied electrodes on them. To reduce tension or nervousness in what was an unfamiliar space, I made sure that the subjects took some five minutes to adjust to the space before I performed a 1-minute measurement in another room in some other color. And to prevent the afterimage from the space where measurement proceeded, the subjects took a break for five minutes in the white space before they moved to another color space, where their brainwave was measured as shown in figure 2.

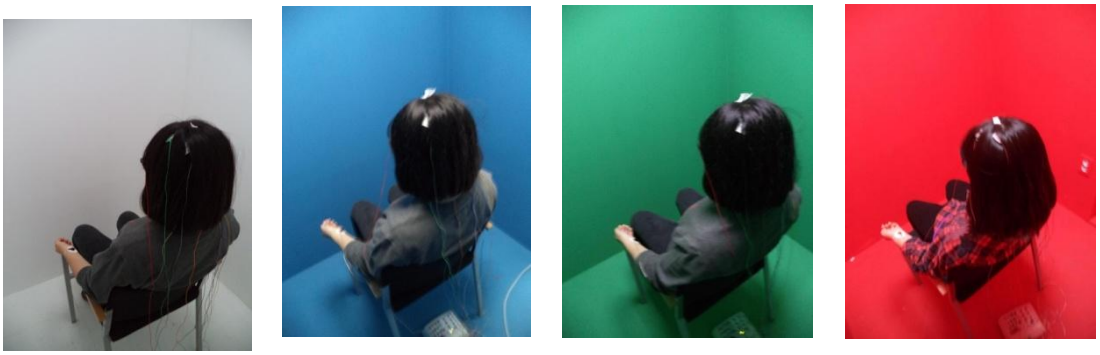

figure 2. Braiwnave measurement in different color spaces

2.2 Measuring tools
2.2.1 MBTI test

MBTI test, which was used to assess the subjects' personality types, is a self-report study of personality types that Katharine Cook Briggs and Isabel Briggs Myers created on the basis of the typological theories proposed by Carl Gustav Jung with a view to ensuring its use in everyday life. Jung's typological theories that served as the basis for MBTI state that individuals prefer fundamentally different methods in collecting data from outside (perception) and making decisions to act based on the collected data (judgment).

2.2.2. Brainwave measuring test

For the brainwave measurement in this study, I used PolyG-I (Laxtha, Inc., Korea), a computerized polygraph system that can simultaneously measure the brainwave, electrocardiogram (ECG), and electromyogram (EMG) that occur in the human body. The device includes as hardware wireless brainwave measuring equipment (WEEG-8) and as software the real-time data collection and time series analysis program (Telescan). In applying electrodes for the purpose of measuring brainwave, ten-twenty electrode system of the International Federation was used to install electrodes on the pre-frontal (Fp1, Fp2), the frontal (F3, F4), the parietal (P3, P4), the Occipital (O1, O2), and the left-right earlobes (A1, A2). To measure heartbeat, I attached a snap electrode on the wrist.

The subject's brainwave signal was filtered with 0.5-50㎐ pass filter and converted with 16bit AD (Analog-Digital converter) before the date was saved to computer for collection purpose.

2.3. Organization of the subjects

The study targeted adults in their 20s or 30s, who were provided with a preliminary description of the research method and purpose. Those subjects who expressed their wish to participate were provided with a sufficient dose of precautions about the experiment and were organized as seen in Table 1 with their prior agreement.

Table 1.Treat the constituent

Gender	Woman : 3 Man : 1
Age	26 ~ 31
Experimental period	2014.04 ~ 2014.06

Those candidates excluded from the test previously suffered from brain diseases, psychiatric issues, and/or ophthalmologic diseases. As part of pre-measurement precautions, the subjects were instructed to have enough sleep the previous night and abstain from having caffeine-included beverages from 6 hours to the start of the measurement.

3. Results And Analysis

Following the implementation of MBTI test, the subjects were divided into group with extraversion and group with introversion according to the MBTI personality types to conduct the brainwave experiment.

In the brainwave experiment, brainwave variance was measured by monitoring it with the data collection and analysis program called Telescan from LAXTHA, which is a computerized polygraph system. For respective channels, the measured values were put to relative power analysis.

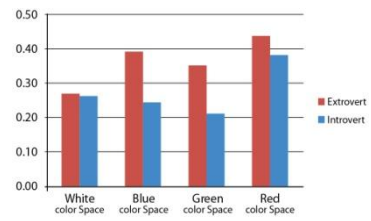	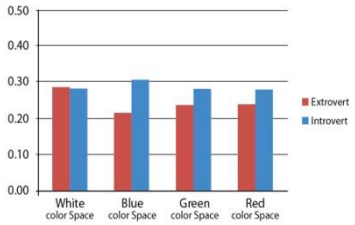	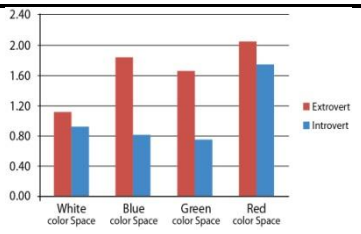
RA (Relative Alpha Power Spectrum)	RB (Relative Beta Power Spectrum)	RAB (Ratio of Alpha to Beta)

Table 2. Graph for indicator-specific brainwave variance in different color spaces

The analysis was performed on the brainwave indicators of RA (Relative Alpha Power Spectrum, 8-13/4-50㎐) that represents relaxation and stability, RB (Relative Beta Power Spectrum, 13-30/4-50㎐) that represents tension, alertness, and concentration, and RAB (Ratio of Alpha to Beta, 8-13/13-30㎐) that represents the alpha/beta ratio. Table 2 shows in a graph the results of the brainwave measured in response to color spaces in the pre-frontal that has rational thinking and cognitive ability for different concentration-related indicators.

4. Conclusion

The study is designed to figure out the characteristics of the brainwave by MBTI personality type in the color spaces in blue, green, red, and white. The study was implemented in the following three stages.

1) Four adults in their 20s or 30s were given MBTI test in order to classify them into group with extraversion and group with introversion, while brainwave was measured, using PolyG-I.

2) Brainwave measurement was conducted in the colors spaces, which were composed of white (N9.5, S0500-N), blue (7.5BG 5/8, S2555-B30G), green (7.5G 5/8, S2555-G), and red (5R 4/14, S2070-R).

The results of the analysis of the implemented study are as follows. The analysis of the brainwave measured on the pre-frontal that has rational thinking and cognitive ability shows that for RA indicator, the group with extraversion grew in all color spaces. For RB indicator, the group with introversion grew in the blue, green, and red spaces. For RAB indicator, the group with extraversion grew in all the color spaces. I saw that the group of people with extraversion who were curious, active, and confident about a new environment were relaxed and stable in all the color spaces, whereas the group of people with introversion who were defensive about a new environment were tense and alert in the blue, green, and red spaces. Through this study, I have seen that personality type influences brainwave.

The number of the subjects for this study is too small for any generalization. So, I think further study is necessary targeting a greater variety of subjects and experiment spaces while considering the number of subjects, age, and sex.

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Comparison of Fluorescent Color Perception using Real Objects and LCD Monitor

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Abstract

Through subjective experiments, the perception of fluorescent colors displayed on an LCD monitor was compared to the colors of real fluorescent objects. We conducted these experiments under two different conditions: one with the stimuli seen through a window and the other without a window. In the experiment using a window, observers could not recognize whether the target color was a display color or a real object color when they looked at the stimuli through the window. Alternatively, in the experiment without a window, the observers could distinguish between displayed color and real object color. The observers evaluated the "sense of fluorescence" in the presented color stimuli based on the magnitude estimation method. We prepared twelve stimuli showing fluorescent colors of real objects. In addition, we employed twelve color stimuli displayed on a calibrated LCD monitor. Hence, the observers evaluated twenty-four color stimuli in all. The results in the case of the experiment using a window showed that the "sense of fluorescence" in the displayed color was almost the same as that of the real object color. In contrast, in the case of the experiment without a window, the "sense of fluorescence" in the displayed color was significantly less than that of the real object color.

1. Introduction

Fluorescence emission is a common phenomenon in many natural and synthetic materials, such as cells, gems, inks, papers, and clothes. Previous research has reported that fluorescent surfaces are present in 20 % of natural scene objects (Barnard, 1999). Thus, it is important to measure, analyze, and reproduce fluorescent colors as well as reflective colors in natural scene objects.

In general, the color of a reflective object is determined by the spectral power distribution of reflected light, which is derived from incident light and surface spectral reflectance. In contrast, the color of a fluorescent object is composed not only of reflected light but also fluorescence emission, which is a phenomenon whereby the material is excited by electromagnetic radiation in a specific wavelength and then emits electromagnetic radiation in another longer wavelength as the excited state diminishes (Tominaga, 2013). As a result, a unique “sense of fluorescences” is achieved for fluorescent colors.

Although a considerable amount of research has been conducted on the appearance and perception of object colors (Fairchild, 2013), little scientific research has been conducted on the perception of fluorescent color. An essential problem as yet unsolved is whether the same "sense of fluorescence" as a real fluorescent object can be perceived as a fluorescent color displayed on a monitor.

In this paper, we investigated through subjective experiments the perception of fluorescent colors displayed on an LCD monitor compared to colors from real fluorescent objects. We conducted these experiments under two different conditions: one with the stimuli seen

through a window and the other without a window. These experiments were conducted to investigate the masking effect in fluorescent color perception.

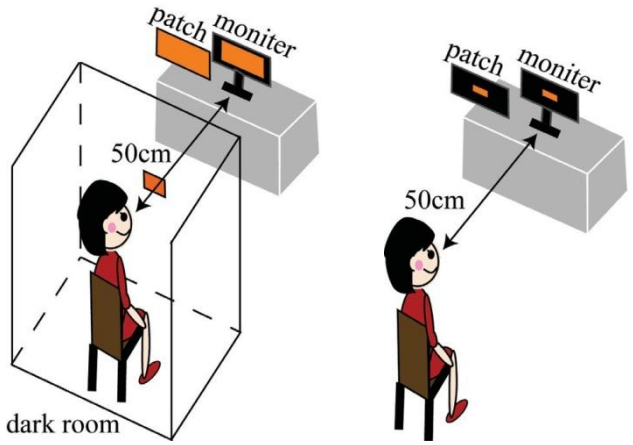
2. Experimental Method

2.1 Experimental Overview

Figure 1 depicts two experimental conditions. To investigate human perception of fluorescent color, we conducted subjective experiments under two different conditions: one using stimuli seen through a window (Experiment I) and the other without a window (Experiment II). In the experiment that involved the use of a window, observers could not recognize whether the color was from a display or from a real object when looking at the stimuli. Alternatively, in the experiment without a window, observers could distinguish between displayed color and real object color.

2.2 Experimental Stimuli

We prepared twelve stimuli showing fluorescent colors from real objects (fluorescent color patches of blue, green, orange and yellow) with three types of illuminants (A: artificial sunlight only, B: artificial sunlight together with a UV light source, and C: artificial sunlight together with two UV light sources). In addition, we employed twelve color stimuli displayed on a calibrated LCD monitor (EIZO ColorEdge 221). Hence, the observers evaluated twenty four color stimuli in all. In this article, we use "object-yellow B" to refer to a yellow object stimulus under illuminant condition B and "monitor-blue C" for a monitor blue color stimulius with under illuminant condition C. Figure 2 shows the *xy* chromaticity of the stimuli with object-blue B and object-blue C falling slightly outside of the gamut. The average color difference ΔEab excepting the two blue color stimuli was 1.16.



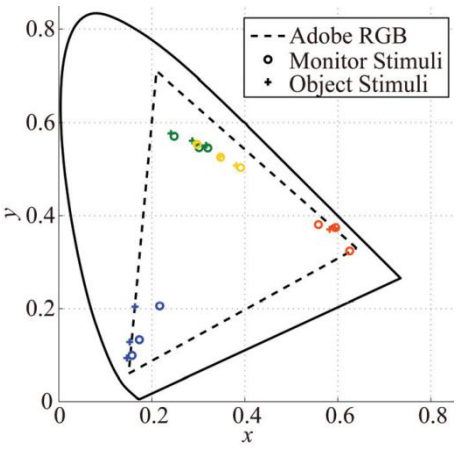


Figure 1: Experimental overview. *Figure 2: xy chromaticity of stimuli. (left) with a window. (right) without a window.*

2.3 Experimental Procedure

Ten observers participated in the experiments. They evaluated the "sense of fluorescence" of the randomly presented color stimuli based on the magnitude estimation method. We instructed the participants to use "50" as the "sense of fluorescence" score for object-yellowB, which could then be used as the reference for their subjective scores. If the observers could not perceive a "sense of fluorescence", they gave the score "0." The maximum subjective score was unrestricted. The viewing distance was 50 cm, and the size

of the stimuli was 4 × 5 cm (2~3 visual degrees). The observers evaluated each stimuli three times. The median of the three scores was used as the representative subjective score.

3. Results And Discussion

Figures 3 and 4 show the results of Experiments I and II. The results in the case of the experiment with a window (Experiment I) show that the "sense of fluorescence" in the displayed color was almost the same as that in the real object color. In contrast, in the case of the experiment without a window (Experiment II), the "sense of fluorescence" in the displayed color was significantly less than that in the real object color.

Table 1 shows the average scores of Experiments I and II. As shown in this table, the displayed colors seen without a window exhibited a significantly decreased "sense of fluorescence." In summary, when we humans view displayed color through a window, we perceive a realistic sense of fluorescence. In contrast, when we are aware that the color is from an LCD display, it is difficult to perceive a realistic sense of fluorescence in the displayed color.

Table 1: Average Scores of Experiment I and II.

	Real object	LCD monitor	Difference
Experiment I (with a window)	51.9	49.4	2.5
Experiment II (without a window)	50.6	38.5	12.1
Difference	1.3	10.9	

4. Conclusions

Through subjective experiments, the perception of fluorescent colors displayed on an LCD monitor was compared to colors from real fluorescent objects. According to the experimental results, the perceived "sense of fluorescence" of a real object color is almost the same as that of a displayed color when the stimuli are presented through a window. In contrast, when we are aware that the color is from an LCD display, it is difficult to perceive a realistic sense of fluorescence in the displayed color.

Acknowledgements

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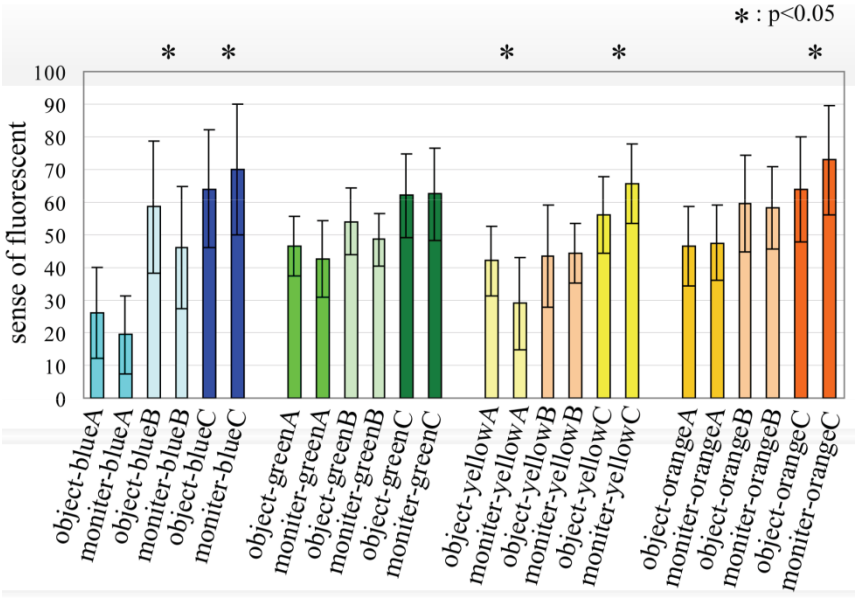

Figure 3: Results of Experiment I (with a window).

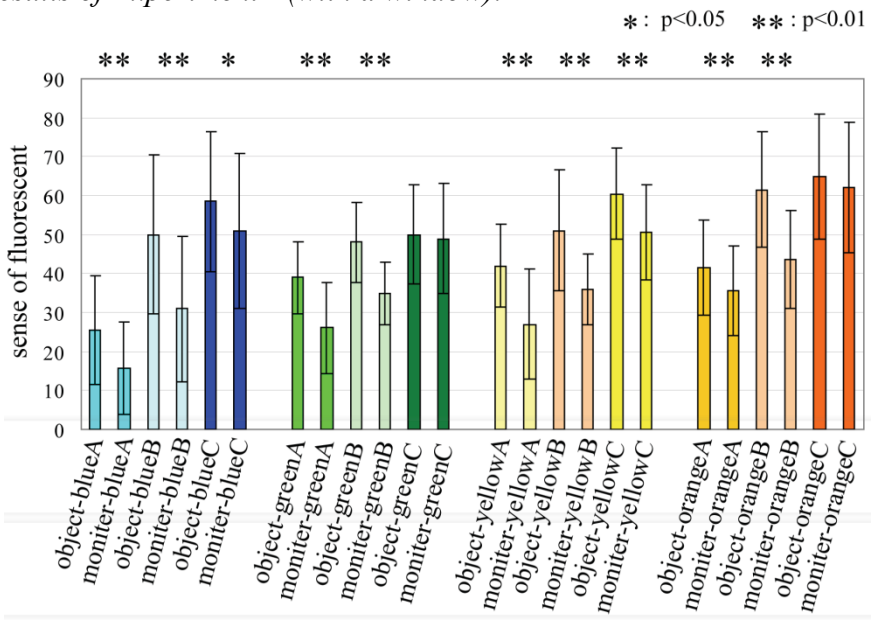

Figure 4: Results of Experiment II (without a window).

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Real-Time Spectral Imaging System Using Complementary Color Filter and RGB Camera

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Abstract

Spectral Image has spectral information in each pixel. The spectral image becomes important for recording and reproducing exact color information in various fields. Especially digital archiving of cultural asset needs measurement of spectral image. However it is difficult to capture spectral image because of changing color filters, using multiple cameras and so on. If spectral image can be captured by only one camera without changing color filters, we can easy record and reproduce exact color in short time.

This paper proposes a novel spectral imaging system using only one camera without changing color filters with the use of special optical element that can acquire 4 images with different spectral properties in one image. This optical element installs 4 different color filters. As the color filters we use 3 complementary color filters (yellow, cyan and magenta) and a transparent filter. Therefore this proposed system can measure 12 bands information (R, G, B, CR, CG, CB, MR, MG, MB, YR, YG and YB) of the same scene in one shot. A captured image by our proposed system has 4 quarter size images in one image. These quarter images are extracted from the image, and registered position by images captured calibration board with checker pattern. Spectral information is calculated by an estimation matrix of spectral information obtained from an image captured targets with known spectral reflectance in each pixel. Then we can get a spectral image. Our proposed system can acquire one spectral image in one shot, so spectral video image can be captured by this system.

Experimental results show the proposed system could estimate more accurate spectral reflectance than RGB 3 bands and capture spectral images. Moreover the system could capture spectral video image.

Introduction

The color information is important for object recognition and representation, and is widely studied in the field of computer vision. In particular, the multi-band imaging attracts more attention in recent years. In the case of traditional three-band shooting, there is a limit to the fineness and range of colors that can be stored, so recording accuracy of vivid colors and subtle color are insufficient. Digital cameras have been used conventionally can not be obtained only few RGB information. It has been difficult to record the exact color of the object by the illumination environment at the time of photography and the characteristics of the device. In recent years, the spectral data is

drawing attention. Spectral Image has spectral information in each pixel. By utilizing the spectral information, an object identifying studies have been performed (MANABE 1996). The spectral image becomes important for recording and reproducing exact color information in various fields (MIYAKE 1998). Especially digital archiving of cultural asset needs measurement of spectral image. However it is difficult to capture spectral image because of changing color filters, using multiple cameras and so on. If spectral image can be captured by only one camera without changing color filters (PARMAR 2010), we can easy record and reproduce exact color in short time.

This paper proposes a new spectral video imaging system. Further, using the proposed system, we construct the spectral video measurement system, and verified the usefulness of this method.

The Proposed Methed

This paper proposes a novel spectral imaging system using only one camera without changing color filters with the use of special optical element that can acquire four images (GAURAW 2006) with different spectral properties in one image. Four different color filters are installed as a part of the optical element. As the color filters, we use three complementary color filters (yellow, cyan and magenta) and a transparent filter. Therefore this proposed system can measure 12 bands information (R, G, B, CR, CG, CB, MR, MG, MB, YR, YG and YB) of the same scene in one shot. Figure 1 is shown in the mechanism of the optical element used in the study.

Registration process

A captured image by our proposed system is tiled image of four images that are quarter size of camera resolution. These quarter images are extracted from the image, and registered position by images captured calibration board with checker pattern. Figure 2 shows the state of calibration.

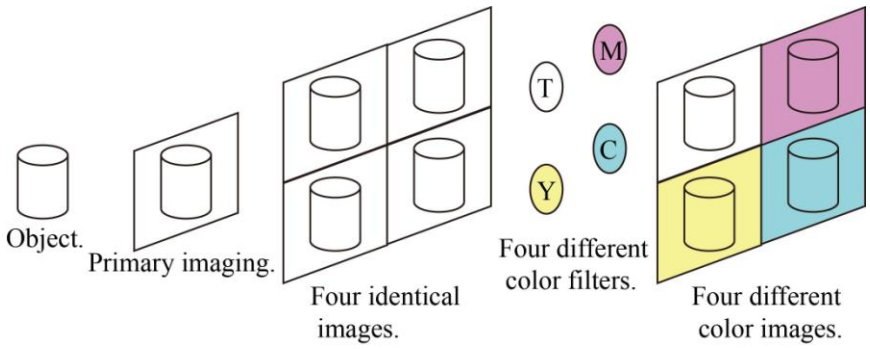

Figure 1. Mechanism of the optical element used in the study

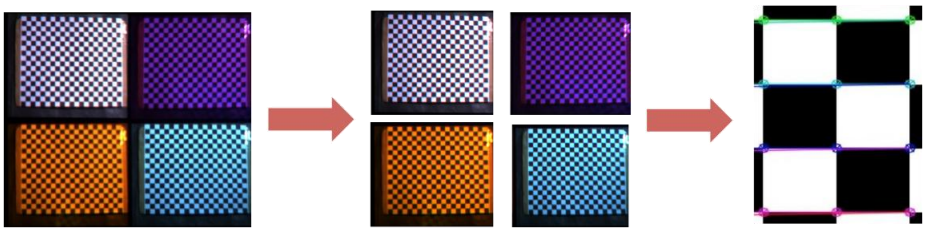

Figure 2. State of calibration

Spectral reflectance estimation

Spectral information is calculated by an estimation matrix of spectral information obtained from an image captured targets with known spectral reflectance in each pixel. Then we can get a spectral image. Our proposed system can acquire one spectral image in one shot, so spectral video image can be captured by this system.

To estimate the spectral reflectance from images taken with a camera, it is necessary to obtain an estimation matrix in advance. To determine this estimation matrix, we measured the spectral distribution data and RGB data. Figure 3 shows the shooting environment.

In this study, we use the incandescent lamp as the light source, by shooting the color chart (24 colors) in the dark room, to obtain the RGB value of each color. In similar environments, we measure of the spectral distribution data of each color of the color chart using the spectroradiometer. The wavelength was measured for each 5nm in 380nm ~ 780nm. And the g, r, is the spectral distribution and the RGB data information. It is possible to obtain the estimation matrix H from equation (1). We can estimate the spectral information from the image using equation (1).

Figure 3. Shooting environment

$$g = Hr$$

$$gr^T(rr^T)^{-1} = H \tag{1}$$

Experimental Results And Discussion

As a result of the estimated spectral information, two graphs are shown in Figure 4. The vertical axis is spectral reflectance, and the horizontal axis is wavelength. In the graph of Figure 4, the blue line is measurement data of the color chart each color, and the red line is the estimated data. These estimated results show that the proposed system can estimate the spectral information using 12 bands. To obtain a close value to the measured spectral distribution data on the whole, it is possible to estimate the 12 bands.

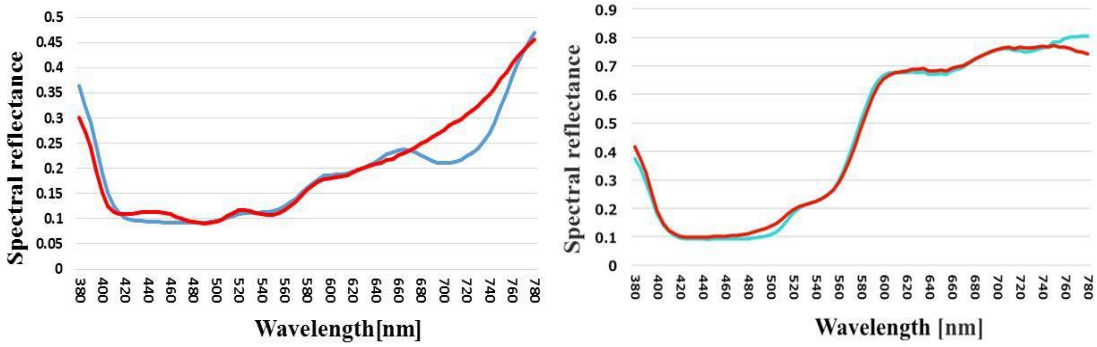

Figure 4.Result comparison graph of the spectral information estimation
(a) Brown of CMYT filter used (left), (b) Orange of CMYT filter used (right)

In the experiment, we shot a video image of 15 fps with CMYT filter (C: Cyan, M: Magenta, Y: yellow, T: colorless transparent). Figure 5 shows one frame of a taken video image. Further, it is assumed D65 light source, a light source to spectral information estimated from Figure 5. Figure 6 (a), (b) show each image by converting the CIERGB color system. In this experiment, assuming the shooting under illumination light of two kinds, and outputs the resulting image. Here, we calculated the mean square error of the spectral distribution data was measured and estimated each at the time of use only C filter and CMYT filter. It was possible to get better results when using the CMYT filter.

From this result, it was possible to confirm the adaptation to the moving image and to obtain the spectral dynamic image. However, It is about 6.8 seconds on average that measures the processing time per frame. We could not output the video image at 15 fps.

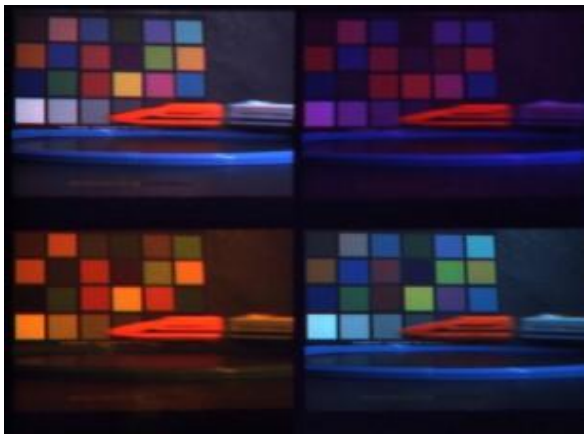

Figure 5. One frame of the moving image shooting

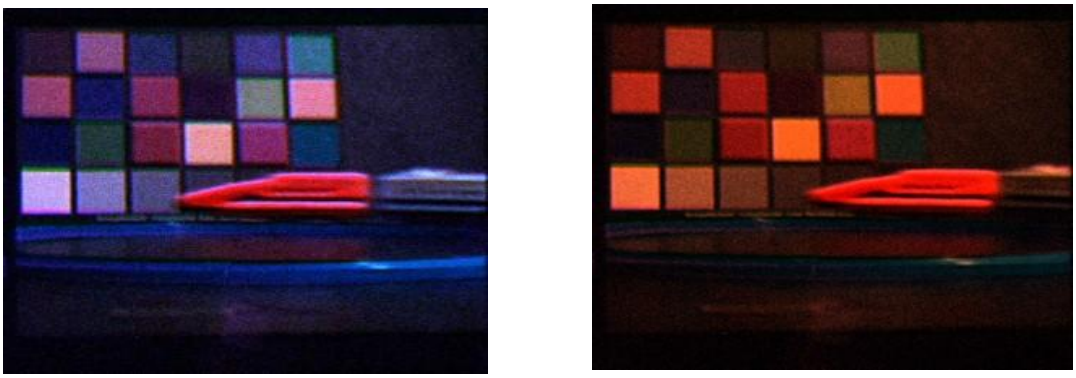

Figure 6. Image result

(a) D65 light source assumption (left), (b) A light source assumption (right)

Conclusions

This paper proposes a novel spectral imaging system using only one camera with the use of special optical element that can acquire 4 images with different spectral properties in one image. We constructed a spectral video imaging system using a spectral image. In the proposed method, it was possible to obtain a spectral video and spectral information with high accuracy. However, the processing time of one frame takes about 6.8 seconds. In the future, we will speed up the process of estimating spectral information.

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A New Metric Of Image Quality Assessment For Stereoscopic Content

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Abstract

Automatic or semi-automatic stereoscopic image quality assessment has arisen due to the recent diffusion of a new generation of stereoscopic technologies and content demand. Thereby, there is a growth in asking for algorithms of Stereoscopic Image Quality Metrics (SIQA). In this paper, we present a method for assessing the stereoscopic image quality, QUALITAS. QUALITAS is grounded on some human visual system features such as contrast sensitivity, effect of disparate image quality in left and right images, and distance perception, which do not depend on the images being tested. QUALITAS is defined in five stages. Instead of averaging individual qualities of the stereo-pair, QUALITAS introduces Contrast Band-Pass Filtering on a wavelet domain at both views, namely our algorithm perceptually weights left and right images depending on certain viewing conditions. This paper includes the comparison of 27 Metrics SIQA proposed by 16 authors, which summarizes the work made in this field in the recent five years, on image database LIVE 3D. Some algorithms can be combined with any 2D/Normal Image Quality Assessments (NIQA), giving as a result that QUALITAS was compared against 221 Metrics. QUALITAS obtained the best results in terms of overall performance of correlation coefficients. We conclude all metrics in SIQA-SET are simple modifications of NIQA, which take into account some extra characteristics from the disparity map (usually depth variances). Instead QUALITAS incorporates disparity masking in addition to divide 3D scenario in two parts: background and foreground planes. Moreover QUALITAS employs a contrast band-pass filtering, so dynamic parameters are considered as observational distance. It includes loss of correlation, luminance and contrast distortion. It takes into account the visual differences between left and right images, employing a penalization depending on their wavelet energy. Thus, the novelty of QUALITAS lies in combining some the best features of stereoscopic image quality assessments.

KEYWORDS: Stereoscopic image quality, Quality assessment databases, 2D image quality.

Introduction

Figure 1 depicts a general scheme of stereoscopic imaging, which is divided in three

blocks objective assessment (in green), subjective assessment (in blue), and strength of relationship (in red). Objective assessment is a subsystem constituted by the following parts:
1) Input: Left and right images.
2) Process: Stereoscopic coding.
3) Output: Stereoscopic image.
4) Feedback: Stereoscopic image quality assessment (SIQA).

Bertalanffy in [1] proposed the general systems theory, which describes that Feedback verifies how efficient the Process is. So, the main goal of the SIQA is to measure in the stereoscopic image either image quality or degradation of the original stereo-pair whereas for the process of stereoscopic Coding is to obtain the least possible degradation of the original stereo-pair. In other words, any kind stereoscopic image coder employed in 3D Cinema, for instance, needs to support its results using a SIQA. This lead us to mention that the recent growth of stereoscopic algorithms goes hand in hand to the growth of the way to predict its quality. Thereby, the algorithms that assess the quality of a stereoscopic image has gained great importance.

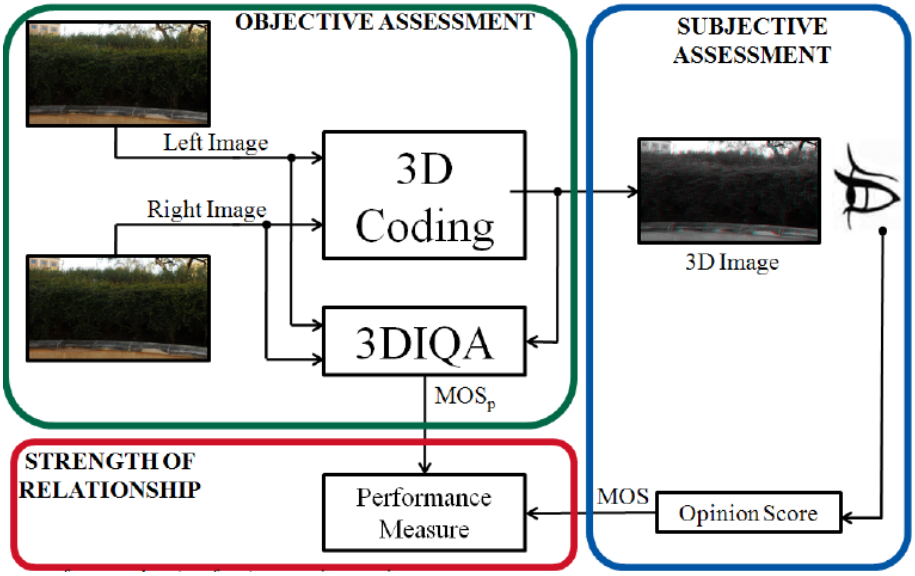

Figure 1. Block diagram of a general system for stereoscopic assessing.

It is reasonable to base SIQA from NIQA, since the observers employed in psychophysical experiments or subjective assessments [2], [3], [4] evaluate image quality from different slices in 2D scenario, which depend of the apparent distance.

Stereoscopic Image Quality Assessments

OBJECTIVE ASSESSMENTS

From Figure 1 (green block, Objective Assessment), the main goal of any the stereoscopic image quality is to predict a subjective response, namely finding a predicted

MOS (MOSp). Then, Table I shows the 27 stereoscopic metrics from 16 authors, this set of 27 metrics will be call henceforth SIQA-SET. It is worth noting that some authors propose more than one metric and we maintain the metric name that they gave them. Thus, we eventually will refer to a certain metric by the name that appears in the corresponding row, not by its author. Also, SIQA-SET was coded ourselves in MatLab.

Table 1. Stereoscopic image quality assessments.

Algorithm	Metric
Akhter et al. [4]	$AkMOS_p$
Benoit et al. [5]	d_1 d_2 d_3 Ddl_1
Bosc et al. [6]	Q_s
Chen et al. [7]	C_m
Gorley et al. [8]	$SBLC$
Gu et al. [9]	$ODDM_4$
Hewage et al. [10]	$PSNR_{edge}$
Jin et al. [11]	MSE_{ms} MSE_{dp}
Joveluro et al. [12]	PQM_{3D}
Mao et al. [13]	Q_{mao}
Shao et al. [14]	Q_{shao}
Shen et al. [15]	$HDPSNR$
Solh et al. [16]	$3VQM$
Yang et al. [17]	IQA SSA
You et al. [18]	$YouDMOS_p$ OQ DQ_{map_1} DQ_{map_2} DQ_{map_3}
Zhu et al. [19]	e_i

SUBJECTIVE ASSESSMENTS

In the field of subjective stereoscopic image quality assessment, few image databases have been developed. We have employed LIVE 3D stereoscopic image database of the Laboratory for Image and Video Engineering of the University of Texas at Austin (USA. LIVE 3D contains standardized psychophysical experiments [40] and their stereoscopic images quality data are based on observer opinion score, collected with individual quality judgments, in Figure 1 the blue block Subjective Assessment). In each trial, the images are rated on a scale of excellent, good, fair, poor, and bad. Then, by means of statistical procedures, the data are processed, finally obtaining the mean opinion scores (MOS). Each stereoscopic image database applies different statistical procedures; the reader can refer to the citation for the details. Additionally, MOS merges results of different types in a form that allows the comparison with any kind of stereoscopic assessment metric. Since SIQA predicts subjective responses, namely it obtains a predicted MOS or MOSp.

Experimental Results

From Figure 1 red block, strength of relationship between normalized MOS and MOSp is measured by a Performance Measure (PM), such as correlation coefficient. Strength of

relationship gauges how strong is the tendency of two variables to move in the same or opposite direction. The performance measures used are:

- Spearman's Rank Ordered Correlation Coefficient (SROCC),
- Kendall's Rank Ordered Correlation Coefficient (KROCC),
- Pearson's Linear Correlation Coefficient (LCC) and
- Root-Mean-Squared Error (RMSE).

Any correlation coefficient value close to 1 indicates good correlation with human perception, while lower values of RMSE indicate better performance.

Table 2 shows the performance of an overall experimental result, which includes all SIQA of the SIQA-SET in addition to QUALITAS. Thus, QUALITAS correlates in 93.92% and 76.68%, Figure 11, being the metric that obtains the best LCC and KROCC, respectively. In terms of SROCC, the best ranking metric is d2 UQI, since it is best with 93.35%. Also, based on these results, DQmap2 is the most accurate metric not only for all set of distortions considered but also for JPEG2000 and JPEG distortions. Regarding only these image compressiondistortions, QUALITAS is the best ranking metric in both distortions obtaining the highest correlation in both rank ordered coefficients.

Table 2. Overall performance across SIQA-SET including QUALITAS in predicting perceived stereoscopic image quality.

Distortion	SIQA	NIQA	PM	Value
ALL	QUALITAS	none	LCC	0.9392
	d_2	UQI	SROCC	0.9335
	QUALITAS	none	KROCC	0.7668
	DQ_{map_2}	none	RMSE	0.1289
JP2K	QUALITAS	none	LCC	0.9467
	QUALITAS	none	SROCC	0.9126
	QUALITAS	none	KROCC	0.7443
	DQ_{map_2}	none	RMSE	0.0961
JPEG	d_2	UQI	LCC	0.7620
	QUALITAS	none	SROCC	0.7384
	QUALITAS	none	KROCC	0.5396
	DQ_{map_2}	none	RMSE	0.0742
WN	QUALITAS	none	LCC	0.9333
	d_2	MSSIM	SROCC	0.9425
	d_2	MSSIM	KROCC	0.7911
	d_1	BRISQUE	RMSE	0.1001
Blur	d_2	UQI	LCC	0.9558
	MSE_{ms}	none	SROCC	0.9318
	$YouDMOS_p$	AD	KROCC	0.7818
	$PSNR_{edge}$	NAE	RMSE	0.1156
FF	QUALITAS	none	LCC	0.8684
	QUALITAS	none	SROCC	0.8256
	QUALITAS	none	KROCC	0.6371
	d_2	BPSNR	RMSE	0.1116

Conclusions

This paper includes the comparison of 27 Metrics SIQA proposed by 16 authors, which summarizes the work made in this field in the recent five years. Some algorithms can be combined with any NIQA, giving as a result that QUALITAS was compared against 221 Metrics.

QUALITAS obtained the best results in terms of overall performance of correlation coefficients either LCC, SROCC or KROCC with 93.92%, 93.34% (just 0.01% below the best one), and 76.68%. For Root Mean Squared Error, QUALITAS did not get the best results, because it was developed with the aim of increasing any kind of correlation coefficient at certain times sacrificing accuracy.

We conclude all metrics in SIQA-SET are simple modifications of NIQA, which take in to account some extra characteristics from the disparity map (usually depth variances). Instead QUALITAS incorporates disparity masking in addition to divide 3D scenario in two parts: background and foreground planes.

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Color Contrast In Natural Scenes Under Daylights With Different Correlated Color Temperatures

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Abstract

Image contrast, such as luminance and color contrast, represent important information in object recognition. But the object colors depend also on both the spectral reflectance of the surfaces and the spectral power distribution (SPD) of the light impinging on them. It has been argued that our human visual system is adapted to natural stimuli to code the visual inputs it receives. The main objective of this work is to quantify the contrast changes under daylight illuminant changes. We used different hyperspectral images to simulate them under daylights with Correlated Color Temperatures (CCT) from 2,735K to 25,889K, and computed image contrast under those CCTs. Our results in the CIEL*a*b* color space suggest that a* chromatic component captures most of the daylight changes with L*- and b*-components being stable.

Key words: Daylight, Color Imaging, Natural Scenes, Color

1. Introduction

Many studies have been concerned with measuring contrast in images [1-3] but only few studies have addressed the influence of daylight in the contrast perceived [4]. Image contrast, such as luminance and color contrast, represent important information in object recognition. But the object colors depend also on both the spectral reflectance of the surfaces and the spectral power distribution (SPD) of the light impinging on them. It has been argued that our human visual system is adapted to natural stimuli to code the visual inputs it receives. Psychophysical experiments have shown that the effects of the illumination cannot only determine color reproduction but also directly influence naturalness and color preference [5]. Figure 1 illustrates how different illuminant CCTs influences the color appearance of complex images. Although the images appear visually different nothing can be objectively say.

Figure 1: *Example of the color appearance changes for a natural scene rendered under daylights with CCT of (left column) 25,889K, (middle column) 6,479K and (right column) 2,735K.*

2. Methods

We used different hyperspectral images of fruits [5] to simulate them under daylights with Correlated Color Temperatures (CCT) from 2,735K to 25,889K. Next we computed a Difference-of-Gaussian (DoG) image contrast under those CCTs. A DoG-based contrast DoG(x,y) was introduced following on from [6]. We have used center and surround radii of different values with $r_S = 2r_C$ (same weighted circularly-symmetric Gaussians to model center and surround).

Besides we have used the classical Weber fraction to take into account local contrast changes. The Weber fraction C_W definition of contrast can be used to measure the local contrast of a single target of uniform luminance seen against a uniform background. Its common definition is $C_W = \Delta L/L$, where ΔL is the increment or decrement in the target luminance from the uniform background luminance L.Hyperspectral data were converted first to color signals using different spectral power distributions (SPD) of daylights with Correlated Color Temperatures (CCT) from 2,735K to 25,889K. The daylight SPDs were measured in Granada, Spain, from sunrise to sunset under different atmospheric conditions and covering a vast range of CCTs from 4,800K up to 30,000K. [7] Data were converted to CIE XYZ tristimulus values by using the CIE 1931 color matching functions, and those XYZ tristimulus values were converted into the IE1976 L*a*b* color space (CIELAB).

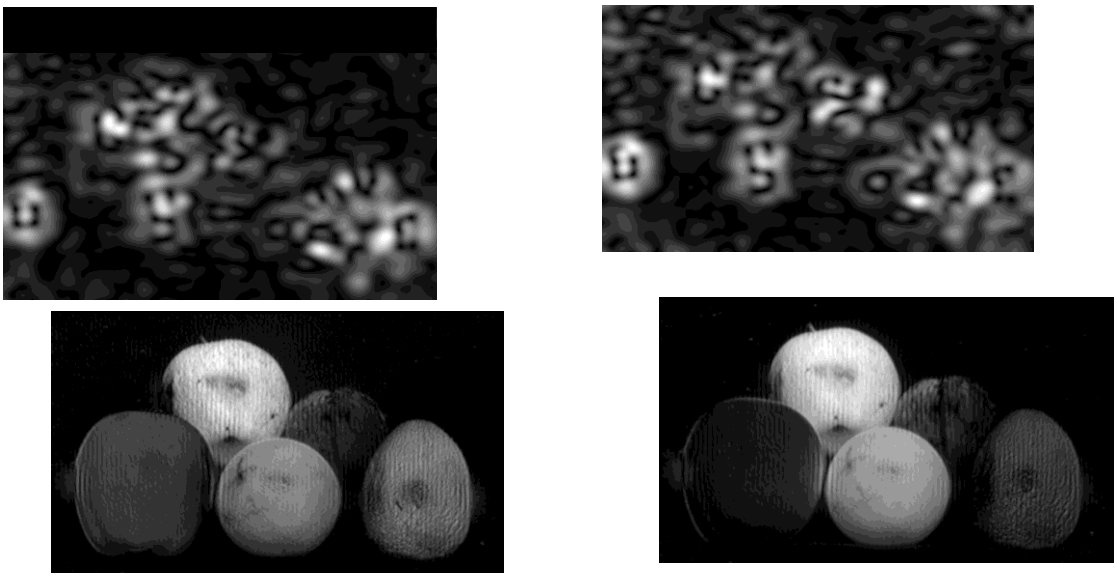

Figure 2: *Example of DoG contrast for a* evaluated for two extreme illuminants (left and right columns) and different rc and rs ratios (upper and lower rows).*

3. Results and Discussion

Figure 2 illustrates how DoG captures the contrast for different daylight changes and how different radii of r_C and r_S tend to preserve either the edges or the global spatial extend of the most relevant objects in the image. As reported by classical studies,[1] the results shows how the different center-to-surround sizes capture different image details. The results suggest that radii of r_C= 6 and r_S= 54 filter image in such a way that only edges are preserved in the image. By decreasing the ratio down to e.g. r_C= 6 and r_S= 12 spatial details are lost and small blobs across the image appears. On the contrary by increasing th e ratio the spatial structure of the objects is clearly preserved.

Figure 3 shows an example of the cumulative distribution function when the Weber contrast was computed for a* and b* components. The cumulative distributions for different daylight illuminants show some differences in a* and almost no influence of daylight along L* and b*, even for the extreme CCTs shown in the figure.

For a* results suggest that 50% of the pixels will show low contrast values below 0.005 under 25,889K; as CCT decreases there will less amount of pixels of contrast below that 0.005 value (only around 15% in that example).Thus, our results in the CIEL*a*b* color space suggest that a* chromatic component captures most of the daylight changes with L*- and b*-components being stable. Nevertheless, apart from this general result it is a matter of further studies how to relate the contrast computations based on those center-to-surround sizes with the chromatic content of the scenes.

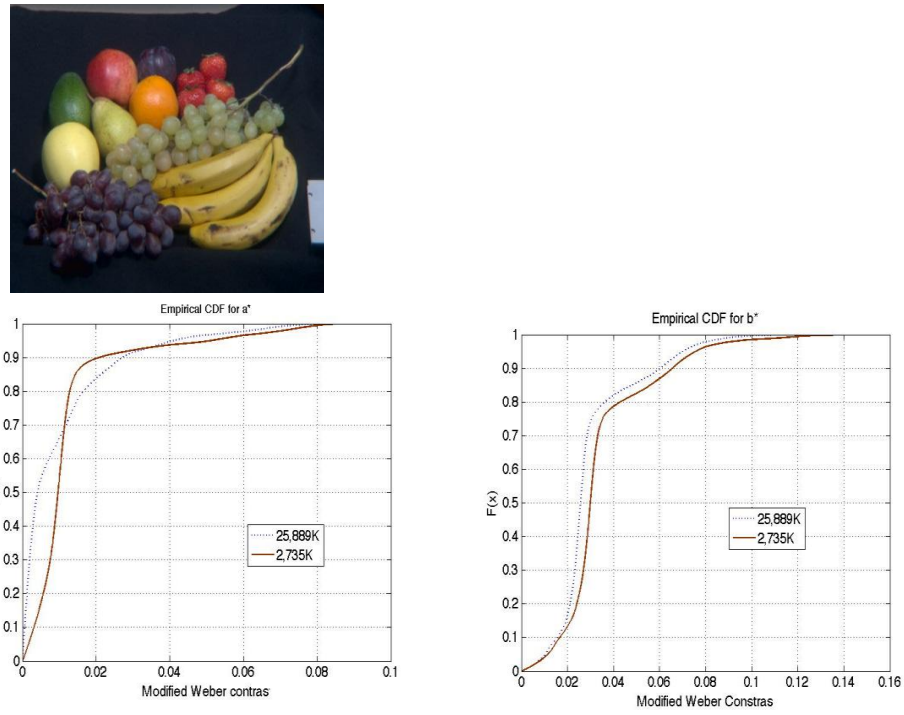

***Figure 3**: Example of the empirical cumulative distribution for a* and b* and two extreme daylights (a warm daylight with CCT of 2,735K and a cold daylight with CCT of 25,889K). **Figure 2:** Example of DoG contrast for a* evaluated for two extreme illuminants (left and right columns) and different rc and rs ratios (upper and lower rows).*

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Effects of Surface Color on the Estimated Freshness of Vegetables

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Abstract

Luminance distribution information is a critical cue for estimating visual freshness of vegetables, such as strawberries [Arce-Lopera et al, 2012, i-Perception, 3(5), 338–355] and cabbages [Arce-Lopera et al, 2013, Food Quality and Preference, 27(2), 202–207]. However, it remains unclear how color affects the freshness estimation of vegetables. Therefore, we conducted two kinds of experiment. They were designed to investigate the effect of the color of vegetables on our visual estimation of fresh vegetables by controlling the image color information. We took calibrated pictures of fresh vegetables: cabbage, carrot and komatsuna (Japanese Mustard Spinach) that gradually degraded in a controlled environment. In Experiment 1, we created gray- scale stimuli of the vegetable surface with the same luminance values as the original color images and derived results of freshness estimation using monochromatic and chromatic stimuli. We found no difference between the results, suggesting that the color does not add critical information for the visual freshness estimation. Moreover, in Experiment 2, we created strange color stimuli of the vegetable surface (e.g. yellow cabbage) with the same luminance values as the original color images. The freshness estimation results showed that visual freshness estimation does not depend on the color of the vegetable surface even when the color does not exist in nature. In spite that color information is an important cue for identifying the type of vegetable and for estimating the ripeness of vegetables, our results suggest that visual freshness estimation is quite robust against color modification.

Introduction

In daily life, we estimate food freshness by glancing but without touching. Even a small image patch of vegetables is enough for assessing freshness (Wada and Arce-Lopera et al. 2010), suggesting that visual information from vegetable's surfaces includes cues for freshness estimation. Luminance distribution information is a critical cue for estimating visual freshness of vegetables (Arce-Lopera et al. 2014), such as strawberries (Arce-Lopera et al. 2012) and cabbages (Arce-Lopera et al. 2013). However, it remains unclear how color affects the freshness estimation of vegetables. Therefore, we conducted an experiment. They were designed to investigate the effect of the color of vegetables on our visual estimation of fresh vegetables by controlling the image color information.

Methods

We took calibrated pictures of fresh vegetables: cabbage, carrot and komatsuna (Japanese mustard spinach) that gradually degraded in a controlled environment (20C/50% for komatsuna, 30C/20% for cabbage and carrot) with a constant temperature and humidity bath (ECONAS, Nagano Science) using a 2D luminance and chromaticity analyzer (UA1000, TOPCON) as shown in Figs.1 and 2. We created artificial stimuli of the vegetable surface with the same luminance values as the original color images but with xy-chromaticities of an aged vegetable. In addition, we created strange color stimuli of the vegetable surface (e.g. a stale carrot or yellow cabbage) with the same luminance values as the original color images. All visual stimuli were presented on a color-calibrated LC-monitor (ColorEdge CG245W, EIZO). The background was a uniform grey (Y = 28.5 cd/m2, $x = y = 0.3333$). Four participants (29-year-old in average) answered the freshness according to a 6-level scaling (1: very stale, 2: stale, 3: slightly-stale, 4: slightly-fresh, 5: fresh, 6: very fresh) with a PC's mouse, and three sessions were performed for each participant.

Fig.1 Experimental setting

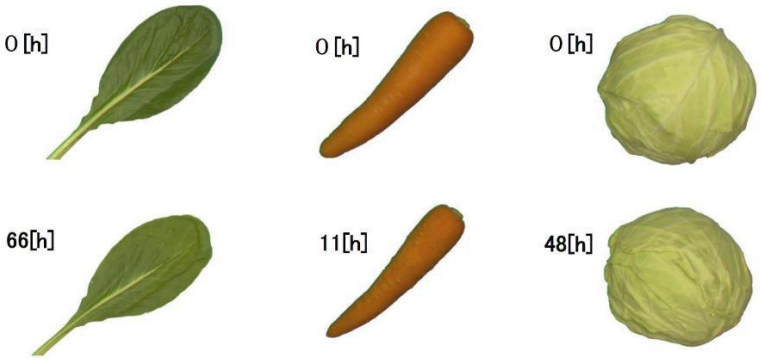

Fig.2 Original images for visual stimuli

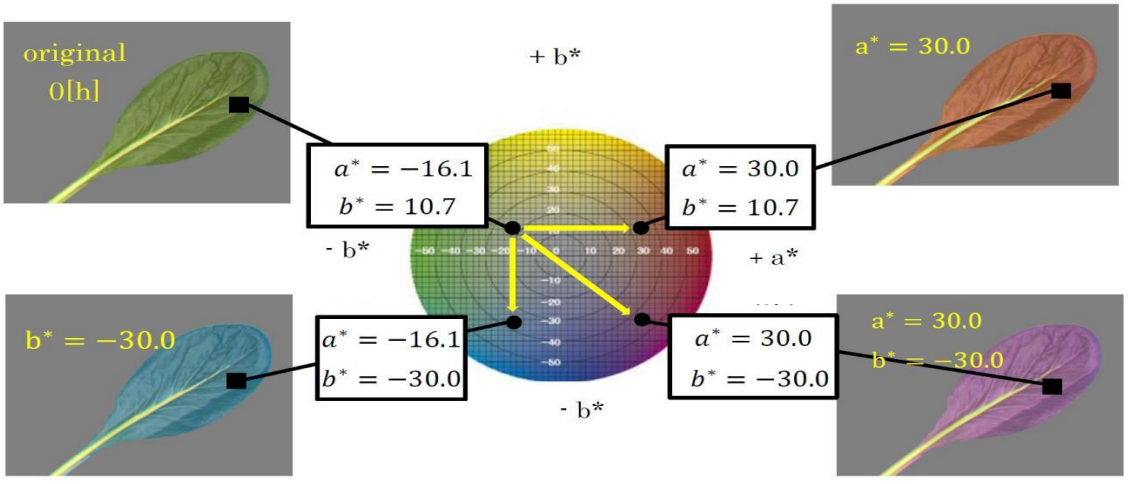

Fig.3 Examples of color transformation in a Komatsuna

Results And Discussion

We found no difference between the results as shown in Fig.4 “Ori” and [I], suggesting that the color information is no critical for the visual freshness estimation.
In addition, the freshness estimation results showed that visual freshness estimation does not depend on the color of the vegetable surface even when the color does not exist in nature as shown in Fig.4 [II]. In spite that color information is an important cue for identifying the type of vegetable and for estimating the ripeness of vegetables, our results suggest that visual freshness estimation is quite robust against color modification

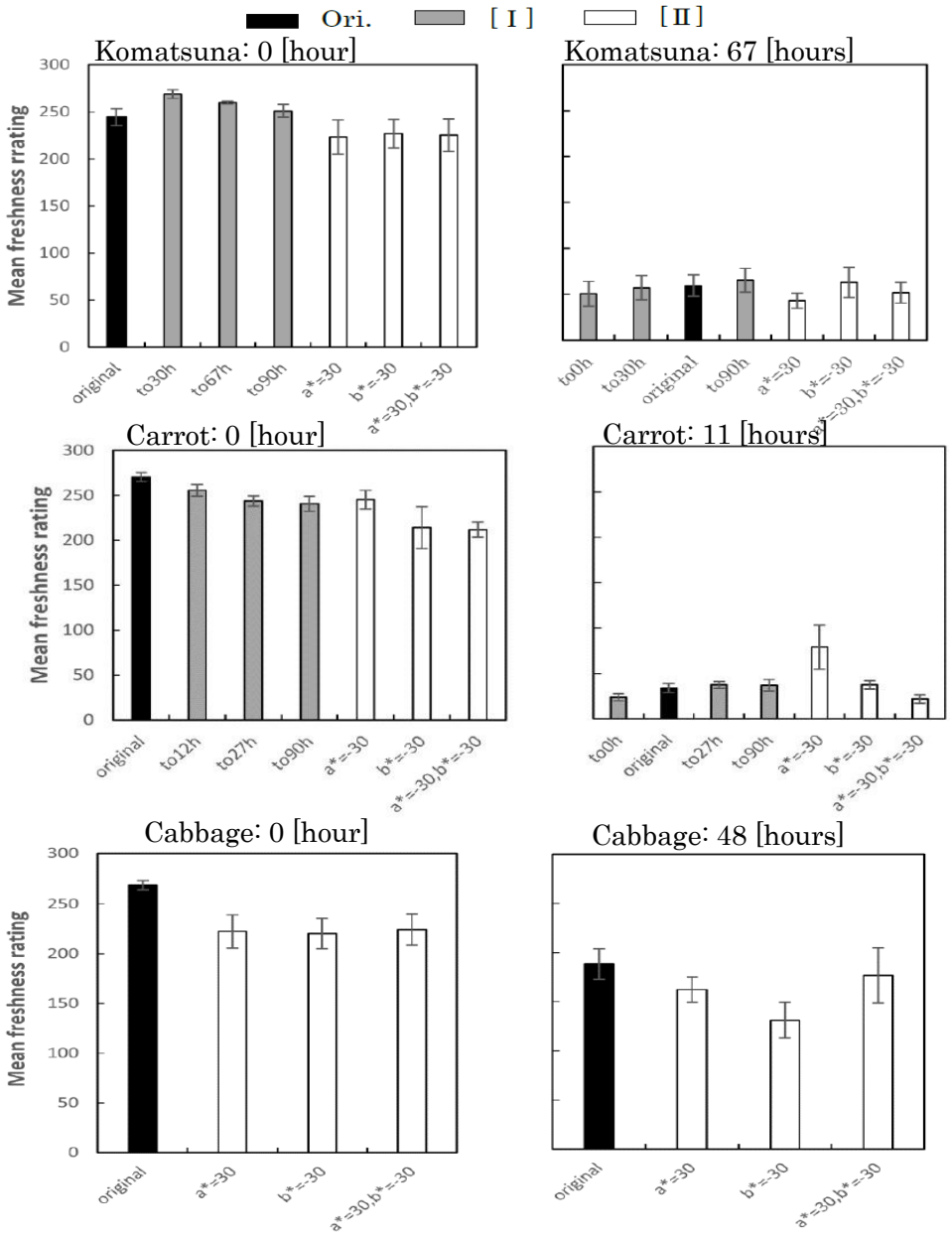

Fig.4 Results of Experiment 1 and 2. (Top: komatsuna, Middle: carrot, Bottom: cabbage)

Conclusions

We investigated the effect of the color of vegetables on freshness estimation by controlling the image color information. We found that the color information is not critical for the visual freshness estimation. In addition, freshness estimation is quite robust against modification of surface colors of vegetables even when the color does not exist in nature. Luminance distribution is a critical cue for freshness estimation whereas color information may be an important cue for ripeness estimation of vegetables as well as fruits.

Acknowledgments

This work was supported by JSPS KAKENHI Grant Number 25135715.

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Delicious-looking Color of Mug with Green Tea

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Abstract

Recently, green tea has been popular around the world and has been adapted to a variety of styles. This study aims at revealing which color of mug with green tea looks delicious. A subjective experiment was conducted by modifying the mug color. We prepared 2 kinds of green tea, one was a bottled green tea (yellowish color) and the other was a decocted green tea (yellow-green color). The chromaticity values of ceramic mugs with green tea were measured using a 2D colorimeter under the standard illuminant D65. In the experiment, the original mug color was replaced with one of several target colors. Nine kinds of chromaticity values (red, red-yellow (orange), yellow, yellow-green, green, blue-green, blue and red-blue (purple) and a grey) were tested. The luminance values were kept intact. Twenty participants observed the modified images presented on a calibrated LCD monitor and evaluated "predicted sweetness", "predicted sourness", "predicted bitterness", "predicted roasted-flavor" and "predicted deliciousness" with a 7 step numerical scale. Subsequently, they evaluated the images using a semantic differential method with five pairs of adjectives. Subjects were all female and in their twenties. As a result, we found that the yellow-green mug could make both the bottled green tea and the decocted green tea visually delicious, and that the yellow and the red-yellow mug could make the bottled green tea delicious-looking. On the other hand, the blue-green and the red-blue mug decreased the predicted deliciousness of both the bottled green tea and the decocted green tea. In addition, it is shown that the yellow-green mug could give natural, classical and noble impressions and the red-blue mug gave artificial, modern and unique impressions. In conclusion, although delicious-looking colors of mug depend on tea color, yellow-green mugs can make any green tea visually delicious.

1. Introduction

Recently, green tea has been popular around the world and has been adapted to a variety of styles. The taste, palatability and preference of tea are affected by the color of tea, the color of a cup, the table coordination, the lighting condition and so on. It was reported that sweetness is a strong promoter of overall pleasantness of soft drinks (Tang 2001). It was also reported that the preferred color is associated with sweetness and that sweetness is stronger as b^* value was higher, according to Thai observer's evaluations for the bottled green tea (Sueeprasan 2010). In addition, we found that yellow and yellow-red colors make the dishes more palatable, but red-blue colors make the dishes less palatable on the basis of the experiments in which the color of the plate rim changes (Okuda 2013).

This study aims at revealing which color of mug with green tea looks delicious. We conducted a subjective experiment by modifying the mug color with image processing technique.

2. Methods

We prepared two kinds of green tea, one was bottled green tea (yellowish color) and the other was decocted green tea (yellow-green color). The chromaticity values of ceramic mugs with green tea were measured using a 2D colorimeter (UA-1000/Topcon) under a standard illuminant of D65. The original mug color was replaced with one of 15 target colors. Figure 1 shows the chromaticity values of 15 mug colors on the a^*-b^* plane, and the luminance values of all mugs were kept intact (L^*=70).

Figure 2 shows the experimental space. Subjects observed a modified image shown in Figure 3 presented on a calibrated LCD monitor (CG245/EIZO). They evaluated five kinds of tastes, "predicted sweetness", "predicted sourness", "predicted bitterness", "predicted roasted-flavor" and "predicted deliciousness" with a 7 step numerical scale. Subsequently, they evaluated the impression using a semantic differential method with five pairs of adjectives, polite-vulgar, common-unique, modern-classical, natural-artificial and valuable-cheap. Twenty participants were all female in their twenties and had normal color vision.

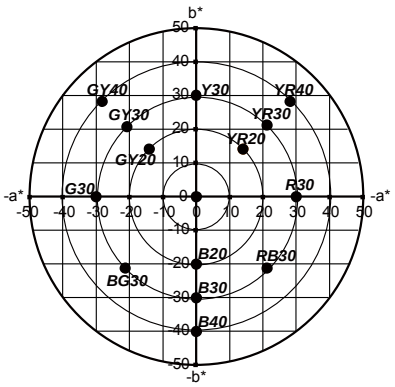

Figure 1. Chromaticity values of mug color conditions.

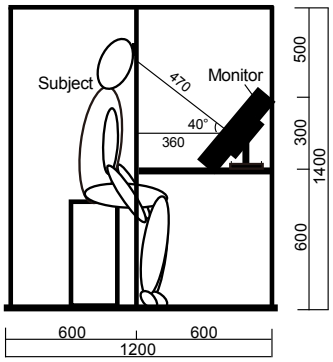

Figure 2. Experimental space.

Figure 3. Modified images of mug with green tea.

3. Results And Discussion

3.1 the predicted tastes of the green tea in the different color mugs

Figure 4 shows the mean values of the predicted tastes and deliciousness for the bottled green tea and decocted green tea in the different color mugs. Predicted sweetness and roasted-flavor of the bottled green tea was higher than that of the decocted tea, whereas predicted bitterness of bottled tea was lower than that of the decocted tea. Red and yellow-red mugs increased the predicted sweetness, and yellow and green-yellow mugs increased the predicted roasted-flavor of green tea.

The predicted deliciousness of the bottled green tea was high in the yellow-red or yellow mug. These evaluation results correspond to the results of the previous study on predicted deliciousness of the dishes (Okuda 2013). In addition, this study revealed that green-yellow mug made the bottled green tea delicious-looking, and that the deliciousness of the decocted tea was high only in green-yellow mug. On the other hand, blue-green and red-blue mug decreased the predicted deliciousness of both the bottled and the decocted green tea, which coincides with the previous study on the dishes.

These evaluation results were analyzed by a two-way ANOVA using IBM SPSS Statistics 20.0. It was shown that the predicted tastes were affected by both the color of green tea and the mug color (p<.001).

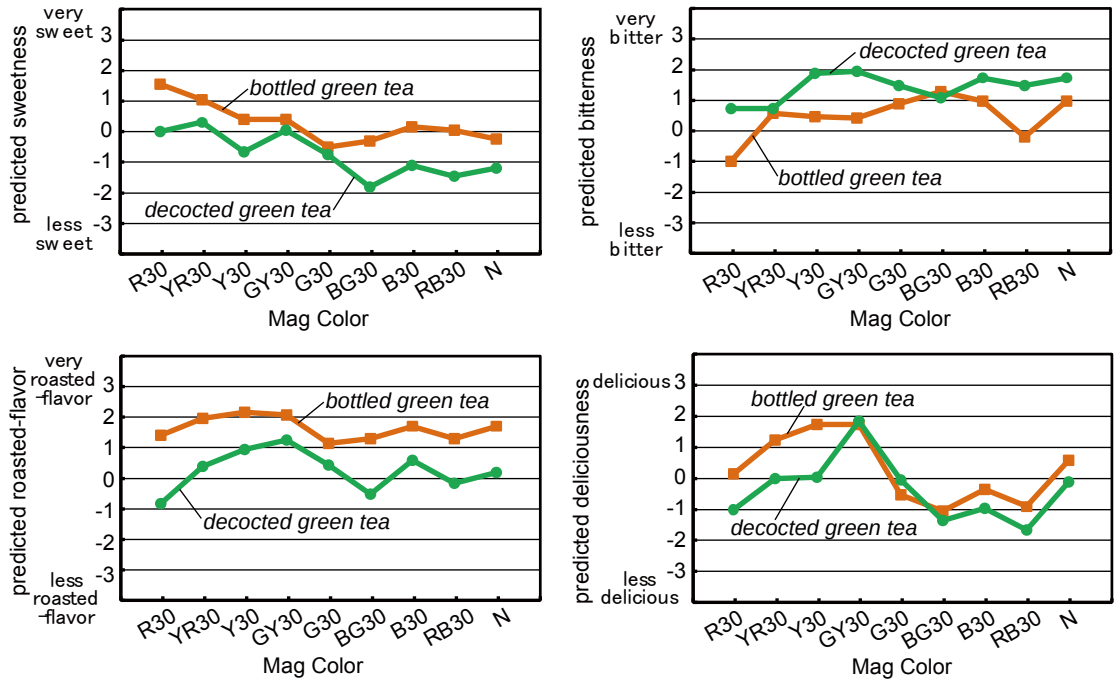

Figure 4. Evaluation results of predicted tastes of the green tea in the mugs.

Impression of the green tea in the different color mugs

Figure 5 shows the mean values of modern-classical and natural-artificial evaluations as representatives of the impression for the bottled green tea and the decocted green tea in the different color mugs. It was found that yellow and green-yellow mugs gave the classical and natural impression, whereas red, green, blue-green, blue and red-blue mugs gave the modern and artificial impression.

The evaluations for the impression of both green teas were analyzed by a two-way ANOVA. It was shown that the impression of the green tea was determined not by the color of the green tea (p>.05) but by the mug color (p<.001).

4. Conclusions

Predicted tastes are determined by the color of green tea and the mug color. Although delicious-looking colors of mug depend on tea color, green-yellow mugs make any green tea visually delicious. Impression of the green tea is affected by the mug color, and yellow-green mug make the green tea classical, natural and polite.

Acknowledgements

I would like to thank Sawako Kishida, an undergraduate student of D.W.C.L.A. for conducting our subjective experiment, and thank Junya Ueda, a graduate student of Y.N.U. for modifying the digital images of mug color.

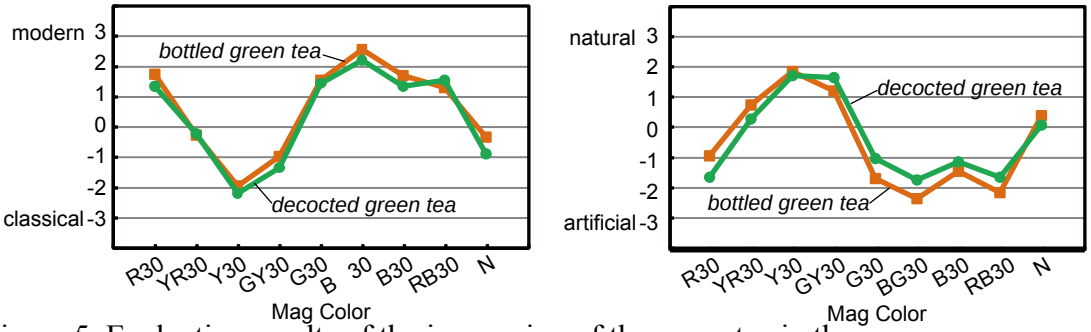

Figure 5. Evaluation results of the impression of the green tea in the mugs.

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Colour Influence on User's Motivation to Press Input Button, and its Comparison with Visual Attraction

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Abstract

The aim of this study is to understand the colour influence on user's motivation to press an input button on touch screen equipment, as well as our previous study (Nishiyama, et al. 2013). An experiment was conducted using mobile equipment which is operated through touch screen by thirty Japanese university students. Sixty-four input button colours consisted of twelve hues by five colour tones, and four neutral colours, on the screen. Grey are used as a background colour for the colour buttons, accordingly all of sixty-four circle buttons were arranged on the screen. The subjects were asked to press five colour buttons freely by their finger doing to scroll the screen by themselves. There were no time and number restrictions to the subjects. The motivation level to press of each colour button is calculated based on the frequency of pressing a button. The obtained results indicated that there was tendency for selection of input button within the subjects. The levels of motivation to press bright yellow, vivid orange, vivid yellow orange, vivid red and white buttons were quite high. As another result, the colour influence on user's motivation to press input button is more than that of visual attraction.

1. Introduction

Since users of touch screen type of information appliances are growing, the graphic design of displayed page is important as visual communication. Input buttons are very often used on touch screens of mobile media such as online shops through Internet. Pressing an input button by user is an executive command to the device, thus design of input button could affect user visual attraction.
Colour is well known as an element of design which can stimulate human emotion and perception, thus, there are many studies about the colour effects on human emotional responses using evaluation forms (eg., Gao and Xin 2006, Hsiao, et al. 2008, Jung, et al. 2012, etc.). The obtained results tend to be psychological response depending on the evaluation intentions or words. Therefore the results may not account for physical response by colour stimulus.

In our previous study, colour influence on user's motivation to press an input button was discussed with the results by a visual experiment and a preliminary questionnaire survey. It was found that some colour buttons, mainly reddish colours, were often pressed. The

background colours of white and black also influced the motivation a little to press the coloured button.

The aim of this study is to reconfirm the colour influence on user's motivation to press an input button on touch screen equipment, as well as our previous study (Nishiyama, et al. 2013), and also to understand the relationship between the motivation and visual attraction.

2. Method

An experiment was conducted to Japanese students in indoor using mobile equipment, iPad mini produced by Apple Inc. which is operated through touch screen. The screen size was 7.9 inch, DPI was 1,024*768 px, colour temperature was 6834 K. An accessible online webpage was designed for the experiment as shown in Figure 1.
The subjects were thirty university students (fifteen male and fifteen female students, nineteen to twenty two years old). Before the experiment, it was checked by the Ishihara test with subjects' agreement and under the rule of the Ethics Committee in Kyoto Institute of Technology. All subjects didn't have colour anomaly.

With using the similar method to our previous study, subjects were asked to access the webpage and following instruction as; Press several colour buttons which ever you want scrolling the screen by your finger. In order to get rid of limitation for subject's behavior, instruction for the experiment was written on the webpage, and there were no time, posture and press number restrictions during the experiment. In this experiment, the same experiment was repeated 5 times. The subjects were also asked press several colour buttons which have two kinds of visual attraction: conspicuous colour, and colour standing out. The situation of the experiment for pressing colour input buttons as shown in Figure 2.

Sixty-four button colours consisted of twelve hues: Red (R), Orange (O), Yellow orange (YO), Yellow (Y), Yellow green (YG), Green (G), Blue green (BG), Green blue (GB), Blue (B), Violet (V), Purple (P), Red purple (RP) by five colour tones based on the PCCS (Practical Colour Co-ordinate System): light (lt), bright (b), vivid (v), deep (dp), dark (dk), and four neutral colours (N). The colours was measured by a spectroradiometer CS-1000 produced by Konica Minolta Inc. The CIELAB colorimetric values of sixty-four button colours were calculated by The Lab colour mode of Adobe Photoshop CS5 as shown in Figure 3. Colour input buttons were put in a random order on grey background (N5) and the shape pf the button was circle.

Figure 1: Colour input button randomized on the mobile equipment (left), the explanation of the experiment (middle), and answer input part (right).

Figure 2: The situation of the experiment for pressing colour input buttons.

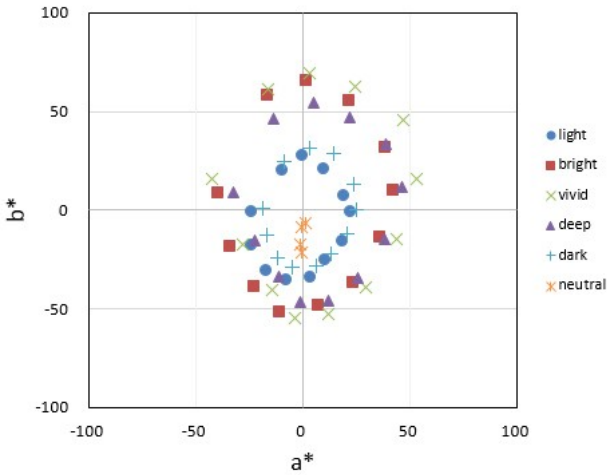

Figure 3: The distributions of sixty-four button colours in CIELAB a-b* diagram.*

3. Results And Discussion

Experimental results were automatically recorded in the spreadsheet of online storage by an online server. Frequency of pressing of each colour button was defined as the level of pressing motivation. The colours of frequently pressed buttons were considered as the colours which have high motivation to press. As a result, 1038 times were totally pressed colour buttons by the thirty subjects.

The level of pressing motivation was depended on the button colour. The colour of highest pressed button was bright yellow (b-Y) which was pressed 100 times (9.63%) as shown in Figure 4. The top 5 high pressed colour buttons excluding the bright yellow were vivid orange (v-O, 8.09%), vivid yellow orange (v-YO, 6.07%), vivid red (v-R, 5.97%) and white (N9.5, 5.88%). The order of the vivid red (v-R), which was the highest pressed colour button in the previous study [Figure 5], changed to the 4th, however the vivid red was high pressed in this experiment again. The percentage of top 5 and top 10 highest frequency colours were 35.65% and 54.82% respectively. White and black were 5.88% and 2.31% respectively. On the other hand, deep yellow (dp-Y), dark Yellow (dk-Y), dark green (dk-G), deep purple (dp-P) and neutral dark grey (N3.5) were not pressed once.

In terms of hue effect, yellow (Y, 19.46%) buttons were the highest frequency. orange (O, 12.81%), yellow orange (YO, 12.43%) and Red (R, 11.75%) were relatively higher. On the other hand, purple (P, 1.45%) was the lowest frequencies. Neutral (N, 8.38%) was a little higher relatively. The percentage of each hue were 11.75% for red (R), 12.81% for orange (O), 12.43% for yellow orange (YO), 19.46% for yellow (Y), 4.53% for yellow green (YG). 6.17% for green (G), 5.20% for blue green (BG), 4.34% for green blue (GB), 6.65% for blue (B), 2.60% for violet (V), 1.45% for purple (P), 4.24% for red purple (RP) and 8.38% for neutral (N).

In terms of colour tone effect, bright (b, 33.43%) and vivid (v, 31.50%) buttons were pressed more, and dark (dk, 2.13%) buttons were pressed less. The percentage of each tone were 19.27% for light (lt), 33.43% for bright (b), 31.50% for vivid (v), 5.11% for deep (dp), 2.13% for dark (dk) and 8.38% for four neutral (N).

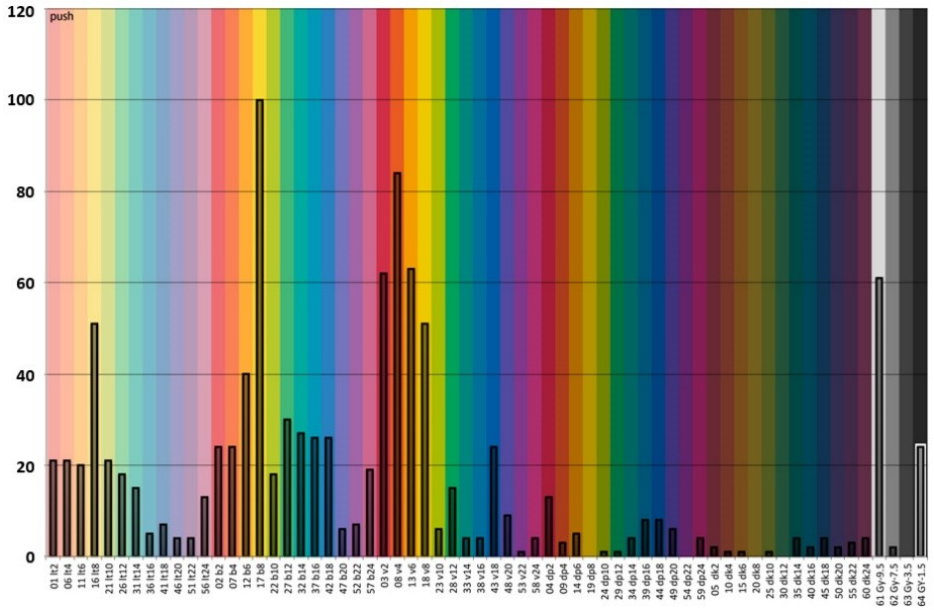

Figure 4: The frequency of input button press for each button colour.

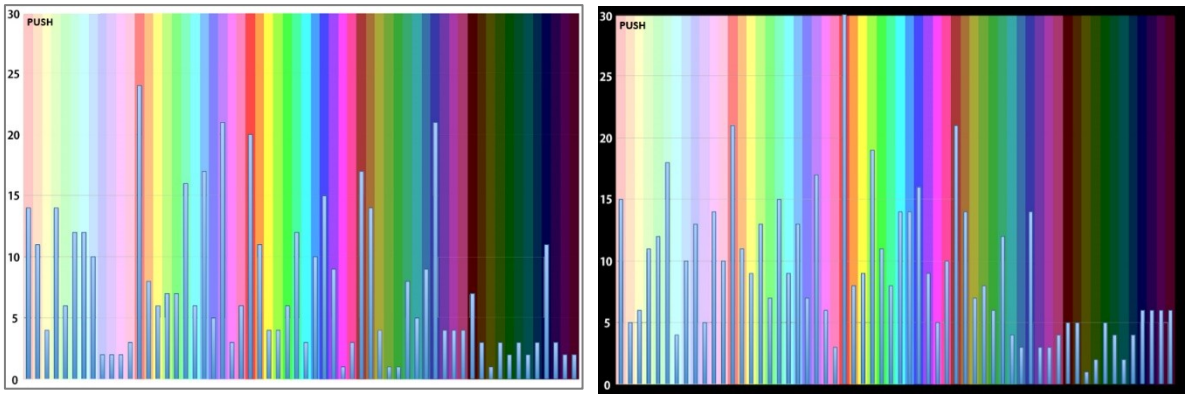

Figure 5: The frequency of input button press (obtained in the previous study, Nishiyama, et al. 2013): white back ground (left) and black background (right).

On the whole, the result obtained in this study was similar to that of the previous study, however there are some discrepancies as shown in Figures 4 and 5. Although it is surmised that this discrepancies are based on the difference in background colours, the difference in subjects, the difference in colour, etc., it cannot explain the cause clearly in this research. More experiments and results are required.

In the experiment for visual attraction, the colour chosen was not concentrated so much on some specific colour as shown in Figure 6. The highest frequency of press for button colours was 28 times, and the lowest frequency was three times. Even the frequency on dark colours was more than five times. Comparing Figure 4 with Figure 6, it was found that the colour influence on user's motivation to press input buttons is quite more than that of visual attraction for the button colours.

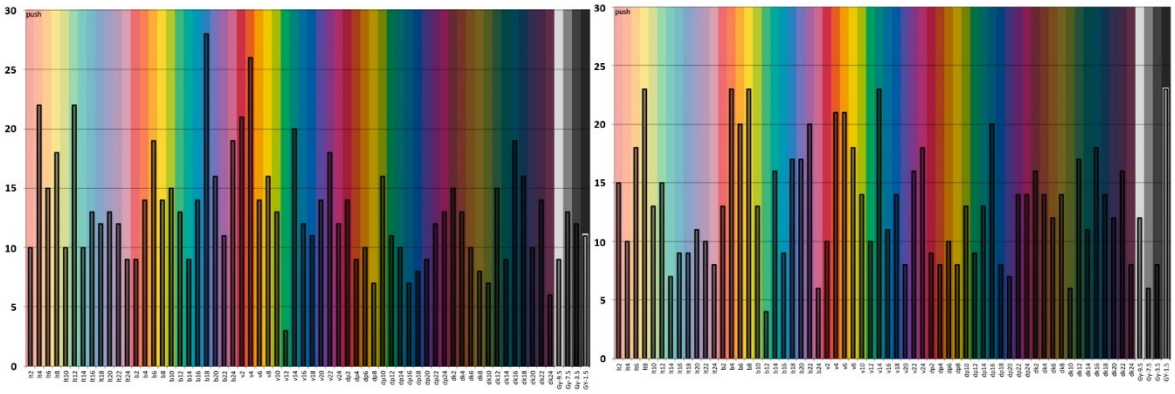

Figure 6: The frequency of input button press on two kinds of visual attraction: conspicuous colour (left), and colour standing out (right).

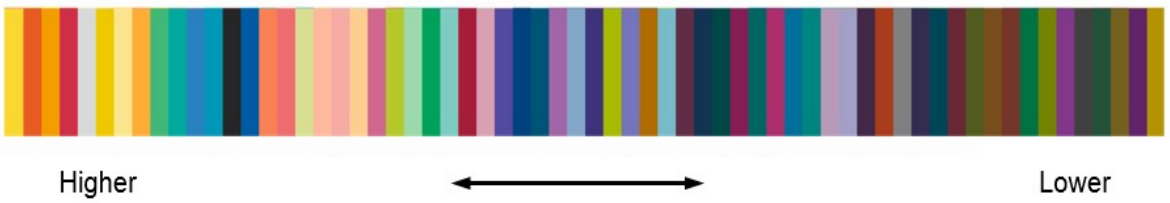

Figure 7: The order of frequency of input button press.

Table 1: Correlation coefficient between pressed rate and colorimetric value.

	H	S	V	R	G	B	L*	a*	b*	C*
r	-0.275	0.046	0.448	0.482	0.409	-0.049	0.502	0.164	0.408	0.444

Correlations between colorimetric values and the pressed rate of each button were analysed to know the relationship between colour properties and the level of pressing motivation. There were not strong direct correlations between *L**, *C**, *a**, *b** and the pressed rate. Therefore, the height of pressing motivation cannot be guessed only with a single colorimetric value of its button colour. However slight common tendency was appeared to press buttons by hue and tone of button colour as shown in Figure 7. Besides, light, bright and vivid tone colours relatively had higher order, especially, yellow, orange and red colours of the tones had the highest level motivation.

4. Conclusions

This study tried to understand the colour effects on human practical response through pressing colour buttons on touch screen equipment, and the obtained result was compared with that of the previous study.

The obtained results indicated that the colour influence on user's motivation to press input buttons is large. The colour of highest pressed button was bright yellow, and it was pressed 100 times (9.63%). Vivid orange, vivid yellow orange, vivid red and white were also higher colour for the motivation pressing input buttons. The results of this study and previous study were similar, however there are some discrepancies in some parts.

Correlations between colorimetric values and the pressed rate of each button were analysed. There were not strong direct correlations between *L*, a*, b*, C** and the pressed rate. However slight common tendency was appeared to press buttons by tone and hue of button colour.

As a result of the experiment for visual attraction, the colour influence for the visual attraction was not so large. Comparing between the motivation for pressing and the visual attraction, it was found that the colour influence on user's motivation to press input buttons is quite more than that of visual attraction.

There was limitation to understand obtained results because the subjects' performance and attributes (e.g., background colour, used colour for button) were not completely the same in both studies.

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TECHNOLOGY

Study on optimal color temperature of an OLED TV

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Abstract

This paper aims to suggest a framework to find an optimal CCT (correlated color temperature) for an commercial OLED TV. As well known, preference is strongly dependent on CCT. Among more preferred CCTs, an optimal CCT which is similarly bright and less power-comsuming CCT compared with each other was selected and suggested. This suggested optimal CCT was verified in terms of preference and power consumption.

1. Introduction

Display's CCT is one of the important attributes for image quality assessment. In case of higher CCT, white color becomes more bluish, skin color turns pale and grass color changes unnatural. If the CCT is lower, however, sky color looks greener. For such a reason, especially, image quality of skin, sky, grass and achromatic color are influenced by CCT. Thus, Optimal CCT for displays has been studied a lot. Schenkman and Kjelldahl recommended that a CCT of 5800K is preferred on a color monitor screen [1]. Meanwhile Sproson suggested that the D65 white point is a good compromise for color television [2]. Yoo also proposed a CCT of 6500K is most preferred at mobile display [3].

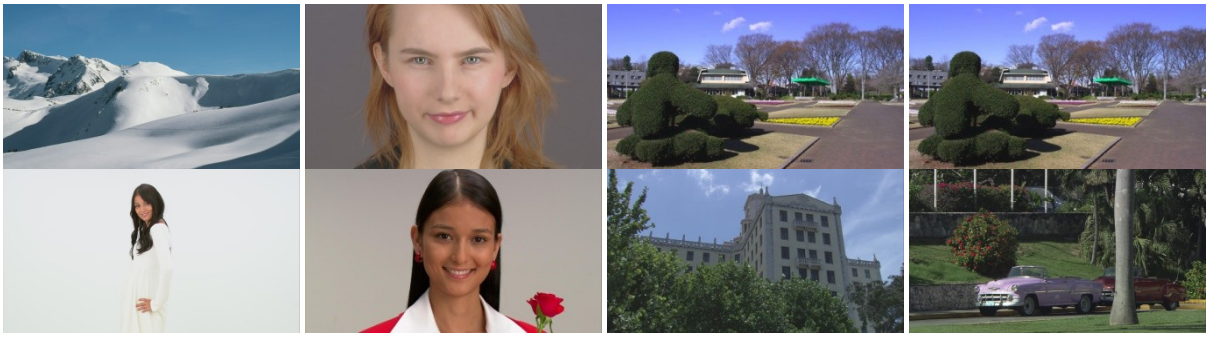
Nevertheless, at the default mode of commercial TVs, CCTs range from 11,000K to 14,000. There is distinct difference between research results and commercial TV's. So, in this paper, the relationship between image quality and CCT was studied in order to select optimal CCT for a commercial OLED TV. At the optimal CCT, power consumption of OLED TVs was also measured and discussed.

2. Method

2.1 Experimental Preparation

In order to investigate the tendency of image quality according to CCT, firstly, the range of commercial TVs' CCTs was found by measuring white points. Secondly, 9 CCTs were finally selected considering both luminance and power consumption. The CCTs' range was distributed from 7200K to 10600K. For a visual experiment, a 55inch FHD WRGB OLED TV was prepared. The gamma of this TV was 2.2 and the CCT was 9600K. To emulate a real living room environment, the ambient illumination was set to 200 lx recommended by Korean Industry Standard. The viewing distance was 3H (H: height of display) which is approximately 2.1 meters. Ten observers (6 males and 4 females) with experience of display image-quality evaluation participated. Test images consisted of four color categories (achromatic, skin, sky

and grass). Fig.1 shows the test images evaluated; two images per color category were selected.



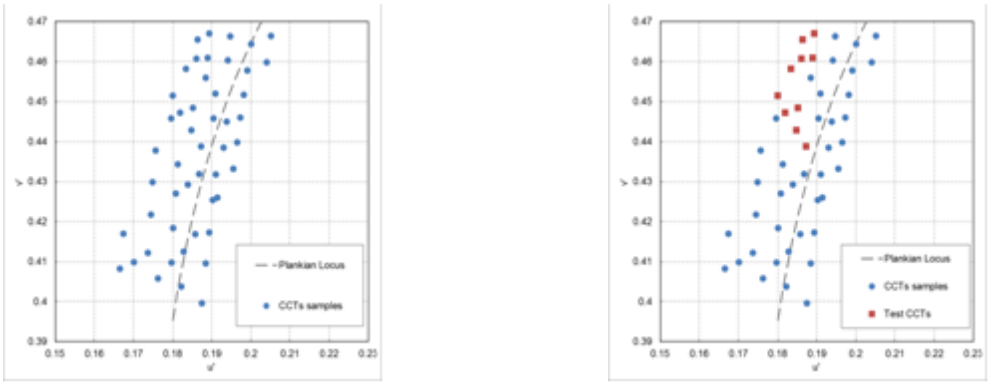
(a) *Achromatic* *(b) Skin* *(C) Sky* *(D) Grass*

Figure 1: Test images

1.2 Psychophysical Experiment

To ensure the ranges of CCTs of conventional displays, white points' coordinates of six TVs and one monitor were measured. From the measurement, the CCT range for the experiment was determined from 6200 to 54400K. Within this CCT range, 49 sample CCTs covering this range as uniformly as possible were prepared by controlling RGB gray levels of the WRGB OLED TV and then luminance and power comsumption of each condtion were measured, where power consumption was measured as panel of WRGB OLED TV. The luminance values corresponding to 49 CCTs should be lower than the initial luminance value of the OLED TV because each controlled RGB gary level cannot be larger than 255.

According to the next two conditions, the CCTs for visual experiment were finally selected. The first condition was that the luminance difference between the CCT covering the range and the initial CCT of the OLED TV should be under 5%. The second was that a power consumption of the adjusted CCT should be less than that of the initial CCT. The CCTs satisfying the two conditions ranging from 7200K to 10600K. Fig. 2(b) shows finally selected test CCTs for visual experiment. Blue circle dots indicate 49 CCTs and red rectangular dots represent finally selected 9 test CCTs. Then, the test images were converted according to the selected test CCTs.



(a) 49 CCTs of conventional displays *(b) Test CCTs for visual experiment*

Figure 2: Process of CCTs selection

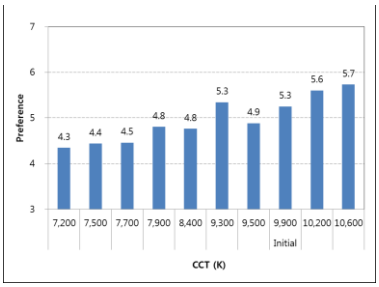
A series of visual experiments was performed using indirect interval scales-category scaling methods [4]. Observers were asked one question 'How much do you like this image color?'. After Observers viewing test images (achromatic, skin, sky and grass), they were asked to answer scale values from 1 (dislike extremely) to 9 (like extremely). The test images were displayed randomly.

3. Results And Discussion

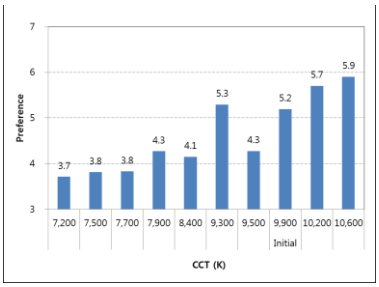
3.1 Preferred CCT in Natural images

As mentioned above, 9 test CCTs, which were determined from adjusting gray level of the OLED TV, are lower power-consuming and similarly bright compared with the initial CCT of the OLED TV. So, the CCTs' color coordinates are not located on the black body locus. That means preference result of these CCTs could not be the same as the result of the CCTs lying just on the locus.

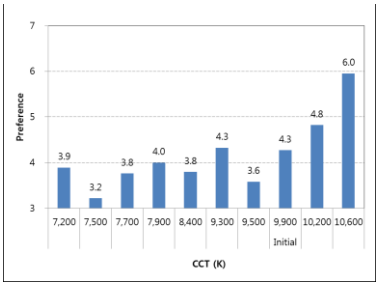
Fig. 3(a) represents preference scores of total images. When CCT increased, preference score also tends to increase. Especially, 10600K shows the highest preference score among 9 CCTs. This might be because 10600K's color coordinates are closer to black body locus. Only 10600K was rated above 5 in all the color categories' images including total images. Preference score 5 means "Neither like nor dislike". In other words, 10600K in this OLED TV is the most optimal CCT considering luminance, power consumption and image quality.



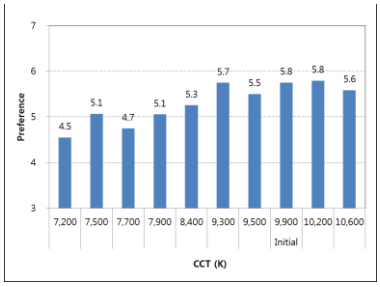
(a) Total images



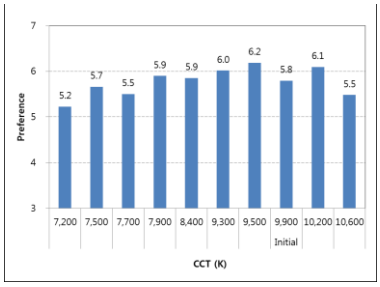
(b) Achromatic images.



(c) Skin images.



(d) Sky images.

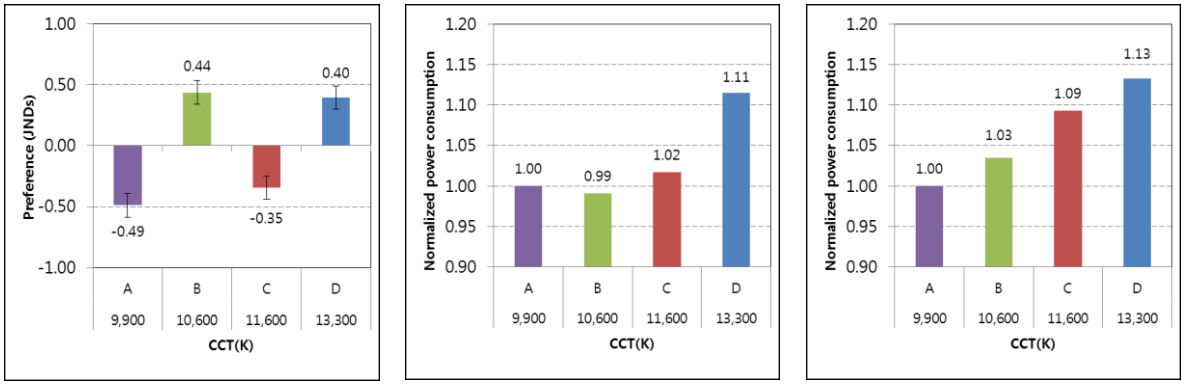


(e) Grass images.

Figure 3: Preference according to CCT

3.2 Comparison of CCTs of commercial OLED TVs

In order to verify that 10600K is the optimal CCT in this OLED TV, preference[5] and power consumption were measured with three different CCTs plus the optimal one. 'A' stands for the initial CCT of this OLED TV and 'B' stands for the optimal one derived from the previous visual experiment. 11600K and 13300K were adopted from other commercial OLED TVs' CCTs (CCT 'C' and 'D').



(a) Preference of test images

(b) Power consumption (white patch).

(c) Power consumption (IEC 62087).

Figure 4: Verification of optimal CCT.

3.3 Power consumption of commercial OLED TVs at the optimal CCT

In this clause, two commercial OLED TVs' CCTs were adjusted to the optimal CCT 10600K (actually, 11000K). Then power consumption of the OLED adopting different technologies, say WRGB and RGB OLEDs, was compared with each other. The specifications of the two OLED TVs are summarized in Table 2.

Table 2. Specification of commercial OLED TVs

Item	WRGB OLED TV	RGB OLED TV
Manufacturer	LG	Samsung
Size (inch)	55	55
Resolution	1920x1080	1920x1080
Mode	Standard	Standard

As a result, it was concluded that the WRGB OLED TV consumed less power than the RGB OLED TV for not only white patch but also IEC-62087 standard video clip as can be seen Table 3.

Table 3. The power consumption of WRGB and RGB OLED TVs

Power consumption	WRGB OLED TV	RGB OLED TV
Black patch (W)	46.5	112.4
White patch (W)	189.1	256.9
IEC62087 video clip (W/h)	101.2	134.4

Conclusions

This paper suggested a framework to find an optimal CCT (correlated color temperature) for an commercial OLED TV, which can be applied to optimize a CCT if a TV is given. Considering preference, luminance and power consumption at the same time, an optimal CCT was found for a certain OLED TV. The optimal CCT value was 10600K for this OLED TV. It was confirmed using other OLED TVs as well that the OLED TV adjusting to this optimal CCT is more preferred and less power consuming if the luminance is similar. Additionally, WRGB OLED TV at the optimal CCT was superior to RGB OLED TV in power consumption.

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Preferencia De Colores En Electrodomésticos De Lujo En Poblacion Mexicana De La Zona Metropolitana De Guadalajara (ZMG)

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Resumen

Los objetos son signos transmisores de mensajes sociales, políticos, religiosos, económicos, culturales entre otros (Sánchez, 2005). Los significados de dichos mensajes son dirigidos del emisor "objeto" hacia el receptor "persona" quien los porta usa o posee, así como también para la persona que no usa el objeto pero entiende el mensaje de un portador del signo "objeto", ésta información se codifica y decodifica, con la ayuda de elementos formales que componen el objeto, como el material del que está fabricado, la forma, textura y color, etc.

El objetivo de esta investigación es determinar los colores que la población de la ZMG relaciona con el lujo en los electrodomésticos, ya que la interpretación de un signo como el color es una variable de cada cultura pudiéndose así aplicar el color en el diseño de productos que se destinarán a determinada población.

El estudio se basó en una evaluación Perceptual Perfil de Personalidad del Producto (PPP) (McDonagh, Bruseberg y Haslam, 2002). Se evaluaron 6 electrodomésticos (cafetera, licuadora, refrigerador, estufa, exprimidor y microondas). Las características de los participantes estuvieron relacionadas con su nivel socioeconómico y el consumo de objetos de lujo. En el proceso eligieron un color para cada electrodoméstico de una serie de opciones (arena, plata, negro, azul, gris, blanco, verde y la opción libre de "otro" color fuera de la lista) que se relacionara con la personalidad del electrodoméstico y un auto de lujo. Uno de los colores predominantes en el resultado de la encuesta fue el color plata (Ibarra, 2013)

Palabras clave: preferencia, color, electrodomésticos, lujo, población.
Keywords: Preference, Color, electrical appliances, luxury, population, soft ergonomics.

1. Introducción

Los objetos son esos artículos o cosas materiales que el ser humano construye o fabrica con los cuáles diariamente la sociedad realiza todas sus actividades, se encuentran en la calle, vivienda, trabajo, centros de recreación y estudio por mencionar algunos entornos, incluso se usan sobre el mismo cuerpo del hombre como es el caso de la ropa joyería y el calzado, existen otros que contienen al hombre como los transportes y edificios. Las actividades psicosociales pueden ser tan simples como caminar y tan complejas como viajar en un submarino, los objetos son incontables como son incontables la cantidad de actividades que realiza el hombre tomando en cuenta que para cada actividad se requiere de un grupo de objetos, según la actividad un grupo pequeño o grande.

"*El término "objetos" se utiliza para describir un amplio conjunto de artefactos tridimensionales que encontramos en las actividades cotidianas en entornos tales como el hogar, espacios públicos, trabajo, escuelas, lugares de entretenimiento y sistemas de transporte*: Heskett (2005:56).

Los objetos se pueden clasificar de muchas formas, en este documento solo se mencionará los de tipo industrial es decir los objetos que han sido fabricados bajo un proceso de diseño metodológico y tecnológico, objetos clasificados como producto del diseño industrial.
El objeto se conforma de una cantidad de características según la función y complejidad de éste, dicho conjunto le atribuye un significado que el usuario es capaz de interpretar, a este mecanismo (Sánchez, 2005) lo denomina el objeto símbolo y se interpretan a través de conceptos o emociones para el usuario. Los objetos de diseño industrial son tridimensionales, tienen textura, color, tamaño, forma y, están hechos de uno o varios materiales bajo un proceso de producción industrial. A continuación se mencionará la relación de las características formales y su significado con objetos de diseño industrial.

La forma es una de las características de composición de los objetos, Gestalt que significa forma en Alemán. Hogg,(1969) afirma que dicha teoría es utilizada en psicología, física, biología, y sociología entre otras disciplinas, consiste en describir las cualidades globales de los sistemas. Los psicólogos de la Gestatl aportaron el concepto de que el todo es distinto a la suma de sus partes, uno de los principales elementos para la percepción de un objeto es el contorno ya que este es de carácter dominante para reconocer una figura, el simple contorno le brinda al espectador información sobre la forma, en ocasiones el contorno es suficiente para reconocer una figura u objeto (Goldstein, 1999).

El tamaño en un objeto es tridimensional se refiere a la medida total del cuerpo objetual es decir el volumen, se compone de las medidas altura anchura y profundidad los objetos suelen tener un tamaño relacionado con la parte del cuerpo que interactúan con el usuario, existe una ciencia llamada Antropometría, rama de las ciencias humanas que estudia la medición del cuerpo (1996 Pheasant, [en: Prado y Avila,2005:11]) y estudia las medidas del cuerpo humano, es una ciencia aplicable al diseño, sirve para dimensionar o hacer una adecuación Antropométrica del objeto al usuario, un ejemplo simple es una puerta la altura de la puerta se relaciona con la altura del usuario, el tamaño de un elevador se relaciona con la cantidad de usuarios que lo utilizarán al mismo tiempo, la altura del usuario y la anchura de ellos multiplicada por el número de usuarios más un espacio entre ellos y para objetos más pequeños como una asa de una taza es la relación de la anchura de la palma de la mano. Según la medida del objeto puede comunicar al usuario la función de éste.

La textura es la forma en que están colocadas y combinadas entre sí las partículas o elementos de la superficie una cosa, produciendo una sensación táctil y óptica del objeto por ejemplo de puede percibir a través de sensación de la vista y el tacto una superficie lisa, rugosa, dura, suave, brillosa opaca.

El Material para la ingeniería es una sustancia, elemento o compuesto químico con alguna propiedad útil mecánica eléctrica óptica térmica o magnética, en el diseño industrial los objetos están conformados por un material, pueden ser fabricados en polímeros, metales u

otros elementos, aleaciones o combinaciones de materiales, esta última característica del objeto es la que da vida al color.

El color desde el punto de vista de la psicofísica es energía radiante, su longitud de onda se mide en nanómetros, y es el único espectro visible para el ojo humano dentro del espectro electromagnético, este último contiene a los rayos que el ojo no puede ver como los rayos x o los rayos gamma. El color estudiado desde la psicología funciona como símbolo visual atribuyendo significados, es un lenguaje cultural porque el significado de un color puede variar según la cultura (Weinschenk 2011:27) en el caso de los objetos, el significado del color no solo cambia de una población a otra, sino que en la misma población dos colores diferentes en el mismo objeto cambian el significado para el receptor, por ejemplo un auto en rojo y el mismo modelo en negro tendrá atributos de significados diferentes siendo exactamente igual un objeto que el otro.

1.1. Consumo simbólico y cultural de los objetos

"El consumo es el conjunto de procesos socioculturales en que se realizan la apropiación y los usos de los productos" (García, 2009:58).

Los seres humanos desde sus inicios han realizado actividades sociales, la necesidad de usar o consumir objetos es tan vieja como el hombre, el consumo de bienes y servicios así como de recursos activa la economía de la sociedad pero al mismo tiempo participa la cultura que es la enseña a consumir en cada región o país.

García (2009) argumenta la existencia de varias líneas de investigación relacionadas con el consumo, no exclusivamente el de tipo macro social, también se encuentra el consumo de la antropología y la sociología urbana, que estudia el consumo como una racionalidad sociopolítica interactiva cuando en el sentido de la proliferación de objetos y marcas de acceso al consumo; también se encuentra la importancia de la política del consumo, cuando los políticos influyen con sus campañas en las decisiones de los ciudadanos. Y una última línea de trabajo es el estudio del consumo como diferenciación entre grupos sociales; en esta tendencia se describen los aspectos simbólicos y estéticos de la racionalidad consumidora.

Por aprendizaje social es decir cultura, el hombre tiende a hacer y manifestarse de cierta manera consumiendo objetos o servicios específicos, la cultura es un factor importante en el desarrollo del consumo,(Brian Eno, citado por Press, 2009) hace una reflección sobre el significado de cultura, entendiendo que es todo aquello que los seres humanos hacen más allá de las necesidaddes básicas o fisiológicas, para tomar una desición de consumo intervienen factores culturales en la de percepción de cada cultura.

> *"Empecemos por aquí: cultura es todo lo que no es necesario hacer. Comer es necesario, pero no lo son la alta cocina, los Big Mac o los tournedós Rossini. Es imprescindible cubrir nuestro cuerpo para protegernos del clima, pero no lo es preocuparnos como solemos por si nos ponemos unos Levi´s o algo de Yves Saint-Laurent. Es necesario desplazarse sobre la superficie terrestre, pero no bailar. Yo llamo funcionales a las actividades "necesarias" y "estéticas" a las no necesarias. Por estéticas entiendo que la base principal sobre la que elegimos entre ellas son sus diferencias de estilo"* (Brian Eno, citado por Press, 2009:23).

El ser humano consume en una escala de necesidades que ya han sido estudiadas, (Maslow, 1991) realiza una escala de orden jerarquico y la llama la piramide de las necesidades

humanas, su teoría tiene un enfoque humanista y explica que la base de la pirámide es la primera necesidad humana ya que se ha cubierto la primera se continúa al siguiente escalon consecutivamente hasta llegar a la cima.

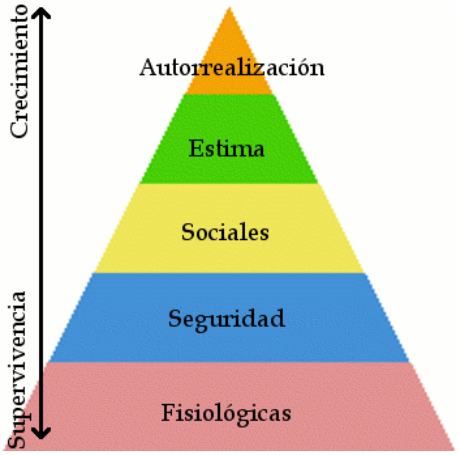

Figura 1. Pirámide de las necesidades de Maslow. www.universidadperu.com

Las necesidades fisiológicas son primarias de sobrevivencia en el individuo, como satisfacer la sed y el hambre, las necesidades de seguridad son cuando el individuo busca de orden y estabilidad, como la protección, las necesidades sociales están relacionadas con la interacción social con otros individuos, con la necesidad de comunicarse con otras personas, las necesidades de estima o reconocimiento son la necesidad de relacionarse, implican la autoestima y el ego, el individuo necesita sentirse apreciado, tener prestigio y destacar en un grupo social, las necesidades de autorrealización son la necesidad superación personal como ideal de desarrollar su talento.

Cuando se han cubierto las necesidades primarias como lo dice Maslow el humano sigue en la búsqueda de nuevas satisfacciones y el usuario se vuelve más exigente, en el caso de consumo de los objetos existe una teoría llamada “pirámide de necesidades de consumo” realizado por Jordan (1999) él explica que en el consumo de productos los usuarios esperan encontrar algo más allá que las necesidades básicas, esperan un plus del producto, en su modelo de pirámide plantea las necesidades de consumo de los objetos cuando éstos tienen un diseño satisfactorio que cubre y en ocasiones rebasa las expectativas del usuario

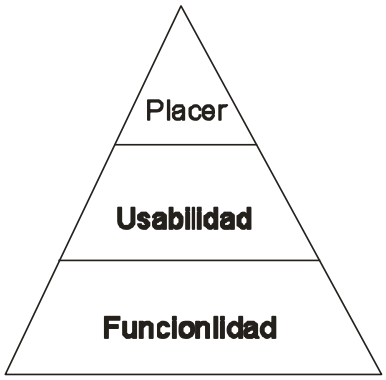

Figura 2. Pirámide de necesidades de consumo (Jordan, 1999:6).

La funcionalidad de un producto es la base de la pirámide que éste realice sus funciones adecuadamente, la funcionalidad es de primera instancia para que el usuario desempeñe sin problemas la tarea evitando la insatisfacción o frustración en caso de que el objeto no la cumpliera

El segundo nivel es la usabilidad, definida por la International Organization for Standarization (ISO), Organización Internacional de Estándares, como "la efectividad, eficiencia y satisfacción con la cual usuarios específicos pueden realizar tareas específicas en ambientes particulares" (ISO DIS 9241-11, en Jordan, 2002:5). Se entiende como la facilidad de uso que el producto proporciona, pues el que un objeto cumpla con el primer nivel, la funcionalidad, no garantiza la usabilidad.

El placer es el tercer nivel que el uso de un producto puede proporcionar al usuario, inevitablemente las personas esperan algo extra de los objetos, los productos brindan beneficios funcionales y también brindan beneficios emocionales. Los productos basados en el concepto de placer se aproximan a los factores humanos pero no son una alternativa para acercarse a la usabilidad, aunque los productos que poseen usabilidad no tienen que ser necesariamente placenteros, y la usabilidad en muchos casos es la llave para el nivel de placer en un objeto, el placer lo define (1992 Tiger [en: Jordan,1999]) en cuatro tipos, el placer fisiológico, el placer psicológico, el placer ideológico y el placer sociológico, que se explican a continuación.

El placer físico lo estimula un producto a través de los sentidos que son el visual, auditivo, tacto, olfato y gusto. Un ejemplo es un equipo de sonido con alta definición causa un placer sensorial auditivo, un sillón cómodo causa placer físico.

El placer Sociológico. En este caso se refiere al placer que causa el uso de productos en interacción con relaciones sociales por ejemplo de tipo laboral, entre familiares, de amistad o de pareja por ejemplo: en un grupo de niños una pelota estimula un juego de relación social, un auto deportivo del año indica que el individuo pertenece a un grupo social de cierta clase, y un usuario de una patineta forma parte de otra identidad social.

El placer Psicológico. Pertenece al placer cognitivo que se liga a las relaciones emocionales, por ejemplo la facilidad de uso que ofrece una computadora puede generar emociones de satisfacción o frustración si el sistema operativo hace que el usuario cometa muchos errores.

El Placer ideológico Este se relaciona según Tiger, (1992) con los valores o teorías de las personas, como entidades como pueden ser los libros música y arte, en el contexto de un producto, son la estética o los valores que el producto refleje, por ejemplo un producto biodegradable implica un valor de medio ambiente y responsabilidad para alguien que tenga ese valor.

El objeto por sí mismo funciona como símbolo, y dentro de la comprehención del mensaje el usuario o receptor puede relacionar el objeto con uno de los placeres clasificados por Tiger, (1992).

Los objetos son estructuras significativas que se componen de elementos individuales con significados individuales, y juntos forman otros significados que emiten una idea al usuario con la cual entiende el objeto en sus funciones físicas, sensoriales y psicosociales para darle una interpretación y apropiación al consumirlo.

El siguiente esquema muestra la estructura del símbolo en el objeto

Fig. 3. Esquema, Objeto –signo imagen http://poesiayotrosvuelos.blogspot.com/ 20/04/2012

Ejemplo de objeto-signo, la cafetera es el referente; el significante es la estructura, la forma, que se puede analizar en este ejemplo como formas orgánicas compuestas de dos conos curvados y unidos por su parte estrecha; el significado es el mensaje que recibe e interpreta el usuario: se puede interpretar como un objeto para hacer café, tiene un estilo de diseño moderno, y aparenta ser un objeto no costoso. La forma del objeto tiene un significado, la forma es el signo según Sánchez (2005) desde dos perspectivas el significado y la representación de la forma "el mensaje como totalidad y la forma que lo representa, cada elemento morfológico transmite un significado que construyen el mensaje.

1.2. Objetos- símbolo de lujo

Dentro de los cuatro placeres de Tiget (1992) se encuentra el placer social, en las relaciones sociales para algunos individuos es importante marcar las jerarquías o clases económicas y el ser humano lo ha realizado antropológicamente a través de los objetos, el modelo de pirámide

de Jordan (1999) menciona que los objetos principalmente deben funcionar adecuadamente según la tarea y en la cima de la pirámide se encuentra el placer, este placer se relaciona con el plus que el producto ofrece al usuario, ejemplo un auto es un medio de transporte, pero lo es también símbolo de poder según el diseño y el costo de este, el pagar un precio por un servicio como el transporte es una necesidad, pagar un extra que otros no pueden pagar por el mismo servicio es un lujo. La antropología ha demostrado cómo los objetos han tenido un juego de intercambio con valores añadidos y connotaciones más allá del valor de uso, significados de pertenencia a un grupo o tribu, símbolos de jerarquía o poder y también valores mágicos (Pérez, Tropea, Sanagustín, Costa, 1992) Esto demuestra que el valor de uso y el valor significativo del objeto han sido parte del hombre desde sus orígenes. Los valores y significados seguirán evolucionando al ritmo de la evolución de las necesidades y la tecnología de la sociedad.

> *"A través **del lujo** intentamos identificarnos para así ser reconocidos. El lujo se encuentra en el área del deseo y sueños. Sin embargo, reconoce como lujo una actitud subjetiva, que imprime lógicas particulares; un concepto relativo, superfluo, amenazado por el consumo, estrechamente relacionado con la adquisición de bienes materiales y servicios. En este sentido, los estilos de vida que se acompañan de lujo ya no son una convención de clase, sino espectáculo para el disfrute y placer de los sentidos. Generalmente se relaciona con la transformación sensual o atractiva de los bienes".* (2004 Lipovesky, [en: Hérnández,C, 2012])

Para que un objeto simbolice lujo, deberá cumplir con características materiales de calidad y visuales altamente estéticas estas últimas tienen un valor subjetivo en la percepción del receptor y deberá rebasar la necesidad básica de su función, así como ser deseado por un numeroso grupo de personas y solo unos pocos podrán poseerlo, entonces cierto objeto será considerado un símbolo de lujo. En otros casos la necesidad básica es omitida, es decir un objeto que no tenga una función de primera necesidad o quizá ni siquiera cumpla con una necesidad práctica y además contenga el exceso de valor subjetivo como símbolo de lujo para quien lo posee, el lujo es una apreciación subjetiva cada persona o grupo social entiende o percibe de distinta forma, y los productos con estas características funcionan como símbolo de distinción. A continuación se hará referencia de aparatos electrodomésticos con características de lujo como símbolo

1.3. Electrodomésticos que simbolizan lujo

Los electrodomésticos son aparatos eléctricos que se utilizan para elaborar tareas del hogar, como limpiar, otros son de ayuda en la cocina para la preparación de alimentos, para conservación de alimentos, y para aseo personal, los electrodomésticos se introdujeron en el hogar durante el siglo XIX, con la idea moderna del uso de la electricidad para mejorar las tareas domésticas, la desaparición de los sirvientes, la idealización del núcleo de la familia y el concepto de higiene y organización científica del trabajo, Pelta (2012:117) Estos nuevos aparatos no estuvieron al alcance de todas las clases sociales, únicamente las clases altas podían adquirirlos, en los años treinta eran tan costosos que se consideraban un artículo de lujo, a partir de los años cincuenta la clase obrera pudo empezar a adquirir estos aparatos, en ese tiempo empezaron a preocuparse por la estética de estos, En la década de 1940, el *Refrigerador* super SixColdspot, del diseñador Loewy quien utilizaba tecnología para la producción de autobuses, locomotoras y automóviles para diseñar electrodomésticos, estimuló el consumo de la época. "El refrigerador super SixColdspot, es el ejemplo más característico

del fenómeno de posguerra estadounidense, con sus bulbosas formas blancas, como en el diseño de autos que cambiaba cada año los refrigeradores también (Comisarenco, 2006).

Actualmente existe una gran variedad de electrodomésticos desde sencillos y económicos hasta muy sofisticados y costosos, los últimos también pertenecen a esferas altas y representan lujo, el diseñador Philippe Starck realizó un diseño de exprimidor para la firma Alessi meramente estético, incluso el mismo autor dice que no es para usarse sino para exhibirse como una pieza de arte y se vende en baño de oro y platino "*Cara ineficiencia como máximo estilo*" Heskett (2005). Otro ejemplo es la cafetera de la firma Casa Bugatti Diva que en su slogan dice, "lujo en forma de cafetera" En el caso de la cafetera si hace café y también es de un diseño altamente estético así como su precio.

Así como algunos autos se diseñan para alimentar emociones de placer social y se convierten en objetos simbolo de lujo, algunos diseños de electrodomésticos comparten la misma filosifía, son los hermanos menores del diseño de autos, ya que se ambos utilizan materiales similares y también les prestan la tecnología para su diseño de ingeniería éstos aparatos se han convertido incluso en esculturas metálicas de decoración, han dejado de ser simples maquinas domésticas, para convertirse el objetos funcionales y también bellos, incluso lujosos.

1.4. Color y significado de los electrodomésticos

En los electrodomésticos grandes como el refrigerador inicialmente fueron en color blanco desde los años treinta a los años cincuenta predominó éste color, que en un inicio se relacionaba con el concepto de higiene y limpieza, pero algunos otros más pequeños eran en color del metal como acero, y aluminio Pelta (2012).

El color relacionado con el acero y la modernidad, (Sparke, 2010:60) a finales de los años 30 la aplicación del aluminio en algunos productos como carrocerías de aviones, coches y mobiliario de vanguardia, había logrado una imagen de modernidad, en el área doméstica tardó en conseguir esta imagen ya que el aluminio se mancha y la población creía que era nocivo, en el periodo entre guerras el material se fue relacionando con modernidad porque es más liviano que el acero y se introdujo en transportes y posteriormente en el hogar con objetos de uso doméstico, por parte del diseñador Rusel Wright en colaboración de la diseñadora Lurelle Guild, sugiriendo a las amas de casa como las anfitrionas del hogar, con elegantes servicios así como enseres para la casa y piezas decorativas de mesa diseñados en aluminio hilado, convirtiéndose en productos muy atractivos.

"El acero cromado también adquirió una significación moderna en el periodo de entreguerras. La aplicación de la superficie brillante y llena de reflejos como material de la base apelaba a la conciencia visual de los consumidores de modernidad que se llagó a valorar más que el de "naturaleza. Asimismo se extendió la idea de que la tecnología era capaz de crear sus propios objetos, que a su vez se convertían en manifestaciones materiales de su propio poder y autoridad en el mundo moderno." (Sparke, 2010:61)

La tecnología en el hogar estaba reservada para las esferas altas por ejemplo el acceso a los muebles de tubo de acero cromado solo se veía en las casas más vanguardistas de Europa, Gracias a los diseñadores Marcel Breuer y Mies van der Rohe, se documentó bien el progreso y uso del acero tubular en Alemania así como también del Arquitecto francés Le Corbusier,

este progreso ayudó al abandono del sillón de madera tapizado por una estructura estética de metal.

En los años de posguerra El significado de los nuevos materiales se impuso fuertemente, aunque su aceptación variaba según el ámbito de la cultura, materiales el que se utilizaran.
"En los países nórdicos, el acero inoxidable se convirtió en un nuevo tipo de plata" (Sparke, 2010:167).

En los años setenta hubo una gran producción e influencia en occidente de productos electrónicos japoneses de alta tecnología, estos productos eran de un diseño complejo por mencionar alguno, cámaras y equipos de alta fidelidad de compañías como Sony, Sharp, Canon, Toshiba e Hitachi, la apariencia de estos productos reflejaba tecnología de punta, y la mayoría eran destinados al uso doméstico.

"El grado de sentido utópico que representaban estos objetos claramente masculinos, en color negro y plata para reflejar esa estereotipada diferenciación de género" (Sparke, 2010,169)

> "A partir de los años ochenta, Japón seguido muy poco de después por Taiwan, Singapour, Indonesia y China, reconoció las diversificadas necesidades de los mercados mundiales e intentó ofrecer variaciones locales y nacionales en cuanto a gustos, El fabricante Japonés de aparatos electrónicos Sharp, por ejemplo, diseñó y comercializó televisores adecuados para cada país tras descubrir que en Alemania gustaban los de color negro, mientras que en Italia se preferían en blanco y en el Reino Unido los de plástico en imitación de madera." (Sparke, 2010:173)

Los electrodomésticos han cambiado de color según la época a la par que el diseño y color de los autos, evidentemente el color plata por darle un nombre a los colores metálicos fue incorporado desde finales de los años treinta en objetos domésticos como un color favorito de los fabricantes y adoptado positivamente por la población, ya fuera por ser en ese tiempo materiales como el acero inoxidable y el aluminio la tecnología de punta en esa época y dejar el tono natural del metal sin recubrimiento de pintura reducía costos en la producción, y al mismo tiempo se relacionaba con la modernidad ya que las máquinas eran de metal o color plata y la modernidad se ha relacionado con el lujo ya que no todas las clases tenían acceso a ciertos productos.

2. Método

2.1. Sujetos

Se entrevistaron 40 participantes en una edad promedio de 43.5 años que cubrían el perfil 17 hombres y 23 mujeres con profesiones indistintas en la Zona metropolitana de Guadalajara. El tamaño de la muestra se determinó por ser un estudio de grupo de enfoque, el tamaño sugerido es de 10 casos por grupo, distribuido en cuatro grupos. Los candidatos para ser participantes debían cumplir con un perfil de nivel socioeconómico: C medio, C+ medio alto, o A/B alto (ver características en tablas de niveles socioeconómicos de México.

2.2 Materiales

Se utilizó un proyector, cañon, hojas de respuestas y lápiz. La encuesta que se aplicó a los sujetos fué (PPP) Análisis de personalidad de perfil de producto, es una técnica de evaluación visual de objetos, (Mc Donagh, 2000) como su nombre los indica el método consiste en realizar un perfil de proyección del usuario, a partir de una imagen de un producto

2.3 Procedimiento

Se solicitó al participante que atribuya una personalidad y un estilo de vida al objeto, se solicitó a los participantes observar a través de un proyector (cañón) 6 imágenes de los electrodomésticos a color (cafetera, licuadora, horno, refrigerador, estufa y exprimidor de cítricos) con características formales relacionadas con el concepto "lujo", una a la vez, así como se les proporcionó una hoja de respuestas, donde tenían que relacionar la imagen con un tipo de auto, relacionar el auto con un color y un estilo de decoración en el hogar. Opciones ver tabla 1

3. Resultados

A continuación se presentan los resultados que se obtuvieron en la investigación, los cuáles se describen en las tres categorías de la encuesta, Atribuciones de concepto lujo y tipo de auto, Atribuciones de concepto lujo y tipo de decoración en el hogar y Atribuciones de concepto lujo y color

Tabla1. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Cafetera)

CAFETERA	**Descripción de color**: El metal parece aluminio por ser un color plateado muy claro, blanco con ligeros tonos azules, la base es de madera en un tono caoba.				
Atribuciones de concepto lujo y tipo de auto	**%**	Atribuciones de concepto lujo y tipo de decoración en el hogar	**%**	Atribuciones de concepto lujo y color	**%**
1.Standar	22.5	1. Estilo Moderno	50	1.Plata	22.5
2.SUV	17.5	2.Estilo Minimalista	25	2.Negro	15
3.Premium	15	3.Estilo clásico	20	3.Gris	12.5
4.Lujo	15	4.Estilo Ecléctico	2.5	4.Arena	10
5.compacto	10	5.Estilo Rústico	2.5	5.Rojo	7.5
6.Van	10			6.Blanco	7.5
7.Intermedio	7.5			7.Azul	0
8.Economico	2.5			8.Verde	0
				9.Sin opinión	25

Tabla 2. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Licuadora)

LICUADORA	**Descripción de color**: Acero inoxidable, el color del acero es un plateado gris con reflejos negros gracias a la forma cilíndrica del objeto, el vaso es de cristal.				
Atribuciones de concepto lujo y tipo de auto	**%**	Atribuciones de concepto lujo y tipo de decoración en el hogar	**%**	Atribuciones de concepto lujo y color	**%**
1.SUV	27.5	1.Estilo Moderno	52.5	1. Plata	22.5
2.Premium	20	2. Estilo Minimalista	27.5	2. Negro	17.5
3.Lujo	15	3.Estilo Clásico	12.5	3. Arena	17.5
4.Standard	15	4.Estilo Ecléctico	5	4. Blanco	10
5.Intermedio	12.5	5.Estilo Rústico	2.5	5. Gris	5
6.Compacto	5			6. Rojo	5
7.Van	5			7. Azul	2.5
				8. Sin opinión	20

Tabla 3. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Horno)

HORNO	**Descripción de color:** El metal es aluminio texturizado, la textura es pronunciado dejando ver líneas negras entre el metal blanco plateado, con una ventana en cristal en negro ahumado mate y algunos detalles del objeto en negro.				
Atribuciones de concepto lujo y tipo de auto	**%**	Atribuciones de concepto lujo y tipo de decoración en el hogar	**%**	Atribuciones de concepto lujo y color	**%**
1.Premium	30	1.Estilo Moderno	57.5	1.Negro	25
2.Lujo	20	2.Estilo Minimalista	17.5	2.Rojo	15
3.Standard	17.5	3.Estilo Ecléctico	17.5	3.Plata	12.5
4.Van	10	4.Rústico	5	4.Blanco	10
5.Intermedio	10	5.Estilo Clásico	2.5	5.Arena	7.5
6.SUV	7.5			6.Azul	2.5
7.Compacto	2.5			7.Sin opinión	22.5
8.Económico	2.5				

Tabla 4. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Refrigerador)

REFRIGERADOR	**Descripción de color**: El color dominante es negro metálico mate, el asa es en color acero un tono gris oscuro y mate, tiene integrada una pantalla de televisión en la puerta del refrigerador, la rodea un marco negro y otra pequeña pantalla de fondo negro con números digitales en rojo, que indica la hora, temperatura y algunas funciones del objeto.				
Atribuciones de concepto lujo y tipo de auto	**%**	Atribuciones de concepto lujo y tipo de decoración en el hogar	**%**	Atribuciones de concepto lujo y color	**%**
1.Lujo	27.5	1.Estilo Moderno	42.5	1.Negro	20
2.Intermedio	20	2.Estilo Minimalista	20	2.Blanco	12.5
3.Van	17.5	3.Estilo Ecléctico	17.5	3.Plata	12.5
4.SUV	15	4.Estilo Clásico	10	4.Gris	10
5..Premium	12.5	5.Estilo Rústico	10	5.Rojo	7.5
6.Standard	5			6.Azúl	5
7.Económico	2.5			7. Arena	5

Tabla 5. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Estufa)

ESTUFA	**Descripción de color:** El color es acero inoxidable, en un tono gris oscuro, con dos puertas de cristal ahumado en azul turquesa.				
Atribuciones de concepto lujo y tipo de auto	**%**	Atribuciones de concepto lujo y tipo de decoración en el hogar	**%**	Atribuciones de concepto lujo y color	**%**
1.Standard	22.5	1.Estilo Clásico	37.5	1.Plata	20
2. VAN	20	2.Estilo Moderno	32.5	2.Azul	17.5
3.Lujo	17.5	3.Estilo Ecléctico	20	3.Gris	15
4.SUV	15	4.Estilo Minimalista	7.5	4.Blanco	10
5.Intermedio	10	5.Sin opinión	5	5.Rojo	5
6.Premiun	5			6.Arena	5
7.Compacto	5			7.Negro	5
8.Económico	5			8.Sin opinión	27.5

Tabla 6. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Exprimidor)

EXPRIMIDOR	**Descripción de color:** El objeto se compone de dos piezas de acero la base en acabado brillante con reflejos, y en la parte superior acero en acabado mate, con un detalle en metal negro brillante y una pequeña pieza superior en blanco.				
Atribuciones de concepto lujo y tipo de auto	**%**	Atribuciones de concepto lujo y tipo de decoración en el hogar	**%**	Atribuciones de concepto lujo y color	**%**
1.Lujo	22.5	1. Estilo Moderno	57.5	1.Plata	25
2.Intermedio	22.5	2.Estilo Minimalista	35	2.Arena	12.5
3.Premium	20	3.Estilo Clásico	2.5	3.Rojo	10
4.SUV	12.5	4.Sin opinión	5	5.Azul	10
5.Estandard	12.5			6.Negro	7.5
6.Económico	7.5			8.Gris	5
7. VAN	7.5			9.Blanco	2.5
8.Compacto	2.5			10.Verde	2.5
				11.Sin opinión	25

3.1. Jerarquía de colores relacionados con el lujo

Los colores que la población de la ZMG relaciona con el concepto lujo en electrodomésticos, según el estudio que se realizó.

En primer lugar se encuentra el color plata, fue preferido en las seis imágenes, en los tres primeros lugares de preferencia el primer lugar lo obtuvo cuatro veces y en la otras dos el primer lugar, con porcentajes de preferencia mínimo de 12.5 y máximo de 25, en segundo lugar se situó el color negro apareciendo cuatro veces en los tres primeros lugares de preferencia con un porcentaje mínimo de 15 y máximo de 20, en tercer lugar se encuentra el color Arena siendo el preferido en dos ocasiones en los primeros tres lugares, una vez en segundo lugar y otra ocasión en tercer lugar con un porcentaje mínimo de 12.5 y máximo de 17.5,en cuarto lugar está el color Gris con una preferencia de dos veces en tercer lugar y sus porcentajes fueron mínimo de 15 máximo de 12.5, no podía faltar el color rojo aunque no fue de los primeros lugares está en la lista, este color estuvo dos veces en los tres primeros lugares una vez en tercero con un porcentaje de 10 y una vez en segundo con un porcentaje de 15, en lugar número seis se encuentra el color azul, seleccionado una ocasión en segundo lugar con un porcentaje de 17.5 y por ultimo está el blanco se seleccionó una vez con 12.5 de porcentaje en segundo lugar, el verde tuvo un valor muy bajo de 2.5 en una ocasión.

3.2. Jerarquía de tipos de autos relacionados con el lujo

En categorías de autos se presentó una lista de todos los tipos de auto y entre paréntesis uno o varios ejemplos de marcas para que tuvieran una idea clara del concepto que elegirían en la encuesta las opciones fueron:

a) Económico (Atos o similar), **b) Compacto** (Chevy Clío o similar) **c) Intermedio** (Aveo o similar).**d) Estándar** (Sentra Megane o similar **e) SUV** (Nitrot Patriot o

Koleos). **f) Premiun** (Mercedes Benz E280, Audi A6,Chrysler Grand Voyager. **g) Lujo** (BMW 730 y Mercedes SLK2. **h)VAN´s camionetas** (Journey Suburban, Durango, Van express).**i) Carga** (Traffic, Cangoo, F-350).

Los resultados fueron en primer lugar la categoría auto de lujo seleccionada 5 veces dos veces en primer lugar una vez en segundo lugar y dos veces en tercer lugar con un porcentaje de preferencia mínimo de 17.5 y un máximo de 27.5, en segundo lugar se encuentra el auto tipo Premiun elegido en los tres primeros lugares cuatro veces, una ocasión en primer lugar, una vez en segundo y dos veces en tercer lugar con porcentaje mínimo de 15 y máximo de 30, el auto tipo Estándar se encuentra en la posición tres de la lista seleccionado tres veces en los tres primeros lugares dos ocasiones en primer lugar y una vez en tercer lugar con porcentajes mínimo de 17.5 y máximo de 22.5, en el cuarto lugar se encuentra el auto tipo Intermedio con dos posiciones de segundo lugar de porcentajes altos 22.5 y 27.5 de preferencia, en quinto lugar resultó la camioneta pequeña SUV una vez en primer lugar con 27.5 y otra en segundo con 17.5 en porcentajes, y finalmente las camionetas tipo VAN´s con una posición en segundo y una en tercero los porcentajes 17.5 y 20 los autos tipo compacto económico tuvieron una preferencia muy baja, sin llegar al tercer lugar el auto tipo de carga nunca lo seleccionaron.

3.3. Jerarquía de Estilos de decoración en el hogar con el lujo

En esta sección de la encuesta las opciones fueron a) Clásico b) Rústico c) Moderno d) Minimalista e) Ecléctico.

La relación de lujo con la decoración en el hogar se ligó fuertemente al estilo moderno ya que es la categoría más seleccionada, en las seis imágenes atribuyeron esta opción cinco veces en primer lugar y una vez en segundo con porcentajes mínimo de 32.5 y máximo de 50, en segundo lugar se situó el estilo Minimalista con cinco veces de preferencia en todos los casos segundo lugar, porcentaje mínimo de 17.5 y máximo de 35 El estilo Clásico lo seleccionaron cuatro veces, tres veces en tercero y una vez en primero, con porcentajes variados el mínimo de 2.5 otro de 12.5, 20 y el mayor de 37.5. El estilo Ecléctico fue seleccionado tres veces la primera, las tres en tercer lugar, con valores de 17.5 en dos casos y 20 en un caso.

4 .Conclusiones

El resultado del estudio muestra que los participantes hacen una fuerte vinculación con el concepto lujo y los colores plata negro y arena, en el orden mencionado mencionando cabe aclarar que dichos colores son metálicos ya que la relación del color, el metal, los electrodomésticos y los autos es fuerte, como se revisó en el apartado de significado de los colores y los electrodomésticos desde los años treinta, los colores del metal como el acero, aluminio y otros metales plateados se implementaron en el diseño de autos, la misma tecnología se prestó a el diseño de electrodomésticos dotándolos de características similares entre ellas el color, asociándolo el color de la máquina, que a su vez se relacionaba con la tecnología, actualmente se sigue aplicando la misma regla de la semejanza de tecnología y moda entre autos y electrodomésticos, En este estudio se puede observar vigente esa vinculación del color plata con el significado de lujo en dichos objetos, ha prevalecido casi intacta después de tantos años se siguen fabricando infinidad de objetos en color plata para el uso doméstico especialmente en la cocina los cubiertos siempre han sido plateados y

actualmente desde detalles como las asas de las alacenas en acero o aluminio resaltan esa estética elegante de la modernidad, las estufas o ahora desplazadas por las parrillas y en juego con las campanas decorativas en colores plateados son los acentos más sofisticados aprovechando que este color armoniza con cualquier otro que se aplique en la cocina como alacenas, pisos u otros detalles.

En seguida se encuentra el significado de lujo asociado con el color negro, el color de la muerte en algunas culturas pero también el de la elegancia en muchas otras, este color aunque ha sido favorito más en los aparatos electrónicos que en los electrodomésticos por su connotación masculina también es uno de los colores que el estudio arrojó con un alto significado de lujo, en los electrodomésticos es favorito de estufas y hornos y cafeteras, muchas veces es acompañado del color plata y juntos son favoritos de muchos diseño referentes al lujo.

Otro color que el estudio relacionó con el significado de lujo es color arena, de luminosidad clara, aunque no es común en electrodomésticos si lo es en autos, seguramente la asociación va más hacia esta línea de diseño ya que ahí es bien explotada, y si este estudio muestra esa fuerte significación con el lujo podría ser una nueva opción con buenas expectativas de aplicación en el área de los electrodomésticos.

De la lista de colores que se utilizaron en la encuesta el color que tuvo una casi nula asociación con el lujo fue el color verde.

En el caso de los autos la categoría de auto de lujo, fue seleccionada en primer lugar por los participantes, seguramente por la connotación de la palabra se relacionaba con facilidad en la primera opción la segunda opción fue el auto tipo Premium y en tercera opción el auto tipo estándar, es interesante la relación de las categorías de autos con los colores asociados ya que el color negro el plata y el arena metálicos son muy explotados en la industria automotriz en estas categorías un ejemplo contrario los autos compactos o económicos no aparecieron como resultado de la relación con el lujo y aunque si los hay en plata y negro son favoritos de colores brillantes que tendrán otro significado.

Por último se encuentran las atribuciones de concepto lujo y tipo de decoración en el hogar que van directamente relacionadas con el estilo de vida que las personas relacionan

En las seis opciones asociaron el significado de lujo con el estilo moderno en la decoración así como en segundo lugar el estilo minimalista, que ambos estilos tienen una fuerte relación con los colores plata y negro, en la tercera opción está el estilo Clásico perteneciente al estilo aburguesado de muebles Luis XV y curiosamente el color arena es un tono cálido perteneciente a este estilo, seguramente para diferentes generaciones diferentes estilos de decoración y colores significan lujo.

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Figura 1. Pirámide de las necesidades de Maslow. www.universidadperu.com
Figura 2. Pirámide de necesidades de consumo (Jordan, 1999:6).
Fig. 3. Esquema, Objeto –signo

Tabla 1.Categorias de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Cafetera)
Tabla 2.Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Licuadora)
Tabla 3.Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Horno)
Tabla 4. Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Refrigerador)
Tabla 5.Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Estufa)

Tabla 6.Categorías de autos, estilos de decoración y colores con asociación a electrodomésticos de lujo. (Exprimidor)

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The Human Skin Colorimetric And Evaluation Way Applied Spectral Imaging And Analysis Of Optics Structure

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Abstract

The human skin is one of the difficult objects to get high accurate measuring result by ordinary contact type spectrophotometer. As the reason, the human skin surface has extremely complex structure and half-transparence phenomenon. In this study, the human skin measuring way was applied non-contact type spectral imaging, and system was composed with wide band white LED light source, liquid crystalline tunable filter, Peltier cooled monochromatic CCD sensor, and laser projector for 3-Dimentional scanning to compensate curvature of image measuring area. Subjects were 2 males and 3 females, and measured part was medial surface of lower arm.

Each subject skin was measured from 420 to 700nm each 10 nm by non-contact type spectral imaging, and compared to contact type spectrophotometer with 150mm size sphere illumination. As the result, each reflectance was almost same in short wavelength, but different from 580 to 700nm wavelength. To confirm this phenomenon, human skin was measured by sphere type spectrophotometer with various illumination and detection diameter. Illumination diameter was more than 30mm, reflectance profile was same as noncontact type spectral imaging measured profile. According to this result, double layer model which are composed half-transparence orange colored filter and violet colored substrate layer was made to reproduce this phenomenon and measured spectral reflectance. These two layers were controlled thickness, $K\lambda$ and $S\lambda$ absolute coefficient of Kubelka-Munk Theory. The both spectrophotometer measured result of this model were same as human skin, and got highly accurate reproduced result.

To evaluate surface of human skin, each wavelength images, *XYZ* images measured by non-contact spectral imaging with gonio-photometric way, were applied Laplacian filter calculation and analyzed correlation between calculated value and each age of subject. The results of correlation about human age, Laplacian filter value, spatial frequency, wave-length were shown in this study. This colorimetric way was quite useful and high possibility for evaluation of the human skin characteristics.

Keywords: Spectral Imaging, Human Skin, Kubelka-Munk, Laplacian Filter

Introduction

The human skin is one of the difficult objects to get high accurate measuring result by ordinary contact type spectrophotometer. As the reason, the human skin surface has

extremely complex structure and half-transparence phenomenon. Ideally, non-contact type colorimetric measuring way is necessary. Especially, spectral imaging is useful to measure and evaluate of human skin. On the other hands, human body has curvature and needs 3-Dimensional metric to compensate optics geometry. In this study, combined spectral imaging way and lattice pattern projection for measuring part to compensate optics dimension, and applied Laplacian filter calculation to evaluate skin surface.

Experiment

Compare with non-contacted spectral imaging way and contacted sphere system

A gonio-photometric spectral imaging system was applied to measure spectral reflectance and texture of human skin. It was composed of white LED illuminates, a liquid crystalline tunable filter (LCTF), and CCD imaging device with Peltier cooling unit. Illuminating direction was 20 degrees from normal direction, and detecting direction was normal against sample, and the CCD device captured the images via the LCTF. And laser projector was applied to get 3-Dimension human skin object by lattice pattern projection to compensate optics geometry and schematic diagram is shown in Figure 1. Left side is optics geometry measuring system, and right side is captured image of lattice pattern projection on human lower arms. Measuring area was around 10cm by 7.5cm and pixel resolution was 772 by 580 pixels in this area, and resolution was 192 dpi.

On the other hands, contacted sphere system was applied to compare with non-contacted spectral imaging way. Measuring equipment was Konica-Minolta CM3600d, sphere size is 150mm and measured wavelength is from 400 to 700nm each 10nm with 3 different illuminating and viewing aperture (Illuminating size is 30mm and combined with viewing size 25.4mm, 8mm, 4mm. Illuminating size is 11mm and combined with viewing size 8mm, 4mm. Illuminating size is 7mm and combined with viewing size is 4mm. Shown in Figure 2) in this study.

Measured part of human skin was middle of lower arm and measured 5 subjects, 2 males and 3 females. These subjects age were around twenties to seventies. Measurement time was need 2 minutes, and arm was fixed during measuring. Each wavelength and synthetic color image under D65 illuminate were shown in Figure 3. There were various textures in each wave length, the surface texture was very smooth in long wavelength region, on the other hand, a lot of particulate texture in short wavelength region.

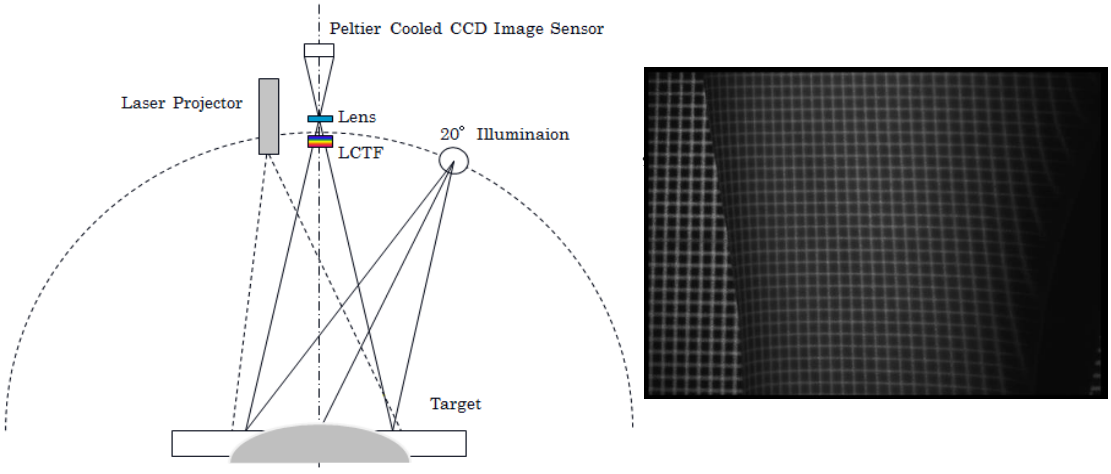

Figure 1. Schematic diagram of measuring system and lattice pattern projection image

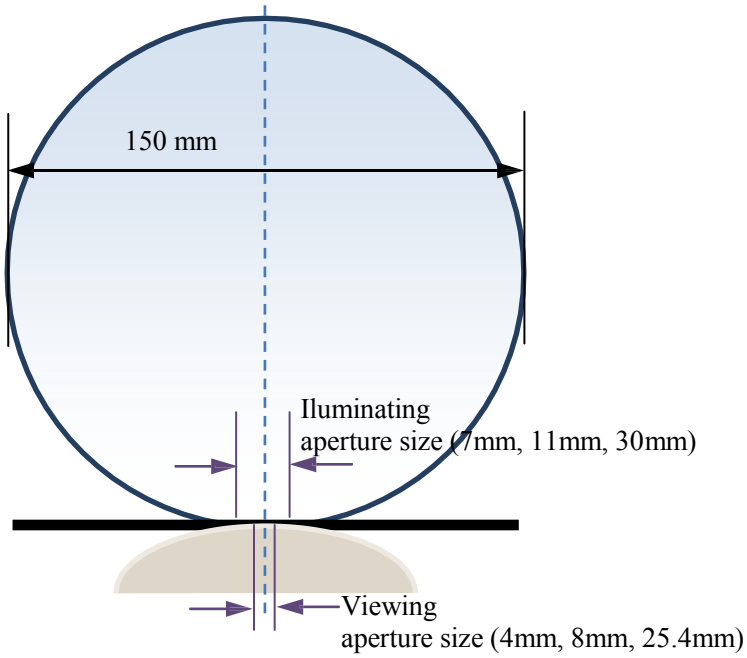

Figure 2. Schematic diagram of sphere measuring and illuminating – viewing aperture size

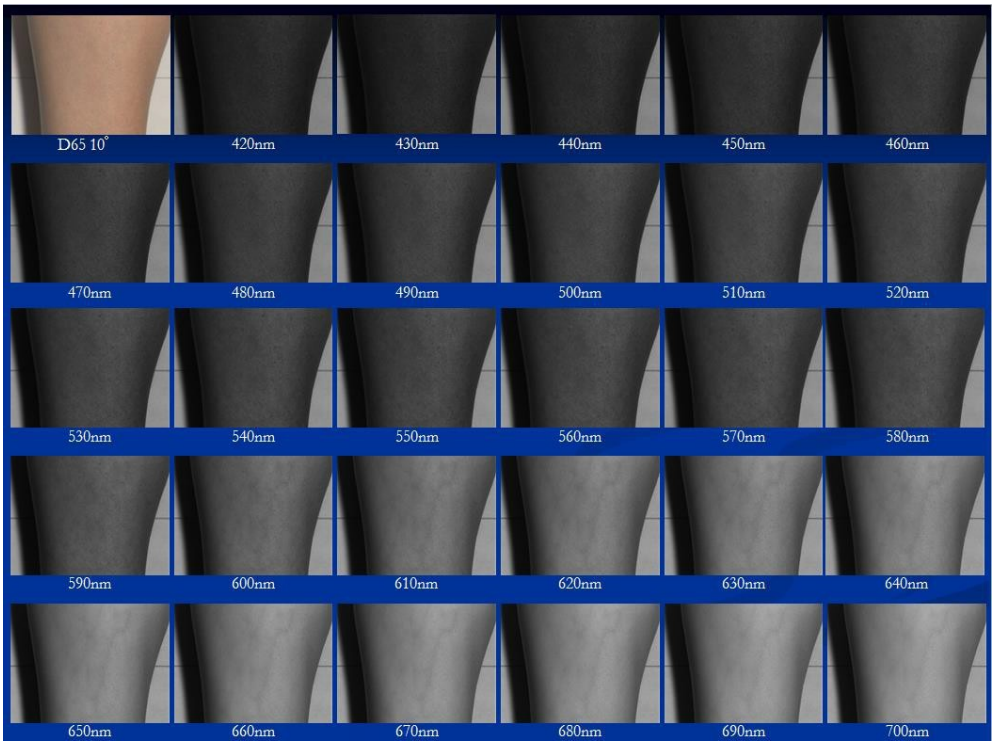

Figure 3. Spectral imaging measured result from 420 to 700nm

The reflectance profile measuring results are shown in Figure 4 and CIELAB value are shown in Table 1. As a result of the reflectance measuring, contacted sphere illuminating and non-contacted spectral imaging reflectance profile was different in long wavelength region. In the case of sphere illuminating, 7mm size illuminating aperture condition was smaller than 30mm size illuminating aperture in 600 to 700nm region (Figure 4.a).

Compere with sphere illuminating and spectral imaging, also 11mm size illuminating aperture of sphere system was smaller than spectral imaging. But 30mm size illuminating aperture of sphere system was same of spectral imaging.

The human skin has half-transparence optical property, and these results are presumably related with edge loss error of sphere illuminating.

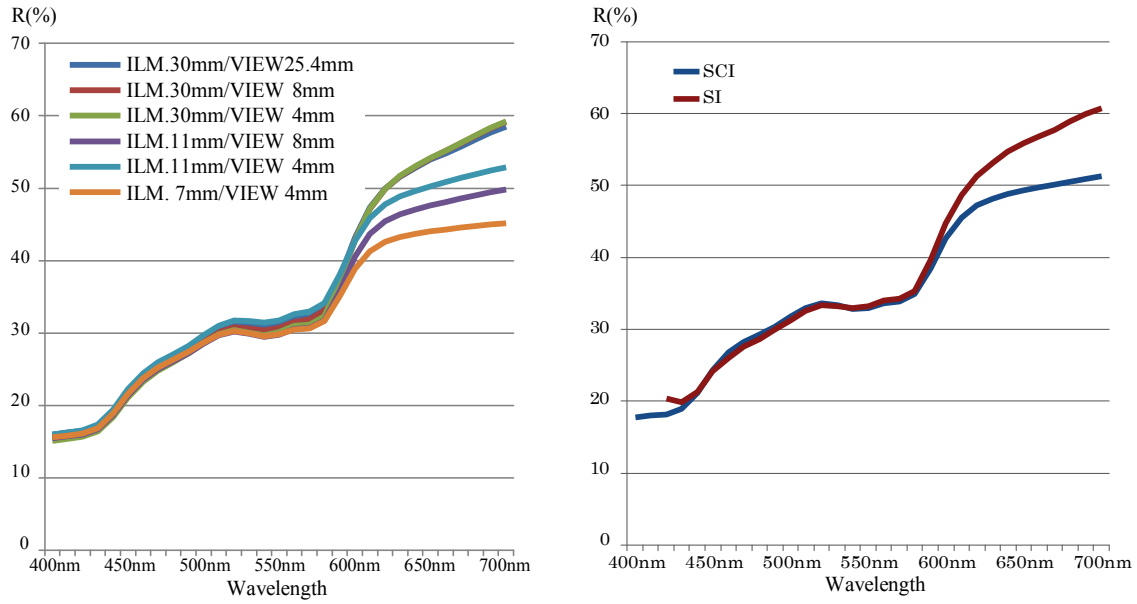

Figure 4. Spectrum reflectance measuring result of non-contacted spectral imaging and contacted sphere illuminating.

Table 1. CIELAB Value of 5 subjects measuring result. SCI/SCE is contacted sphere illuminating and S.I. is non-contacted spectral imaging.

Age / Gender		20 F	20 M	40 F	50 M	70 F
SCI	L*	68.32	67.53	63.85	62.11	67.26
	a*	4.92	4.05	5.85	7.94	3.49
	b*	16.26	14.64	16.92	15.99	18.41
SCE	L*	68.02	67.26	63.84	61.80	66.96
	a*	4.98	4.11	5.92	7.98	3.53
	b*	16.41	14.84	17.17	16.12	18.55
S.I.	L*	70.06	68.44	64.19	61.55	67.21
	a*	7.43	8.58	7.95	9.95	7.83
	b*	17.54	16.14	17.55	16.91	18.70

Reproduced human skin optics model applied silicon material

According to the above reflectance measuring result, it was considered about the human skin optics model. The optics model was applied double layer structure composed with substrate layer and opaque layer (See Figure 5). The substrate layer color was related hemoglobin and opaque layer color was related with epidermis, hypodermis, and subcutaneous fat. The opaque layer was applied silicon material with Kubelka-Munk absolute two constancy way, and the substrate layer was applied industrial paint material with relative two constancy way. These equations are following.

$$R = R'/\{(1-k_1)(1-k_2)+k_2 \cdot R'\} \quad (1)$$

$$(K/S) = (1-R)^2/(2R) \quad (2)$$

$$A = R_{WC} \cdot R_B - R_{BC} \cdot R_W$$

$$B = \{R_W - R_B\}\{1+R_{WC} \cdot R_{BC}\} - \{R_{WC} - R_{BC}\}\{1+R_W \cdot R_B\}$$

$$R_\infty = \{-B+Sqrt(B^2-4A^2)\}/2A \quad (3)$$

$$S = ln[\{(R_\infty - R_W)(1/R_\infty - R_{WC})\}/\{(R_\infty - R_{WC})(1/R_\infty - R_W)\}]/\{X \cdot (1/R_\infty - R_\infty)\} \quad (4)$$

$$K = S(1-R_\infty)^2/(2R_\infty) \quad (5)$$

$$(K/S)_m = \{K_1P_1+K_2P_2+ \quad +K_s(1-\Sigma P_i)\}/\{S_1P_1+S_2P_2+ \quad +S_s(1-\Sigma P_i)\} \quad (6)$$

In these equation, R is ideal reflectance after compensate by Saunderson correction, R' is actual measured reflectance, k is coefficient of specula reflection, R_W is reflectance of white substrate, R_B is reflectance of black substrate, R_{WC} is over bright reflectance, R_{BC} is over dark reflectance, K and S are Kubelka-Munk absorbing and scattering coefficient.

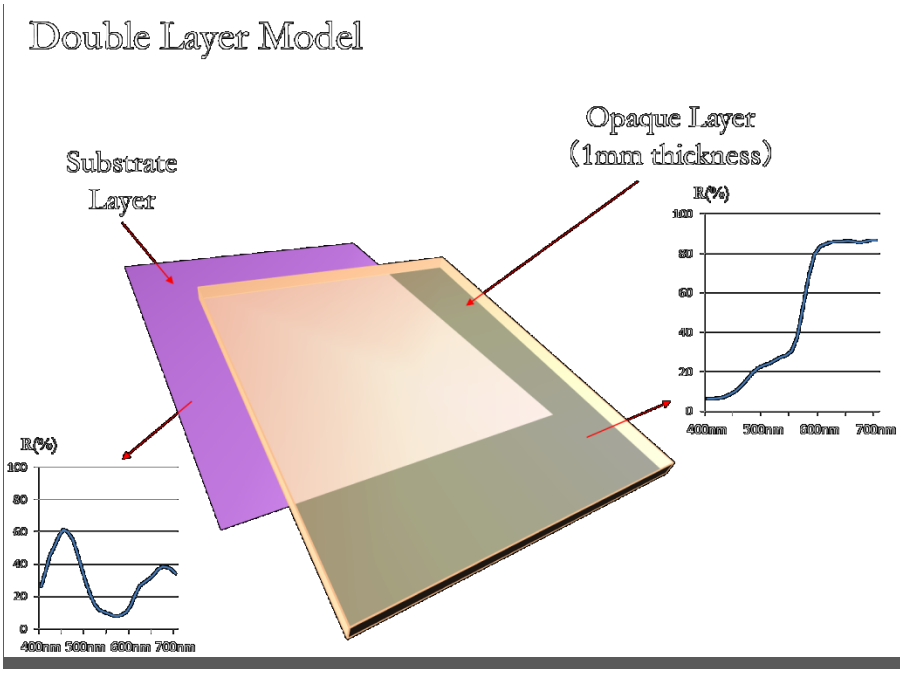

Figure 5. The human skin double layer optics model

The opaque layer was composed with high transparent silicon resin and color tonner (Volks Inc.) and casted 1mm thickness. To get Kubelka-Munk K and S coefficient, single tonner mixed sample on white and black both substrate was measured with 7mm, 11mm, and 30mm illuminating aperture size by Konica-Minolta CM3600d spectrophotometer. And K, S coefficient was calculated by equation (1) to (5).

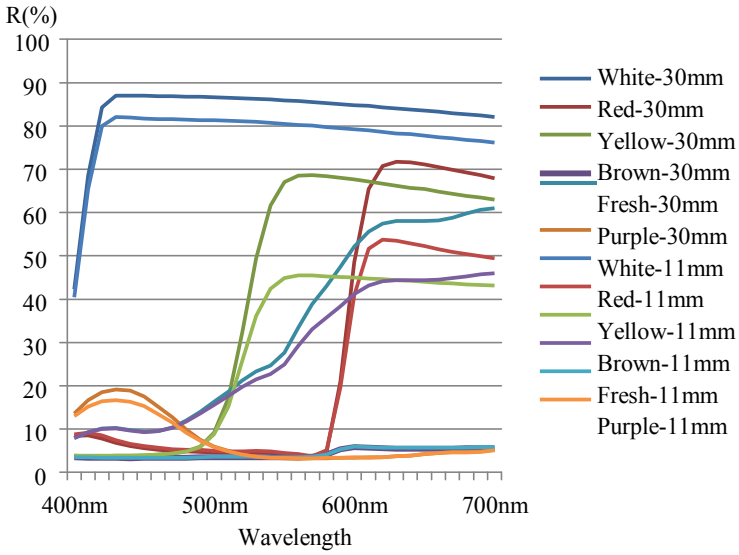

Figure 6. Spectrum reflectance of each tonner in silicon resin measured by sphere illuminating spectrophotometer

The substrate layer was made by industrial paint (KCC Inc. Baromatch Paint), and target profile was hemoglobin. 1 White(KM100), 1 Black(KM702), 2 Yellow(KM401, KM409), and 3 Red(KM604, KM605, KM613) total 7 paints were composed and matched.

Target profile was actual measuring reflectance which subject was male in 50. And matched reflectance curve combined with opaque layer and substrate layer is shown in Figure 7..

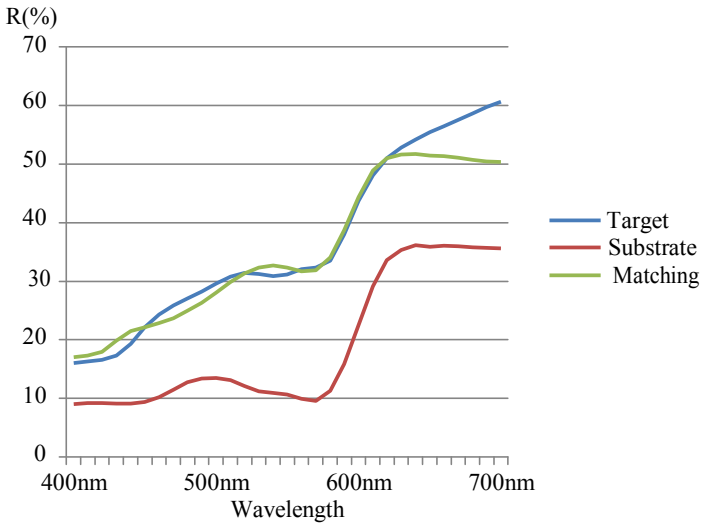

Figure 7. Matching result of spectrum reflectance profile combined with substrate and opaque layer

Human skin evaluation by Laplacian filter

After measuring 5 subjects of lower arm, Laplacian filter value of each 10nm wavelength from 420 to 700nm measured spectral imaging data was calculated with 1 to 50 filter size (See Figure 8). Also *L*a*b**, *XYZ* value were calculated from each pixel spectral imaging data under illuminant D65, F10, and A. Each wavelength image, *L**, *a**, *b** image, and *XYZ* image was applied Laplacian filter calculation way of equation 7.

$$\nabla^2 f(x,y) = \frac{\partial^2 f(x,y)}{\partial x^2} + \frac{\partial^2 f(x,y)}{\partial y^2} = f_{xx}(x,y) + f_{yy}(x,y) \tag{7}$$

The Laplacian filter calculation way of *L*a*b** color image under D65, F10, and A illuminate was applied color difference calculation. *Delta* E^*_{ab} between two beside pixel is same as deviation. The Laplacian filter calculation way of color image was applied summation of *Delta* E^*_{ab} between center and up and down, left and right, total 4 direction pixels. These calculation results are shown in Table 2.

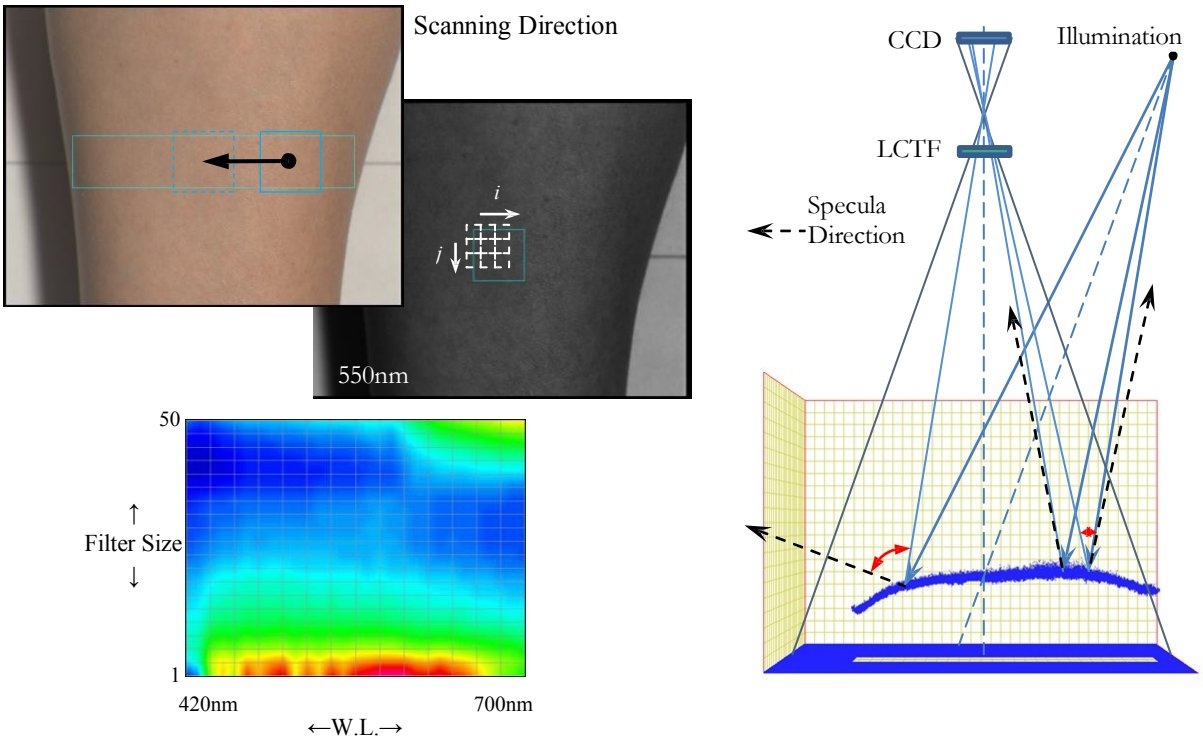

Figure 8. Schematic diagram of measuring system and lattice pattern projection image

The measuring part of middle of lower arm was not flat. The specula directions of pixel in image are recognized by lattice pattern which was projected laser beam projector. Each subject calculates results of lower arm center part are shown in Figure 9. And also calculates results of lower arm with various specula directions are shown in Figure 10.

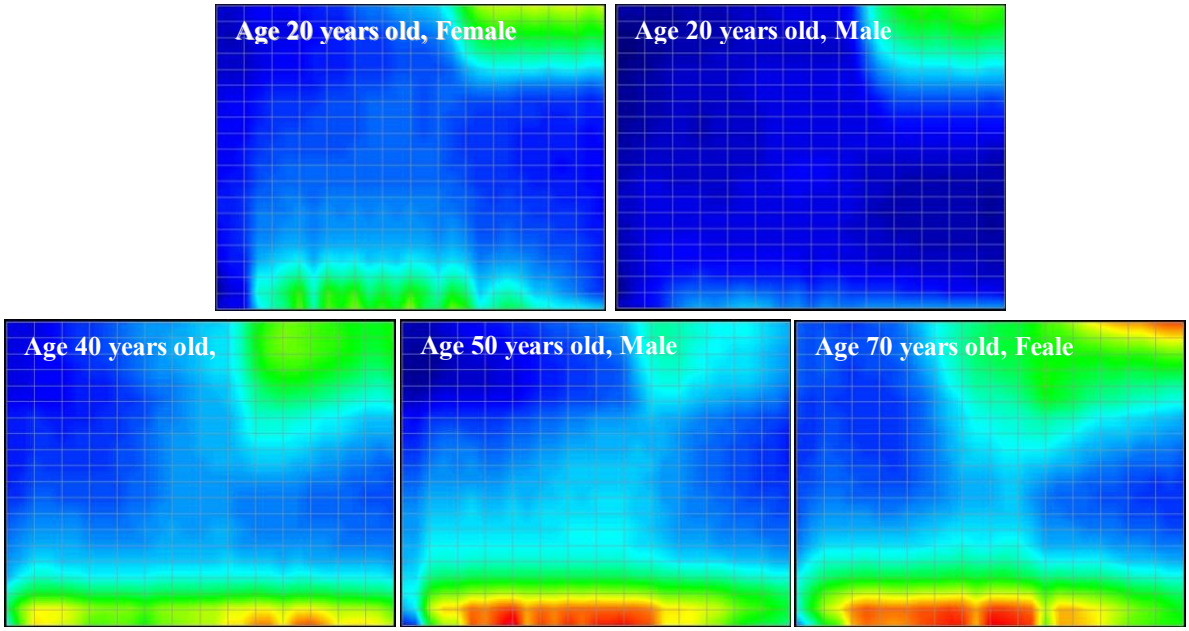

Figure 9. Laplacian filter calculate result of 5 subjects (Center part of lower arm)

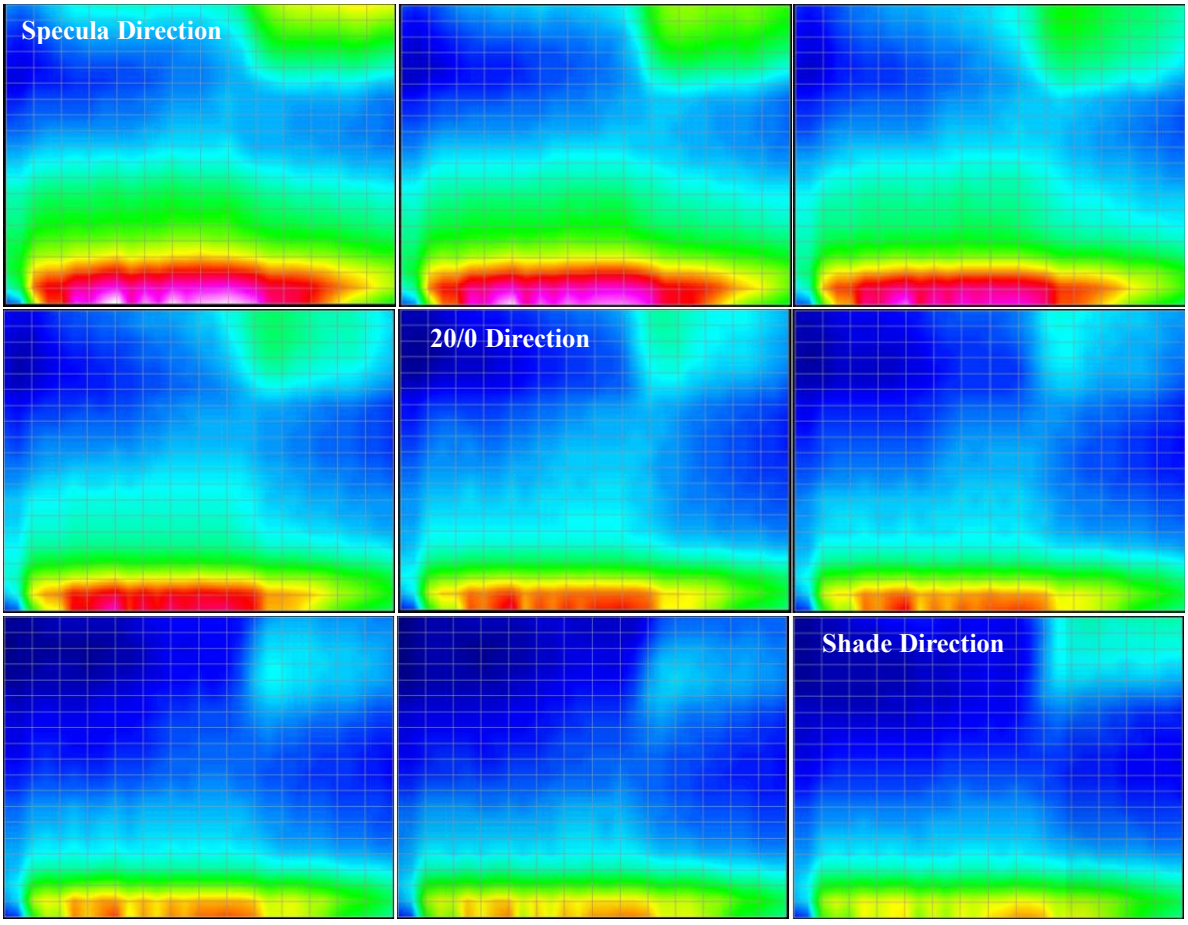

Figure 10. Laplacian filter calculate result with various specula direction

The single wavelength image of 500nm applied Laplacian filter was shown in Figure 11. In this figure, Laplacian filter calculated averaged of 5 different size of area and each size were 3 by 3, 5 by 5, 10 by 10, 20 by 20, and 40 by 40 pixels.

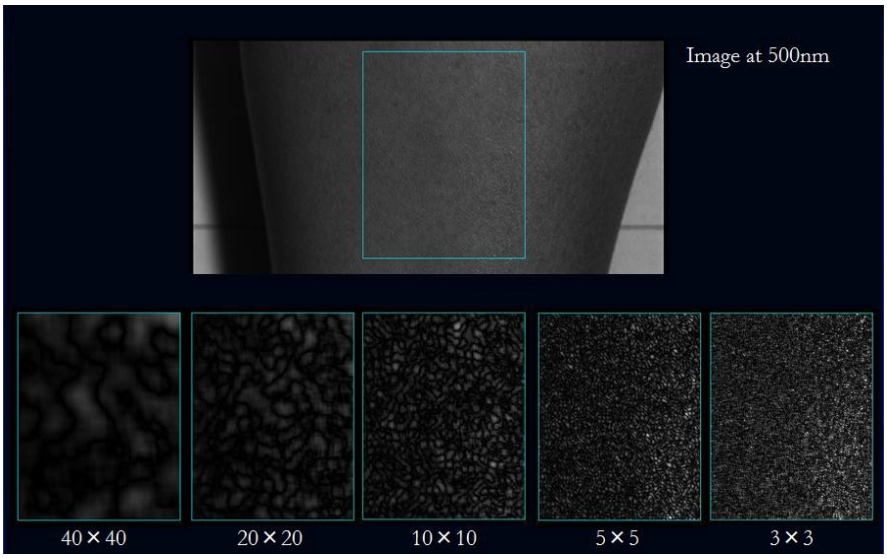

Figure 11. Laplacian filter calculation result of 500nm spectral imaging with 40 by 40, 20 by 20, 10 by 10, 5 by 5 and 3 by 3 filter size

The Laplacian value of color image based on CIELAB coordinate under D65, F10, and A illuminate, average value of each wavelength image were shown in Table 2. Yong age value was smaller than old age, and these Laplacian filter value were correlated with age.

Table 2. Laplacian filter values

Age **Gender**	20 Female	20 Male	40 Female	50 Male	70 Femal
D65	2.0	3.1	3.2	3.0	4.9
F10	2.6	3.1	3.8	3.2	4.8
A	2.1	2.8	3.6	2.9	4.7
Average of each wavelength	2.2	2.0	3.1	3.0	3.5

Each wavelength image Laplacian filter values are shown in Figure 12. In this figure, horizontal axis is wavelength and vertical axis is filter value. The filter values were depending on wavelength. The long wavelengths between 600nm to 700nm values were smaller than 460nm to 600nm values. Also Laplacian filter values of color image were depending on illuminants. Especially, in the case of young age and illuminant F10 value was higher than the other illuminant values. These results were indicated human skin image appearance is different under illuminant spectral type.

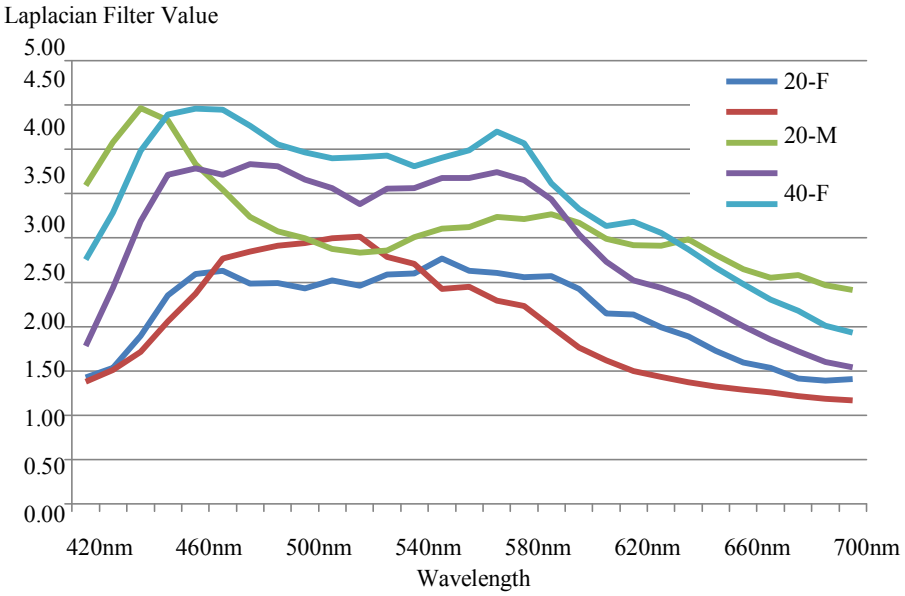

Figure 12. Laplacian filter calculation result of each wavelength of spectral imaging

Conclusion

1. Gonio-photometric spectral imaging way with 3-Dimensional scanning is useful for human skin color measuring. It is possible to compensate human body coverture and high accurate measuring with non-contact way.
2. Compare with contact type sphere illuminating spectrophotometer and spectral imaging measuring, measured result was different in long wavelength region. Reason is edge loss error of sphere illuminating.
3. Calculated Laplacian filter values were correlation with age. Laplacian filter value is increased with age.
4. Laplacian value was depends on optics dimension. In the case of small a-specula angle, filter value is larger than large a-specula angle.
5. The human skin image is different under different type of illuminant.

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Influence of colours in the perception of emotions

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Abstract

Several fields of colour study show that each colour has a meaning and causes a feeling, or a set of feelings, on the observer. Colours influence our reasoning and corresponding actions. We state that colours are agents of the relationship between perception and emotion. It is established knowledge that emotional responses are more intense to certain stimuli. From the viewpoint of the interpretation of emotions, this statement triggers the following question: what is the relationship between colour and an emotional perception? This question arose during the preparation of the practical component of the research integrated in the doctoral thesis under development by the main author of this paper and its supervisors. Using a set of shopping windows as focal stimulus, the research techniques adopted encompass cross-analysis of emotional responses obtained through observational techniques as well as surveys. At a certain stage, the respondents are asked about the perceived emotion when there is a prevalence of a certain colour. We hypothesized that emotional response varies according to the colour that predominates in the environment, whether in the significance of the situation, whether in intensity. To confirm or reject this hypothesis, a field test was carried out that runs parallel to the thesis. The field test uses illustrations of facial expressions that were inserted in seven frames with seven different colours. The survey is based on issues about the perceived emotion in each illustration, the relationship between the seven colours and emotion, as well as the relationship between the intensity of seven colours with every emotion dealt in the illustrations. The group of respondents include Brazilians and Portuguese, which generates cross-cultural data on multiple relationships. This test corroborates the results obtained in the research field of colour and emotion developed within the larger universe of design research.

Keywords: Colours, emotion, perception, emotional design.

Emotions In The Perceptual Process

In every moment of our daily lives we make decisions, take action and have certain attitudes without having awareness of the causes. This occurs because emotions lead our

lives and assist us in the evaluation of what can have a positive or negative effect on us. For all stimuli, there are emotional responses, these being more or less intense according to the stimulus. Emotions influence ratings for satisfaction and thus shape our attitudes, because consciously or unconsciously we ask ourselves in each situation " how do I feel about this?". This intense involvement of emotions in our lives is very important, since the attitudes of such emotional responses have ensured, for example, the survival of primates due to their negative affective reactions to snakes and spiders. "On a general level, affective feelings provide feedback about whether something is good or bad. More precisely, they provide information about the momentary value of objects and situations (SCHNALL, 2010, P.2).

With regard to products, they do not cause only positive or negative emotions. What occurs in relation to products is a combination of feelings that are therefore called mixed emotions. In addition, they are subjective and individual, so that emotional responses are different for each person. However, the process that triggers an emotion is essentially universal, and biological relations on which they are based can be identified.

Although emotional responses are mostly unconscious, we express them when we smile, frown, press lips among other physiological manifestations. These attitudes are common to all human beings, and even when they occur in different ways and for different reasons, due to difference in culture, a set of universal facial expressions was possible to establish. LeDoux (2011) points out some emotions that are considered to be the most universal, according to eminent scholars in the field, such as Sylvan Tomkins, an American psychologist. The latter proposed the existence of eight basic emotions that are considered innate, standardized, and controlled by interrelated brain systems: surprise, interest, joy, anger, fear, disgust, shame and anguish.

Another American psychologist, Paul Ekman, considers that discreet facial identities can be grouped in six universal expressions of the human face: surprise, happiness, anger, fear, aversion and sadness (Ekman, 1994). However, Robert Plutchik and Nico Frijda believe in a tendency for more global actions of emotions, involving not only facial expressions, but also the rest of the body, hence, involving other physical systems.

The palette of emotions which may be evoked by products can vary in intensity: some light, some intense, superficial or of long duration. These variations occur mainly through interaction with the product or within the context of the moment; in other words, the answers are in accordance with the stimulus. The palette also includes indirect emotions such as confidence, renunciation, compassion, empathy, melancholy, hope. However, in our daily live, there is great variability in both individual and social contexts, where ambiguous expressions are frequently found. Calvo, Fernández-Martín, Nummenmaa (2012) quote the research by Paul Ekman, presenting evidence of this psychologist's eighteen different types of smiles he identified, even though suggesting the probable existence of more than fifty.

Smiles have certain differences and occur as a result of a variety of emotions and situations we are able to recognize some key expressions. To prove this claim, a quick test was carried out by the main author of this work, as part of her doctoral research. The research used the studies of Desmet (2002) and Ekman (1994) to arrive at a number of eight

cartoon-type pictures to match the universal facial expressions established by both authors. These were shown to 25 people separately while questioned if they were able to recognize the emotion expressed in each cartoon-type picture. Their replies confirmed the use of this strategy. Although we do not know how to distinguish the positive from the negative valence in an expression of surprise, for example, we were able to identify that specific emotion when it occurred. The importance of this recognition is due to the fact that human beings care about a situation or product, when positive emotions are aroused.

Desire is born when we feel pleasure. If we apply this same assertion to design and the market field, then we can state that by providing pleasure – may it be visual, psychological or physiological – the desire for purchase is awaken in the consumer. In pleasing situations when pleasure is felt users tends to evaluate (emotionally) the product as something good that brings benefits. Norman (2008, p.39) claims that when we feel well, we can perform better in our actions and choices. This comment was based on research by psychologist Alice Isen. The results of her survey point to findings such as that happy people have expanded reasoning, as well as being more creative and imaginative. On the other hand, the state of negative affect changes the focus of something that could be good to a focus on problematic details, notwithstanding interference in the use of a product itself.

With regard to negative emotions, they are not seen as bad, since they ensure us safety, since focus is transferred to problems. For instance, when feeling anxious or in danger, our neurotransmitters are focused on a topic without distraction, with the aim to ensure a solution.

> Whenever your brains detect something that might be dangerous, whether through visceral or reflective processing, your affective system acts to tense muscles in preparation for action and to alert the behavioral and reflective levels to stop and concentrate upon the problem. […] When you are in a state of positive affect, the very opposite actions take place. Now, neurotransmitters broaden the brain processing, the muscles can relax […]. Positive affect arouses curiosity, engages creativity, and makes the brain into an affective learning organism (NORMAN, 2004, P.26).

The knowledge about the effects of positive and negative emotions on the users is of critical importance to designers for a large gamut of reasons. We know that joyful and pleasant objects receive less criticism than objects destined to stressful situations, in which case, the product or situation must be projected in an accessible way and easy to use, because in situations of risk or danger, our concentration becomes more precise and excess of information can induce errors and mistakes.

For this reason, we need to know which features of a product or service influence positive and enjoyable perceptions. In addition, we must keep in mind how the object will be offered to the consumer, in order to make decisions on what the designer has to provide, e.g. visual pleasure in the case of a shop window, or tactile pleasure in the case of any direct physical contact. In any event, the elements of perception – as light, shapes and colours – will bear very significant weight in both cases.

The relations between visual pleasure and the shop window is a fundamental topic of the doctoral research by the first author of this paper. The object of study is a clothes shop window and the aim of the thesis is to identify the emotional responses of the consumers to it as a means for understanding the cause of their reactions. However, a research of this particular nature is quite complex, since there is a range of components in a shop window that awaken emotions in observers.

Running in parallel to the main practical tests, an understanding was required that established the relation between the most influential elements of perception– colours – and emotions. In addition, this piece of research involves the participation of individuals from two countries, Brazil and Portugal, each of which with different cultures, an important factor that also justifies this test on colours and emotions and therefore constitutes the focus of this paper.

Colours And Emotional Design

Various fields of colour study show that each colour has a meaning and causes a feeling, or a range of feelings, on the observer. Colours influence our reasoning and corresponding actions, as well as being the agents for the relationship between perception and emotion. Colour organizes, confers spatiality, attaches components, it can group or separate, it may influence the ability of reading and, consequently, our understanding and perception. Its role is also operational, as well as psychological and even medicinal. Colour may be used to induce patterns of behavior along psycho-physiological dimensions. The deeply rooted connotations with certain colours are part of our collective heritage, and therefore, provide a credible basis upon which to develop design solutions. (Durão, 2002). It is therefore important to consider the existing knowledge on colour when used in the built environment- a claim stressed by Faber Birren, the first colour consultant to address issues concerning the human responses to colour, in the great number of books and articles he published, as well as by Porter & Mikellides (1976) and Mahnke (1996), among many others.

> "A certain colour impression not only evokes a momentarily visual sensation, it also involves our entire experience, memory and thought process and appeals not only to the sense of sight but, by synesthetic association, also to other senses such as temperature, hearing, touch, taste and smell" (DURÃO, 2009, P.401).

Colour is therefore a stimulus, sometimes subtle, that affects the human beings in their daily lives from physically, physiologically to psychologically and socially. For Farina, Perez and Bastos (2006), colours interfere with our life in such a way as to originate sensations and feelings: joy or sadness, exaltation or depression, heat or cold, balance or imbalance, among others.

Each range of the visible spectrum has an effect on our emotions, in our impulses and desires, being able to be stimulate a vast range of responses. Our brain has enormous capacity for association and evidence of synaesthesia is growing, albeit many studies have already been reported. Along with more common synaesthetic dimensions, such as taste, temperature or weight, colour makes surfaces seem harder or softer or wet and dry and even

influences the perception of sound. For example, Gestalt psychologists such as Heinz Werner reviewed phenomena in which sounds affect colour perception and Kravkov (1942) found that loud noises, strong odors and tastes, tend to raise the sensitivity of the eye to green and to decrease sensitivity to red. Associations between colours and musical keys, notes or instruments are so common that a body of research exists surrounding this kind of synaesthesia. The composer Scriabin associated musical keys with colors. He experienced the key of C as red, G as orange, D as yellow, A as green, E as light blue, B as whitish blue and so on. Ketcham (in Porter and Mikellides, 1976) claimed that a noise sounded louder to a listener in a white room than the same noise heard in a violet room. Although research results are not conclusive as to environments being experienced as noisier if painted in loud, bright and saturated reds oranges or yellows, or in white, empirical evidence seems to indicate that there is a definite correlation between colour and sound

On the other hand, the distinction between warm and cold colours is generally used and can be found in books on theory of colour. Many studies into the effects of perceived colour temperature agree that it varies from warm to cold as hue moves from red to blue. Surveys have been published on some synaesthetic effects, within settings, such as in Durão (2002a), reporting some of the following research results. Generally yellow, yellow-orange, orange, red-orange, red and red-violet are referred to as warm, and yellow-green, green, blue-green, blue, blue-violet and violet as cold. For example, research by Newhall (1941) and by Wright and Rainwater (1962), found the connotation of warmth to have a linear dependence on hue and that the greater redness in the hue change corresponds with greater warmth. In the latter, the connotation of warmth was also affected by lightness and saturation but less definitive than hue. Itten (1973), reports that occupants of a blue-green room felt cold at 59º Fahrenheit,
but when the room was repainted red-orange, the temperature had to be reduced to 52º before the subjects complained again. Porter and Mikellides (1976) report a Norwegian study suggesting that the thermostat in a red room was set 4º lower than that in a blue room in order for subjects to feel comfortable. Finally, it is also common sense that the effect of ambient temperature is such that warmer hues are preferred in cool conditions and cooler hues in warm conditions.

An immediate example of the relations between colour and taste is that of attributing sweet flavours or smells to pink, as well as colour green to sour flavours. Porcherot et al. (2012) show the close relationship in their research between colours and fragrance of softners for clothes. The study shows that the influence between senses modifies the emotional response. Presented odours in inappropriate colours, participants felt great difficulty in making the relationship, for example, to the aroma of strawberry or cherry in a green liquid. In addition to this relationship, Porcherot research et al. (2012) investigated the relationship between colour-smelling-emotion and found that if we use the smell without vision the answer certainly is different than when the both is used. This claim can be exemplified with the replies of the participants. For instance, the blue liquid, called Lagoon, was found to have a more refreshing aroma (aquamarine) and was ranked at emotional level as energetic, invigorating and clean. The pink liquid, called Princess, sweet scent (floral), was characterized as more romantic, desiring, also nostalgic, amusing and mouthwatering.

The analogy of colours with emotions arouses great interest in the scientific field. Nurlelawati, Rodzyah, and Normahdiah (2013) investigated the relationship between colours and emotions according to different perceptions of men and women. For the authors, female answers were more expressive compared with male associations. Some results of this research indicate that both genders classified red colour as happy and joyful and related with more positive and stimulant emotions, such as surprise. Yellow was also classified as generating positive emotions. Both genders related the colour with 'surprise', but women also classified it as happy and amusing. Blue and green are, for both sexes, colours for comfort and soothing emotions, although female respondents rated them as more 'peaceful' that the male respondents. As predicted, pink is the colour that is highly associated with love for both sexes, while purple was described as 'curious'. Finally, black, brown and gray were associated with negative emotions.

Colour is largely related to our feelings (psychological aspects), and at the same time suffers the influence of culture, becoming a symbol, in addition to the purely physiological aspects, according to Farina, Perez e Bastos (2006, P.2) . A good example of this assertion is in graphic design and marketing fields. Often we are induced to consume unconsciously, by the action of the colours of certain logos and products. Figure 1 summarizes this influential relationship.

Figure 1: Colour emotion guide for western culture. Photo: Design Library of Interaction Design, 2014.

This bibliographic survey triggered the need for a special attention to colour before proceeding with the doctoral research on emotional responses to shop windows.

Correlation Between Facial Expressions Of Emotions And Colours: The Test

Colour is one of the basic elements of perception, and is a key element to building a shop window. The shop window designer determines certain colours to stage a desired environment. Farina, Perez and Bastos (2006) reminded us that the visual communication by means of colours has triple action on the individual: it makes an impression (vision), it is felt (cause emotion) and it constructs meaning (it has proper value). In this context some inquiries emerged that then motivated the test that is presented next.

Scientific research on colour is still limited and not always conclusive, with some of its results and findings being contradictory. In fact, much more research is needed for the complexity of the phenomena of colour to be fully understood and findings to be used by the designer. Durão (2002) claims that subjective self reported measures and observational techniques are suited for collecting data on affective responses, as well as for establishing relationships among variables in complex situations. She enumerates the range of research techniques from objective measures to observational techniques and self - reported measures as well as experiments on physiological response that may use objective measures such as EEG, GSR, heart rate, respiration rate, blood pressure, oxiometry and eyeblink frequency. Much of the research carried out in architectural space interior settings is normally done in laboratorial environments using a question-answer format in which psychophysiological responses are elicited. The study reported here prepares a real world research where unexpected and uncontrolled phenomena may occur that are not bound to in controlled experiments.

Previously, there had been an identification of emotions through facial expressions with cartoon-like caricatures, which indicated that people recognize intense feelings, even when not always knowing what caused them. Therefore, the question that followed was: does the colour featured in a shop window induce particular facial expression? When observers encounter a certain facial expression of a given emotion, do they create analogies to a particular colour? And from another angle: Is there a correlation between these cartoon-like caricatures and certain colours? Thus, along the inquiry focused on the relation 'colour X facial expression', the research on the relation between colours and expressions led to the research of the relations previously studied, even before initiating the practical investigation on the shop window and its elements.

Although Brazilians share to some degree Portuguese cultural inheritance, this research compares both nationalities, so that in addition to the questions raised, consideration was given to differences between Portuguese and Brazilians, for symbolic use of colour in each culture.

The result of this study will confirm or reject one of the hypotheses of the doctoral thesis: emotional responses vary with the colour that predominates in the environment, whether in the meaning of the situation or intensity.

The test was structured as follows: a sequence of images was presented to 54 students of architecture and design, being 27 Brazilians and 27 Portuguese. The used methodology to determine the universe was a causal one, because the research occurred in environments of

the University of Lisbon (Lisbon, Portugal) and in the State University of São Paulo "Júlio de Mesquita Filho" (Bauru, Brazil) and depended on the students of the referred courses.

To each shown image, the participant answered some questions in *viva voce*. The researcher used the microphone of the computer to make the recordings, aiming to not interfere in the research. The first image (Figure 2) displayed the caricature of the emotional expression and asked the respondent to identify the emotion depicted, correlating the image with a particular emotion. Although this test had been carried out previously, it was important to confirm the understanding of each emotion by each of the respondents.

Figure 2: "Correlate the image with an emotion". Photo: personal archive.

The presented expressions were recognized by all participants, and although they have verbalized in different ways, the used words were equivalent, as for example in the case of 'scare' and 'astonishment'. In the sequence, the caricature was presented on seven different colours and the participant indicated the colour most suited for each facial expression of the emotion, i.e. the one with which there was a greater relationship.

In the visible spectrum, we see colours between 380nm and 780nm. In the software used to determine the colours for this experiment - Adobe Photoshop tools- the spectrum reproduces the colour palette between 0 and 400 points, using a spacing of 50 in 50 points. However, even knowing the vision reaches 400 points the software was not able to reproduce colours effectively and colours were selected up to 300 points. Figure 3 shows how the question "what colour do you relate to that emotion" was presented.

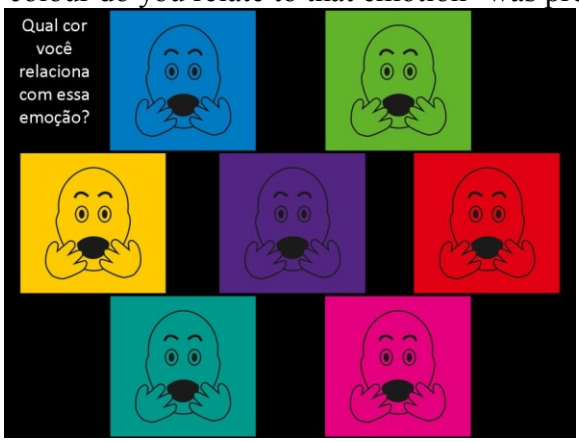

Figure 2: "What colour do you correlate with this emotion?" Photo: personal archive.

After choosing a colour, the respondent was asked to place them in decreasing order according to the level of influence in the emotional expression, starting by the most influential colour and ending with the least influential one. The intention was to find out whether later on in the research process the predominant colour in a shop window would induce the same emotional response. Colours were identified by letters, so the respondents would not feel the constraint of naming colours as shown in Figure 3.

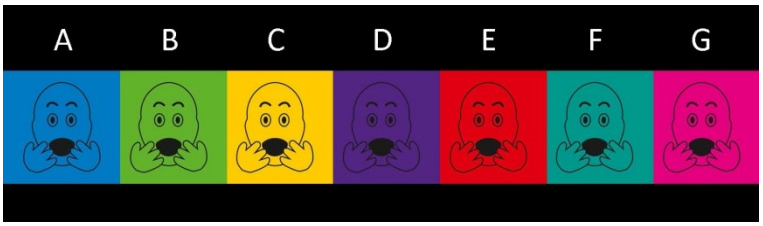

Figure 3: "Order the colour according to the level of emotional influence". Photo: personal archive.

Responses were analysed and organized in tables. We observed the choice of each facial expression made by participants, as well as the occurrence of each colour. Figure 4 shows a table of responses. The left notes are choices made by Portuguese respondents, while choices made by Brazilian are on the right side.

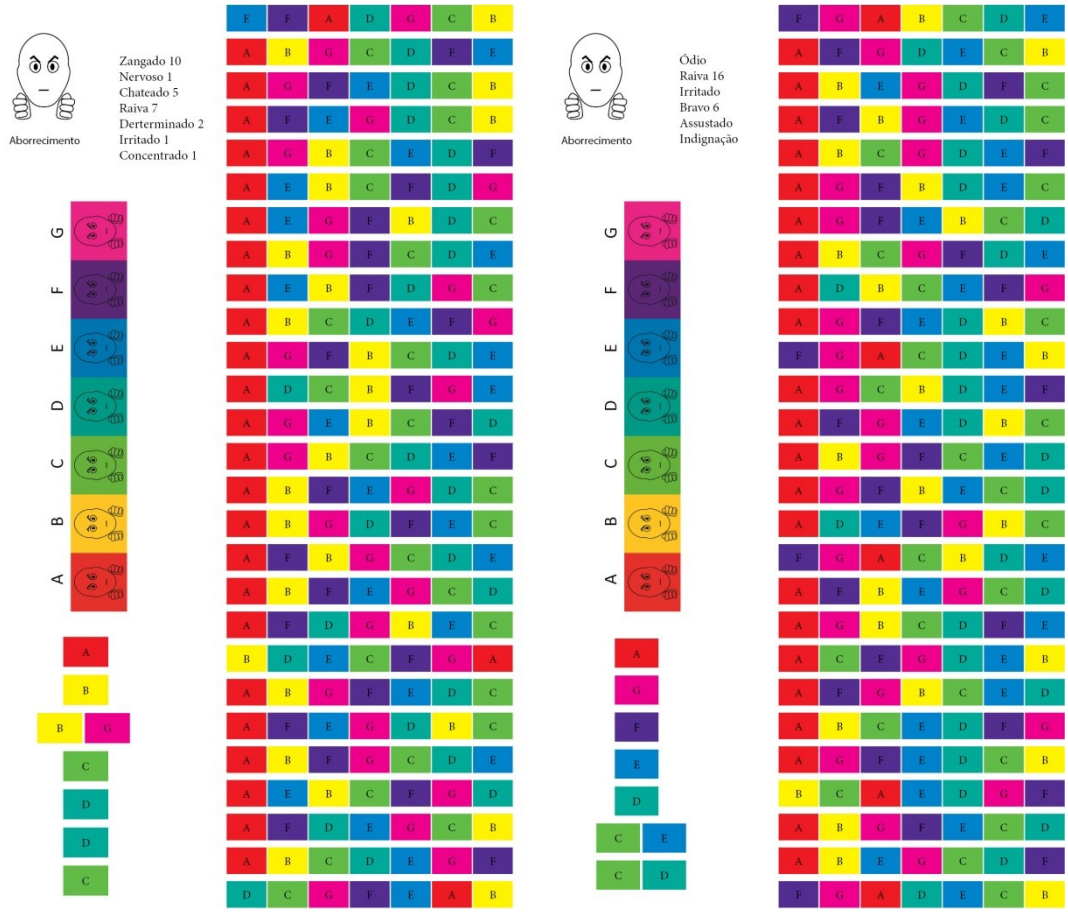

Figure 4: "What colour do you correlate with this emotion?" Photo: personal archive.

The colours that were repeated more often in each column were grouped. We made a graph comparing all the tables of colours for the discussion of the results, shown in Figure 5.

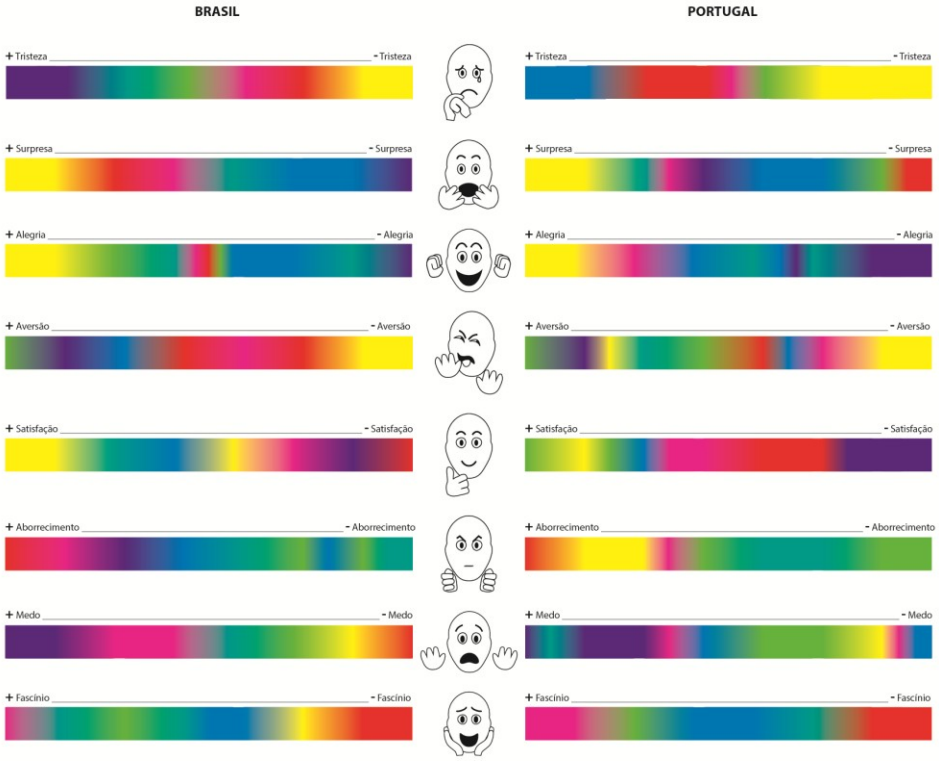

Figure 5. Graphic of relative colour x facial expression

Results And Data Analysis

When we asked participants about their chromatic preferences, achieving consensus was improbable because this type of choice involves personal taste. The influence of colour preference is there even when the choice is made of a colour and its relationship with a caricature. Another anticipated risk of this study was obtaining significant difference in response between Portuguese and Brazilians, to the point of not being able to establish similarities due to the cultural differences.

However, the comparative graph of the eight universal emotions, shown in Figure 5, is surprising since it shows acculturation and detachment of personal taste in the responses. Both the Brazilians and the Portuguese made similar options for almost all expressions. Only ‘sadness’ and ‘satisfaction’ showed distinct colours, but still with similar characteristics. For Brazilians, ‘sadness’ is related to violet, and for Portuguese, it has analogy with blue- both colours are cool and closed. There was some cultural influence in the choice of ‘satisfaction’. Feeling satisfied is associated to green for Portuguese and associated to yellow for Brazilians.

Analyzing the choices of the colours for each emotion, we notice the existence of a sufficiently clear and interesting relation: the intensity and temperature of a colour are directly proportional to the amplitude and dynamics of the feeling. Concerning the election of the colours for ‘fear’, violet (position 250points on the palette used in this study) was considered a cold, intense, heavy and closed colour. In descending order, the colour that least influences the expression of ‘sadness’ is yellow. Yellow was selected as the colour more often related to positive surprise, joy, openness, invitingness and warmth. Such features were described in equal proportion to the colour (spectrum 00pt position used in this study).

The feeling of ‘annoyance’, also understood as anger by the respondents, was associated to red. Red, symbol of warmth, dynamism, action, when used or displayed with great intensity causes excitement, which leads to irritation, hence the connection with the feeling of anger or annoyance.

‘Aversion’, also voiced as disgust, was mostly related to colour green. As most respondents explained, the person when disgusted gains a greenish tone to the skin. In fact, relationships between colours and our bodily changes are quite common:

Apart from the green being related to nausea or disgust, the red is related to warmth, due to reddening of the skin as result of sun exposure. Pink is related to shyness and enchantment, since a romantic declaration is often associated with a rosy face. This last statement was confirmed with the choice of pink, 300pt position in the palette used for the emotion 'fascination', also called 'enchantment' and 'in love' by respondents.

Final Considerations

Colours are not only important in our life through our senses (mainly vision), but they fundamental to our perception of stimuli, whether of ambience, time, space and movement. In addition, colour affects our physical, psychological, physiological and sociological relationship with the world, causing sensations and feelings/emotions. Chromatic relationships established in our everyday life are so intense that synaesthetic phenomena occur with certain smells and tastes like green for acid or something refreshing.

Results indicate a strong and close relationship between facial expressions of emotions and colours, where no cultural influence of personal taste was observed in the choice of participants. Based on the graphic results in the research, we can get an idea of the possible emotional responses associated to certain colours in a shop window setting. This piece of research also confirms the existence of a relationship between features of colours and emotions expressed by the face. Colours were correlated to heavy and closed feelings, such as in the case of violet to the expression of fear. Colours were also correlated to open and warmer emotions, as in the case of yellow for joy, for example.

A close relationship between facial expressions of emotions and colours is confirmed and based on the graphs there is an array of possible emotional responses to colours that may influence the observation of a shop window. If on one hand, the hypothesis of the doctoral thesis states that emotional response varies according to the colour that predominates in the environment, whether in the meaning of the situation or intensity, on

the other hand we may effectively claim that the results presented here also indicate a similar set of expectations in the next research experiment using a shop window.

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White Colour In Architecture And Built Environment – Facts, Myths And Contemporary Application.

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Abstract

The article presents selected results of the broader research conducted by author, dedicated to the use of the individual colour hues (colour palette) in the built environment, including their history, traditions and contemporary application. The main goal of this article is to summarize and present the most important facts, but also myths, concerning use of the white colour in the built space. White is an exceptional colour and the rationale for its use in the architecture were and are very diverse. Different aspects of architectural white include: functional "whitewash" of the traditional houses; the classicist and neoclassicist praise of white, based on the myth of the whiteness of the antique Greek's and Roman's structures; Le Corbusier's "white manifesto", with all its consequences for the "white" image of the Modernism; the activity of architects such as: New York Five group, A. Aalto or O. Niemeyer and architects for whom "white" is a trademark, as S. Calatrava or A. Siza, ending with other followers of "white colour philosophy" - a preference for the white volume over the decorated surface, which can be linked to the conflict between classic and romantic, *disegno* versus *coloure*. Article deals also with aspect of contemporary whiteness of the buildings, which is different from this of the classic modern architecture, due to new artificial materials and façade technologies, that makes achieving glossy and bright whites possible, difficult to reach in plaster. White is traditional and classical both modern and avant-garde colour in architecture. Simple and neutral both complicated and contrasting, appropriate and at the same time radical, both "naked" and "dressed" (according to M. Wigley), unambiguous and chameleonic, safe and pure, dangerous and aggressive. Having significant position, white will never be old-fashioned colour in architecture.

Key words
White colour in architecture; "white" architects; whitewash; white-coloured materials

1. Introduction

The main goal of this article is to explore the multifaceted significance of the white colour in the built environment, including its history, traditions and contemporary application. According to Berlin and Kay, in the languages with the least developed nomenclature there are always present two colour definitions: white (which also means bright – warm) and black (dark – cold) (Berlin 1969). The human eye is sensitive to the infinite nuances and subtleties of white, named in different cultures according to their brightness, matteness, degree of purity, occurrence or even to the energy of colour.

Variations of whites include also what is commonly termed off-white colours like e.g. egg-shell white, ivory white or vanilla. However this cultural vocabularies are becoming rare today, the symbolism associated with the colour continues to be rich and meaningful (Varichon 2006:11). Most of the white colour aspects are positive, only with a few significant exceptions[1].

The white colour has been used by man in arts and architecture from the earliest times. Beside red, yellow, and black, this colour has already been used in the paintings of the Palaeolithic. According to Empedocles, these four colours also formed the basis for the palette of Greek antic painters (Rzepińska 1989). White is an exceptional colour in architecture and the rationale for its use were and are very diverse. Different ways of application of white in the architectural space can be expressed by seven specific categories:

- White as a mean of protection – functional white,
- White as a symbol / idea – realm of whiteness,
- White as a light – presence of all colours of the spectrum, one of the contrast extremes – light / dark,
- White as an absence of colour – negative presence of colour,
- White as a mean of expression of the architectonic forms,
- White as a counterbalance to the chromatic colours,
- White as a trademark – attribute, identification mark.

2. White As A Mean Of Protection - Functional White

First category refers to the use of white colour for its functional assets: cleanliness – in both the hygienic and the psychological sense, the ability to protect the surface from the weather and from the heat and last, but not least, antibacterial, antifungal and fire-redundant properties of lime used for whitewashing (Lancaster 1996: 67). Whitewash (or calsomine, calcimine) has been associated with human habitation since the bird of mankind and is present in all mature vernacular cultures throughout the world (Wigley 1995 [2001: 8]).
First, and probably the most important reason for choosing white finish for the buildings exteriors was the necessity for **protection of the porous materials (mainly wood and stone) from the damaging effects of weather conditions.** For example in Poland traditional house's whitening habit should be linked in underlining with lime of gaps between wooden beams, protection of protruded ends of corners and finally painting of frames around windows and doors. In result there were vertical decorations of cottage corners and horizontal decoration of the frameworks (Tarajko-Kowalska 2005). Whitewash is especially effective on adobe-like materials because it is absorbed easily and the resultant chemical reaction hardens the medium. For example in classic Menorcan farmhouses, the walls and ceilings are made from local limestone. The whitewash, which both protected and coated the stone, over the years gives to them plasticity and roundes shapes. White paint

[1] White is the most often associated with: light, purity, hygiene, innocence, virginity, honesty, spiritual, supernatural phenomena, nobility, hope, truth, grace, holiness, salvation, revelation, redemption, wisdom, the beginning of something new, joy, holidays. Negative aspects include: cowardice, fear, cold, loneliness and death.

defines also the paths on the roof where the tiles were set with mortar, what allows an economical way to manage the roof tiles while creating a powerful aesthetic[2].

Second reason for using white on the buildings façades is **high reflectance value** (even up to 98%) and thus **ability to reduce the heating from the sun**, what may have contributed to the tradition of white appearance of towns and villages across the Mediterranean from Portugal to the Turkish coast (Lancaster 1996: 65). Visually white provides the sense of cleanliness and chill, and in practice creates a natural barrier between hot exterior and the inside of a building, which is taken advantage of in regions with warm climate[3].

Thirdly, the frequent use of white in the buildings is an attribute that originated as a cheap method for disinfecting, based on the aseptic properties of lime[4]. Thus, the common use of lime, both inside and outside of the houses, was found to be **valuable as a hygienic measure and protection from all kinds of plagues** that submerged the old world (cholera, typhus etc.). Sometimes, for fear of epidemics, inhabitants e.g. the islanders of the Cyclades used the white painting even out over the paving of the streets (Lancaster 1996: 65).
In 19th century Europe, white invaded also industrial architecture in an effort to cut back pollution (Varichon 2006). Lime was also regarded as a useful fire-retardant and frequently painted over all internal and external surfaces including the thatch of the roof e.g. in 17th century Britain. (Lancaster 1996: 65)[5].

Whitewashing was also often connected with Christian holidays of Easter and Christmas or with important family celebrations like e.g. weddings (Tarajko-Kowalska 2005). A Christmas or Easter tradition of the "whitewashing of the house" was commonly practiced in rural areas and villages. The ancient custom of whitewashing purified homes and farms for the coming Christ Child or for the resurrected Savior. "In numerous countries purifying and protecting limewater is still generally washed onto the walls of the dwellings and even on the doorstep" (Lenclos 2004: 32), however it sometimes retains some association with rural poverty. In the United States this attitude is expressed in the old saying: "Too proud to whitewash and too poor to paint"[6], with the connotation that whitewash is a cheap imitation of more expensive, but longer-lasting "real" paint, which had become a status symbol of sorts.

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[2] http://www.binichic.com/blog/2011/07/form-follows-function/ Accessed 17 Jan 2014

[3] According to the study conducted by the Lawrence Berkeley National Laboratory in California, white roofing materials can help to fight against global warming as well as contribute to solving of urban problems such as heat islands formed in large cities. Using white roofs, which reflects 60% to 80% of sunlight, would reduce the cost of air conditioning and by that lower the emission of CO_2 (http://socyberty.com/activism/30-amazing-white-buildings-that-help-to-fight-global-warming/ Accessed 17 Jan 2014).

[4] Whitewash is also applied to fruit trees in orchards, to prevent sun scald and protect against vermin.

[5] White plaster was also used for its resistance to fire in the Japanese Himeji Castle (Himeji-jō, 1333). The castle is frequently known as Hakuro-jō ("White Egret Castle") or Shirasagi-jō ("White Heron Castle") due to its brilliant white exterior.

[6] Quote first time used in the 1890's by journalist from Washington D.C. to describe Charleston's genteel bourgeoisie.

In the first category white is functioning as a "protective layer" or "protective cream" imposed on the building due to properties of the lime, such as: disinfecting, antibacterial, antifungal, fire-redundant, and reducing heating of the surface. All those aspects contribute to the emergence of a whitewashing tradition and as a consequence to the socially cohesive appearance of many villages and towns throughout the world.

3. White As A Symbol / Idea – "Realm Of Whiteness"

Second category touches the more **symbolical aspects of white**, which goes beyond the simply aesthetic and functional issues. Although "abstractive white" in architecture is difficult or even impossible to achieve - due to its material nature - in certain uses it can become more the idea of colour than a real painted surface. This occurs when colour is used mostly for its symbolic meanings, thus generating specific "realm of whiteness" (Bachelor 2000: 49). It is no coincidence that this category immediately follows the previous one, since oftentimes whitewashing traditions had symbolic connotations, becoming a kind of ritual and due to uniform appearance of the calcimined settlements, created desirable atmosphere of whiteness. First of all, this category is referred to the Le Corbusier's rhetoric of whiteness, who promoted white colour as the modern state of mind, whereby white became in the beginning of the 20th century a symbol of the future world. Secondly it is related to white used as a symbol of hygiene also in terms of "hygiene of vision", purity and cleanliness of both body and soul. Thirdly the associations of white with religious as well as civic virtue are considered.

Manifestation of the modernity - the new beginning, future world

In Western culture white is the **colour often associated with beginnings and the new**, mostly due to the traditions of whitewashing of the houses, the ritual which has always signaled a new start, giving to the buildings fresh and clean look.
But in the beginning of the 20th century architects "gradually codified this vernacular practice of white walls" (Wigley 1995 [2001: 303]), through numerous buildings, thus creating new, modern aesthetics. House for an Art Lover (Haus eines Kunstfreundes) by Charles Rennie Mackintosh built in Glasgow in 1901, is believed to be the first source of the abstract white surface. Also Otto Wagner is often identified as the pioneer of both the theory of modern architecture and the corresponding practice of white wall. In his Austrian Postal Savings Bank building in Vienna, constructed in 1906 with reinforced concrete, the entire façade is covered with white, square, marble plates. Josef Hoffmann's The Stoclet Palace (Stocletpaleis) in Brussels, Belgium (1905-11) was described as "flat surfaces…made up of white marble slabs" (Wigley 1995 [2001: 303]) and Adolf Loos'es Villa Steiner in Vienna, Austria (1910) characterized as "white, unadorned prism" (Wigley 1995 [2001: 303]). White has also been used that time to unify a number of large developments like: Tony Garnier's Cite Industrialle (1904-17), Victor Bourgeois'es Cite Moderne (1922-25), Hermann Muthesius Hellerau (1910), or J.P.P Oud Witte Dorp and Mathenesse (1922). Functional architecture of the Modernism with its preferred smoothness, simplicity and purity of structure also required the unambiguity of colours – the unambiguity of white. But white was not simply the aesthetic issue. Although the Modern Style of the 1920s and 1930s has been often characterized as a "white style", it was

not quite as white as it has been represented, mostly due to the fact, that "architects promoted whiteness not only as aesthetic stance, but also as a moral one" (Bachelor 2000: 49). As Mark Wigley puts it: "the whole moral, ethical, functional and even technical superiority of architecture is seen to hang on the whiteness of its surfaces" (1995 [2001: 16]). Thus, white becomes something more than just the colour - "an important cultural factor and a new expression of value and of the times"(Wigley 1995 [2001:309]). This rhetoric of whiteness was derived basically from Le Corbusier, who documented both the arguments against ornamentation and the promotion of the use of white enamel in his *A Coat of Whitewash, The Law of Ripolin* (1925), calling every citizen to replace all the decorative elements with "a plain white coat of ripolin"[7] (Le Corbusier 1925 [1987]). Also for the three important contemporary artists: Wassily Kandinsky, Piet Mondrian and Kazimir Malevich "white" was a symbol of a future world (the last one painted in 1918 his famous "White on white"). Mark Wigley points that "the liberating moment in which architects actively chose to use white" (Wigley 1995 [2001:97]) was the year 1925, when Bauhaus building at Dessau, Germany by Walter Gropius has been finished by plaster and painted a unified white[8]. White played also a crucial role in De Stijl's architecture. Theo van Doesburg repeatedly referred to its spiritual quality and in 1930 turn the modernity of white into a kind of manifesto: "White is the spiritual colour of our times, the clearness which directs all our actions. White is the colour of modern times, the colour which dissipates a whole era. […] White includes everything. […] White, pure white" (Bachelor 2000:46). His praise of white can be found e.g. in built in the same year Maison Van Doesburg in Meudon-Val-Fleury, France. But probably the most important and influential "manifestation of the white, prismatic, flat-roofed mode of building" (Wigley 1995 [2001:330]) was settlement Weissenhofsiedlung in Stuttgart, Germany, built for the Deutscher Werkbund exhibition of 1927. The only restriction by Mies van der Rohe (who was that time director of the exibition) was that architects use flat roofs and white exterior walls, which was later identified as main attribute of International Style. Due to black and white photography, subtle, light colours used by some architects were gray-scaled, as a result giving the impression of the coherent environment defined by white walls. Therefore, according to Wigley: "The idea that modern architecture is white was successfully disseminated to an international audience"(Wigley 1995 [2001: 14]). Thus white has become the colour of the vision of a better, more open, more international world.

Symbol of cleanliness, hygiene - "hygiene of vision", purity and purification

Through all cultures **white has been associated with purity, cleanliness and hygiene**. But at the beginning of the 20th century, together with the discovery that dust and dirt can carry germs, this association became especially important in terms of architecture.

[7] "Ripolin" was first commercial brand of enamel paints founded in 1897 in France. Due to its popularity company name became soon synonymous with enamel paints in general.

[8] At the time Gropius created also the ensemble of the Master's Houses (for the teachers), which together with Bauhaus building was in 1996 included to the list of Unesco World Heritage (www.meisterhaeuser.de and www.bauhaus-dessau.de/masters-houses). In 1938 Gropius designed his own house in Lincoln, Massachusetts (today National Historic Landmark) all in white. Building after recent restoration was repainted in so called "Gropius White" of California Paints (http://www.californiapaints.com/content/color-details/Gropius-White-/1294.aspx).

In the 30s of 20th century in many European countries were introduced general regulations (certainly for hygienic reasons) for cottages walls whitening, what causes in great measure a disappearance of local decoration habits. The zeal of whitening run often to exaggeration in painting of not only building walls, but also decorative gables, window frames, fences[9] and even beehives (Tarajko-Kowalska 2005). Also the decision to paint traditional Greek island houses white was in some way a political decision, imposed in 1938 by the Greek dictator Ioannis Metaxas, whose order was initially issued to prevent a cholera epidemic, but was also an attempt to protect Greek cultural heritage, as well as to promote mass tourism. (Pantouvaki 2011). Up to the 70s of the 20th century, also the interiors of the hospital - the walls, equipment rooms as well as medical and nursing uniforms were completely white as a sign of their purity and sterility. This "white hygiene" was deeply connected with the philosophy of whiteness of the architecture of the beginning of the 20th century. In his book *When the cathedrals where white* Le Corbusier identifies the whiteness of the modernity with the cleanliness and purity, which is translated also as freedom from adulteration or contamination (Wigley 1995 [2001:284]). "But the white surface was not simply representing cleanliness, it was the mechanism for cleaning" (Eliasson 2006: 243). In 1925 Le Corbusier writes, that everything should be white, because white would purify the whole city – through the white building is understood as a mechanism of purification, which "purifies the vision" (Eliasson 2006: 245). In this context white can be seen as a visual liberation. According to Wigley: "It is a form of architectural hygiene to be carried out in the name of visible truth" (Wigley 1995 [2001:5]). For Le Corbusier white surface constructs a new kind of space, which "liberates the eye by reconstituting the idea of body hidden behind it, recovering the sense of space that has been lost" in nineteenth century under layers of ornaments (Wigley 1995 [2001:7]). Definitely, Le Corbusier's argument has to be understood in terms of the central role of whiteness in the history of the idea of cleanliness (Wigley 1995 [2001:5]). "The mythology of health, hygiene, purification, conspired to give the white this special quality". (Eliasson 2006: 250). Even today objects which are expected to be clean, such as bathtubs, washbasins, refrigerators and toilets, as well as bed linen and towels are traditionally white or at least light coloured. Curious reference to this can be find in white volume of Stedelijk Museum, called for its shape "The Bathtub" by Benthem Crouwel Architects (Amsterdam, The Netherlands 2012) made from fiber enforced composite[10]. Also in the Fazenda Boa Vista – Spa by Isay Weinfeld built in Porto Feliz São Paulo, Brazil in 2012, white is the underlying element in the project for all it inspires: peace, quiet, relaxation, purity[11].

Symbol of religious virtue and celestial power – temples, churches, mosques

The colour white, as the essence of luminosity, has been associated with celestial power since the ancient times. (Varichon 2006:16) White also represents the immaculate, absolute purity of both body and soul, innocence and virginity, divine light and glory and renewal of

[9] Mark Twain's classic account of how Tom Sawyer whitewashed a fence is known to most of Americans as well as the readers all over the world (Twain 1876).

[10] "Stedelijk Museum Amsterdam / Benthem Crouwel Architects" 04 Apr 2013. ArchDaily. Accessed 01 Jan 2014. <http://www.archdaily.com/?p=350843>

[11] "Fazenda Boa Vista – Spa / Isay Weinfeld" 17 Jan 2014. ArchDaily. Accessed 17 Jan 2014. <http://www.archdaily.com/?p=467519>

the spiritual life. Therefore it is not surprising that whiteness is present in many religious buildings in the world.

In Christian beliefs white is the highest colour representing the purified soul, virginity, integrity, light, and perfection of all characters and principles before God, whose glory also appears as a white, shining light which radiates from the body. White is at the same time the result of purification of sins. In 1452 Leon Battista Alberti, the Renaissance architect and scholar, wrote that churches should be plastered white on the inside, since that was the only appropriate colour for reflection and meditation (Zuffi 2012: 254). After the Reformation also Protestant churches were whitewashed and sober, as a sign of purity but also modesty and simplicity. Nevertheless, white can be found not only inside, but also outside the churches. European cathedrals were usually built of off-white or light-coloured stone. To this tradition referred Le Corbusier in his book *When cathedrals were white* writing: "the cathedrals were white, completely white, dazzling and young – and not black, dirty and old" (Le Corbusier 1937 [2013: 26]). For Le Corbusier white image of the cathedral was a modernist paradigm – indication of the sources of the new architecture and the need to return to them. His Chapel of Notre Dame du Haut in Ronchamp (France) completed in 1954 is "all white inside and outside". Le Corbusier wanted the space of the chapel to be meditative and reflective. The stark white walls add to this purist mentality, what together with the light generates ethereal atmosphere. "The effect of the light evokes expressive and emotional qualities that create heightened sensations in tune with the religious activities"[12].

One of the most beautiful white Roman Catholic churches in Europe is the Basilica of the Sacred Heart of Jesus, commonly known as Sacré-Cœur Basilica, located in Paris, France. Designed by Paul Abadie (1914), Sacré-Cœur is built of travertine stone quarried in Château-Landon, which constantly exudes calcite, which ensures that the basilica remains white even with weathering and pollution.

Among the famous white Roman Catholic churches others be mentioned as well:
Aalvar Aalto's Heilig Geist Kirche (1962) and Stephanuskirche (1968) in Wolfsburg, Germany; Oscar Niemeyer's Cathedral of Brasilia, which led to his acceptance of the Pritzker Prize in 1988; Jørn Utzon's Bagsværd Church in Denmark, completed in 1976 finished in Aalborg White Concrete[13] as well as located in the eastern suburban area of Rome, Richard Meier's The Church of 2000 - Dives in Misericordia (2003), for which Italcementi developed and patented a new type of white self-cleaning cement called Bianco TX Millennium[14]. Being also symbol of innocence and virginity white is often chosen as a colour for churches devoted to the Virgin Mary like e.g. the Church of Our Lady Immaculate Conception in Panjim, Goa, India (1540); The Cathedral of Saint Mary of the Assumption in San Francisco (1971) designed with collaboration of Pier Luigi Nervi and Pietro Belluschi; Alvaro Siza's The Santa Maria Church in Marco de Canavezes, Portugal

[12] Kroll, Andrew. "AD Classics: Ronchamp / Le Corbusier" 03 Nov 2010. ArchDaily. Accessed 01 Jul 2014. <http://www.archdaily.com/?p=84988>
[13] www.aalborgwhite.com.au
[14] "Church of 2000 / Richard Meier & Partners Architects" 19 Apr 2009. ArchDaily. Accessed 30 Jun 2014. <http://www.archdaily.com/?p=20105>

(1996) constructed of whitewashed reinforced concrete[15] or John Pawson's Abbey of Our Lady of Nový Dvůr (Bohemia, Czech Republic, 2004)[16].

For the Buddhist tradition, white is self-mastery and redemption, referred to the highest spiritual transformation. White is representative of the principles of purity, as in Western Culture, but it is also considered the colour of knowledge and longevity. It is the colour of goddess Saraswati, white Tara and Buddha Vairocana. The colour white appears also in numerous Buddhist episodes, one of the most well known being the birth of Buddha and the dream of "White Elephant", thus being frequently used in Buddhist temples. For example The Hsinbyume Pagoda, also known as Mya Thein Tan Pagoda in Mingun, Myanmar (former Burma) built in 1816 by Bagyidaw, is painted all white, being modeled on the physical description of the Buddhist mythological mountain Mount Meru. Buddhist symbolism can be also seen in two newly constructed unique objects: White Temple in Kyoto designed by Takashi Yamaguchi in 2000[17] and Wat Rong Khun (1997-2012) in Chiang Rai, Thailand, designed by Chalermchai Kositpipat, one of Thailand's most renowned artists. Wat Rong Khun has been constructed entirely in a radiant white colour with sparking reflections from mirrored glass mosaics embedded in the white plaster, to signify the purity of Lord Buddha, while white glass is the symbol of the Buddha's transcendental wisdom.

In Hinduism, white is the symbol of pure consciousness, upward movement, light, and manifestation. A lot of Shri Swaminarayan Hindu temples - so called Mandirs - around the world are finished in absolute white including i.a.: The BAPS Mandir – the Nesden Temple in London, being Europe's first Traditional Hindu Temple (1995), constructed mainly from hand-carved Italian Carrara marble and Bulgarian limestone, as well as similar temples in United States: Houston, Chicago, Atlanta or in Canada: Toronto.

In Islam the white colour of clothing evokes the absolute uniqueness of God – the fundamental dogma of Islam (Varichon 2006:16). The floor in the Great Mosque – Al Haram Mosque in Mecca, Saudi Arabia is made of polished white marble plates, creating the sacred atmosphere by strong contrast with black of its spiritual centre - Kaaba. White finish fulfills also a functional role reducing the heat. Each year during the pilgrimage season traditional black cloth draped over Kaaba in Mecca is girded by white veil. (Varichon 2006:21). White colour dominates also in Sheikh Zayed Grand Mosque, Abu Dhabi, United Arab Emirates (1996-2007), which is up to date the largest mosque in the United Arab Emirates and the eighth largest mosque in the world.

Symbol of civic virtue and nobility – palaces, government buildings

White is also associated with civic virtue as well as nobility, honesty, truth and sincerity and therefore many government buildings as well as king's palaces in many countries have traditionally been white. This tradition of using white stone for façades finishing dates back

[15] Sveiven, Megan. "AD Classics: Santa Maria Church de Canaveses / Alvaro Siza" 16 Feb 2011. ArchDaily. Accessed 01 Jul 2014. <http://www.archdaily.com/?p=112535>
[16] www.johnpawson.com
[17] www.yamaguchi-a.jp

to the ancient Roman times and was revived in the Renaissance and especially in the Neoclassical Styles of the 18th and 19th centuries. Also in ancient Egypt white (*hdj* and *shsp*) was the colour of the crown of the Upper Egypt and suggested omnipotence and purity. The ancient capital of Egypt (today Memphis) was called Inbw-Hdj (translated as "The white walls" or "Fortress of the White Wall"). The term may have referred originally to the king's palace, which would have been built of whitewashed brick (Gestoso Singer 2010). One of the most prominent white building in this category is The White House - the official residence and principal workplace of the President of the United States in Washington since 1800. Despite of the myth emerged that white paint was applied to mask the burn damage after the Burning of Washington in 1812 – the truth is that building was originally painted white with lime-based whitewash as a mean of protecting the porous stone from freezing. Today façade of The White House is paint with Duron Exterior Alkyd/Oil Gloss labeled "Whisper White 248"[18] .

In Polish manor complexes, which were also traditionally white, this colour was the symbol of quiet isolation, solitude, and security (Tarajko-Kowalska 2005).

Another white government building among many is the Belvedere in Warsaw, neoclassical building designed by Jakub Kubicki in 1819–1822, which used to be 1989-1994 the official residence of Poland's president. Currently, the Belvedere remains the property of Chancellery of the President of Poland and the domicile of the Polish president and his family.

Symbol of grief, mourning – mausoleums, mortuaries, memorials

In some cultures e.g. in South Asia, white is also associated with grief and mourning. Probably the most beautiful example of this symbolic in architecture is the Taj Mahal, built in India in the 17th century (1632–1654) as a **tomb-memorial** to Shah Jahan's favorite wife Mumtaz Mahal, who died very young. In Mughal times the dome of Taj Mahal was compared with clouds, milk and sugar due to its whiteness, a phenomenon central to the experience and meaning of the building. While earlier Mughal buildings were primarily constructed of red sandstone, here the combination with white marble constituted a "colour dualism", which can be also interpreted in relation to caste hierarchy as well as colour symbolism in India: Brahmin (white, priestly) and Kshatriya (red, warrior) (Wescoat 2010: 179). Another example might be the Mazar-e-Quaid - the tomb of the founder of Pakistan, Muhammad Ali Jinnah, also known as the National Mausoleum. Located in the center of Karachi this marble structure was designed by the Indian architect Yahya Merchant and completed in 1970[19].
In 2013 completely sterile white **funeral house** was built in the fields of Cartagena, La Palma, Spain[20]. Architect Martín Lejarraga decided to use white despite of the fact, that in

[18] The earliest evidence of the public calling it the "White House" was recorded in 1811. The name, though in common use, remained a nickname until September 1901, when Theodore Roosevelt made it official. (www.whitehousehistory.org)
[19] Rizor, John. "AD Classics: Mazar-e-Quaid (National Mausoleum) / Yahya Merchant" 30 Aug 2011. ArchDaily. Accessed 01 Jul 2014. <http://www.archdaily.com/?p=157683>
[20] "Mortuary in the field of Cartagena / Martín Lejarraga" 12 Sep 2013. ArchDaily. Accessed 16 Jan 2014. <http://www.archdaily.com/?p=426242>

European tradition mourning is mostly associated with black. Nevertheless, the absolute whiteness of both exterior and interior creates atmosphere of solitude and sorrow. At the same time it's referring to the purity and cleanliness - attributes used to convince opponents of the mortuary in the neighborhood. Similarly, two mortuaries in Portugal: one completed in 2014 by Raul Sousa Cardoso and Graça Vaz for the parish council of Vila Caiz[21], second in Alhandra by Matos Gameiro Arquitectos (2008)[22], due to its white colour are providing a spot of mourning and contemplation, catalyzing an atmosphere of neutrality, silence and introspection.

Associations between white colour and mourning can be also find in many **memorial buildings**, especially in United States. However here the main reason to choose precisely white is more related to the nobility of the honored person and to material - as marble was a relatively common choice for noteworthy monumental works of architecture. Nevertheless, three white buildings are worth presenting in this category. Two are presidential memorials located in Washington D.C. in United States. First, built in 1922 to honor Abraham Lincoln, designed by Henry Bacon reminds a classic Greek temple and features white Yule marble from Colorado. Second memorial, dedicated to Thomas Jefferson, was designed by the architect John Russell Pope in neoclassical style in 1943. Third building, located in Rome, Italy is a monument built in honor of Victor Emmanuel and holds also the Tomb of the Unknown Soldier. The Altare della Patria also known as the Monumento Nazionale a Vittorio Emanuele II or "Il Vittoriano", is the eclectic structure, designed by Giuseppe Sacconi in 1885. This building is to date the largest monument built in white marble from Botticino (Brescia).

4. White As A Light

Third category refers to white as light, being "the sum of all colours of the spectrum" (Lenclos 2004: 32) as well as one of the extremes of "light" and "dark". According to Le Corbusier "Architecture is the masterly, correct and magnificent play of masses brought together in light" (Le Corbusier 1923 [2012:31]). This play of volumes can be most fully realized when the form is white, due to the its ability to transform visually (Lancaster 1996: 67). "White is the colour where the reflections from all other colours in the environment are best received and revealed" (Pernão 2010:156). This sensitivity to light produces changeability with light and shadow games incomparable with other colours and the associated appearance of reflexes of various colours on white architectural forms. As Pernão points: "If carefully designed, a white environment can be painted by colour reflections in a dynamic journey during daylight, giving us time awareness" (Pernão 2010:156). According to Richard Meier: "White is the ephemeral emblem of perpetual movement. The white is always present, but never the same, bright and rolling in the day […] White is the light, the medium of transformative power" (Jodidio 2008). Probably the most significant word in this description is "light", which floods through the white

[21] "Mortuary House in Vila Caiz / Raul Sousa Cardoso + Graca Vaz" 02 Jun 2014. ArchDaily. Accessed 30 Jun 2014. <http://www.archdaily.com/?p=511518>
[22] "Mortuary Houses in Alhandra / Matos Gameiro Arquitectos" 30 Dec 2013. ArchDaily. Accessed 30 Jun 2014. <http://www.archdaily.com/?p=462726>

buildings, bringing constant change to its architecture. Where there is no chromatic colour, “the rising sun and blue sky infuse white forms with the authentic, ephemeral palette of the world“ (Jodidio 2008).

White as one of the contrast extremes - light/dark

White and black often represent the contrast between light and darkness, day and night, good and evil. In Far East Cultures, white is the colour of Yang in the Yin-Yang theory, according to which the reality is composed of two factors, Yin and Yang, and imbalance between them leads to destruction. The constant transformation of *yin*/*yang* is depicted in the *taijitu* diagram, in which the circle, the symbol of the whole, is divided into the white part of *yang* and the black part of *yin*. Yang in bright, active and light, symbolizes air, space, radiation, heaven, atmosphere and cosmic space. In many Japanese cities e.g. in Kyoto the traditional house’s windows *shoji,* made from white rice paper, visibly contrasts with the dark and dim shades of the general colour palette (Lenclos 2004:32).
The question of light and dark was also dominant in Purist architecture. Le Corbusier believed that light-dark made the forms visible (De Heer 2010: 98). But, due to the highest luminous reflectance factor of all colours, white can easily produce glare. Thus, it can be aggressive to the spectators comfort and difficult to relate with other elements of space, that will mainly deal with it through contrast (Pernão 2010:56). So pure white should be introduced into open landscapes with the greatest care. A large number of white buildings in view can cause a sense of chaos, if they are functioning in a compositional arrangement as an unordered group of architectural and landscape accents. At the same time it is worth to remember, that white can be also camouflaging colour, due to the specific landscape conditions like dominant snow cover e.g. in the Arctic regions or even high mountains.

5. WHITE AS AN ABSENCE OF COLOUR – NEGATIVE PRESENCE OF COLOUR

Fourth category referenced to white seen as a lack of any colour, negative presence of colour, the reminiscence of so-called "killed colours” - neutral, plane surface of the “naked” architecture, which can be understood also in terms of emptiness, calmness and silence. The neutrality and nakedness of whiteness, which can be appreciated only by the one who has a very sophisticated sense of colour in general (Rzepińska 1989). Wassily Kandinsky wrote that:“white […] has its harmony of silence, which works upon us negatively, like many pauses in music that break temporarily the melody. It is not a dead silence, but one pregnant with possibilities. White has the appeal of the nothingness that is before birth...” (Kandinsky 1911 [1977]). For Kazimir Malevich the white surface, seen as a kind of emptiness is the monochrome ground against which geometric forms seem to float weightlessly. Also Piet Mondrian deployed white to emblematize empty space. For Mies van der Rohe, white was an "invisible" colour, which effectively disappeared into the background, as seen in The Farnsworth House, Plano, Illinois, USA (1951). In relation to the architecture this approach can be linked to the minimalistic architecture, through unacceptable sterile emptiness of white wall, finally leading to “a bit of nothing” in the space.

Minimalistic architecture – "naked" white

The term minimalism is used to describe a trend in design and architecture wherein the subject is reduced to its necessary elements. Minimalist architecture, highly influenced by Japanese traditional design as well as concept of Zen philosophy, simplifies living space to reveal the essential quality of buildings. Thus the white colour of the walls reveals the simplicity and unity of the building. In this case "the white paint is meant to be the skin of the body rather than a dissimulating layer of clothing" (Wigley 1995 [2001:18]). Contemporary minimalist architects include some "white" architects as i.a.: John Pawson, Eduardo Souto de Moura, Álvaro Siza Vieira, Alberto Campo Baeza. It is worth to mention in context of "whiteness" John Pawson's: Baron House, Skåne, Sweden (2005); B60 Sloop, Kiel, Germany (2007) and Casa delle Bottere, Treviso, Italy (2011)[23]. For Alberto Campo Baeza: Olnick Spanu House, Garrison, New York (2008); The MA: Andalucia´s Museum Memory, Granada (2009); Between Cathedrals, Cádiz (2009) and Pibamarmi Rebuilt, Mantova (2014)[24]. This minimalistic approach to white is also seen in Japanese architecture. Through numerous built examples, Thomas Daniell, architect and co-curator, analyzing Contemporary Japanese Architecture during turn of the 20th and 21st century defined two main streams, among which one being the "white school" depicted i.a. via the minimalist designer flagship stores of Tōkyō's Omotesando Avenue and buildings by Toyō Itō – SANAA[25], for example Dior store in Shibuya, built in 2001 with cool white acrylic sheets on the external facade that filter the light and partially reveal the store's contents.

Sterile emptiness, which can be unacceptable

In some cases, when there is too much white in the surroundings, white walls can be difficult to accept "suddenly looking quite naked" (Wigley 1995 [2001:259]). Raw white seemed also to be too far away from human natural vision sensation, since there is no too much pure white found in the landscape. As Amedee Ozenfant puts it: "There cannot be too much white in a room; there cannot be too much silence to hear the music of the colours" (Wigley 1995 [2001:259]). Of course such environment of white giving the feeling of the sterile emptiness, can be a mean of artistic expression, like for example in House N by Sou Fujimoto located in Oita, Japan (2008)[26], which is completely white both inside and outside, thus creating special atmosphere of absolute whiteness.

Also in outdoor sculpture titled "Square Depression" (Quadratische Senkung), by Bruce Nauman, built in Muenster, Germany in 2007 (first proposed in 1977), analogies to emptiness, loneliness etc. can be found. Sculpture in shape of inverted pyramid forms a concave city square of white concrete with its edges extending downwards and crossing at the lowest point in the center, from where an observer could only just glance over the sides.

[23] www.johnpawson.com
[24] www.campobaeza.com
[25] http://architectureau.com/articles/parallel-nippon/
[26] "House N / Sou Fujimoto" 14 Sep 2011. ArchDaily. Accessed 01 Jan 2014. <http://www.archdaily.com/?p=7484>

Standing at the center of the sculpture the spectators may feel depressive and helpless, which should be largely attributed to the object whiteness[27].

"A bit of Nothing"

In this section white is seen as a lack of colour, visual "hole", that gives impression of an empty space. This aspect of white was pointed out by David Batchelor in a series of photographs presenting small monochrome rectangular shapes found in the city – mostly advertising spaces or just plain sheets of paper. Thus, the blank surface began to form a small empty centre in an mostly saturated visual field "…in detaching itself from the surroundings, by being white and parallel to the picture plane *(it creates)* A bit of nothing – but more nothing-much than nothing-ness; a presence that is more like an absence, at least for a moment or two". [Batchelor 2010].

6. White As A Mean Of Expression Of The Architectonic Forms

Fifth category refers to the fact that for many designers as well as architects white is still perceived as the best colour to represent the architectonic forms, thus being colour of more the "skeleton" and "bones", than of the "dress" of the building. Le Corbusier wrote that "the language of the architectonic forms is best expressed in the superior luminosity of white" (De Heer 2010:104). "If the house is all white, the outline things stand out from it without any possibility of transgression; their volumes shows clearly; their colour is distinct" (Wigley 1995 [2001]). And as Matthias Sauerbuch and Louisa Hutton adds: "If the form is not coloured, it can only be white" (Hutton 2010).

"The most architectural colour"

However the domination of white in architecture was mainly connected with the 20th century, it is still the colour treated with some privileges as "the most architectural" one. White colour has been usually used for architectural paper models as the best presentation for form and shape of the building. Of course today such models are being replaced by 3D realistic models, but cardboard models are still common, especially in the first design phase – in point where an architectural concept is first realized. Interesting "tribute" to this practice can be found in the Hungarian Pavilion for the 13th Venice Architecture Biennale in 2012, where 500 student's models were exhibited, thus creating "sacred atmosphere of the white architectural forest"[28].

White colour dominates also in Lego Architecture Studio - avaliable since 2013 set of blocks, which are very rarely plain white, rather being coloured in prime shades like yellow, red, blue or green. Lego's brand relations director, Michael McNally explains total whiteness of the collection: "We rarely offer a toolkit in only one colour, but using white

[27] http://www.skulptur-projekte.de/kuenstler/nauman/?lang=en

[28] Rosenfield, Karissa. "Venice Biennale 2012: Hungarian Pavilion" 08 Sep 2012. ArchDaily. Accessed 17 Jun 2014. <http://www.archdaily.com/?p=271928>

actually creates natural lines and shadows that can more accurately represent architectural shapes and form. We felt using all that white gave the kit a very 'sketchbook' feel."[29].

White is often use when the form of the building is the most important factor of the design. This connections between white and the structure can be found for example in concrete architecture of the second half of the 20th century, to mention only two buildings: Joern Utzon's Sydney Opera House from 1957 or Eero Saarinen's The TWA Flight Center opened in 1962 as a standalone terminal at New York City's John F. Kennedy International Airport (JFK). It is also noteworthy that many bridges are painted white to concentrate the eye of the spectator on its construction and form, among them few Santiago Calatrava's bridges e.g: The Zubizuri (Basque for "white bridge") footbridge across the Nervion River in Bilbao, Spain (1997) or Samuel Beckett Bridge in Dublin, Ireland opened in 2009. It is also worth to mention The Millau Viaduct - cable-stayed bridge that spans the valley of the River Tarn near Millau in southern France, designed by the structural engineer Michel Virlogeux and architect Norman Foster (2004).

White as material colour

New technologies have allowed the production of new materials or to improve old, such as white concrete, artificial stones, sheet metal and prefabricated tiles with a level of durability and white constancy impossible to achieve just a few years ago. Contemporary whiteness of the buildings is different from this of the classic modern architecture (egg-shell like or ivory off-whites) due to new façade technologies, that makes achieving glossy and bright whites possible, difficult to reach in plaster. Thus, white materials are nowadays selected without worrying about dirt and cracks, that could completely subvert the status of the surface.

DuPontTM Corian®[30] in colour **Glacier White** is one of the new materials, eagerly used by designers, not just due to its durability and resistance, but also its very aesthetic appearance. Seeko'o Hotel in Bordaux, France (2007) by architect Jean-Christophe Masnada from Atelier d'architecture King Kong was world-first exterior cladding with this material, in order to create the desired "iceberg" effect. (Seeko'o means "iceberg" or "glacier" in Inuit)[31]. All-white Corian was also used for exterior finishing in Richard Meier's OCT Shenzhen Clubhouse (Shenzhen, China, 2012)[32].

Another interesting new material, chosen for exterior finishing due to its dirt repelling ability, practical, aesthetic and performance qualities, is **HI-MACS®** (Natural Acrylic Stone)[33] often used in **Alpine White** colour. HI-MACS® is a thermo-formable, multipurpose, ultra-resistant and non-porous Solid Surface material, produce by LG, which

[29] http://www.fastcodesign.com/1673217/a-monochrome-lego-set-to-teach-tomorrows-architects
[30] www.dupont.com
[31] "Seeko'o Hotel / Atelier King Kong" 07 Aug 2008. ArchDaily. Accessed 08 Jul 2014. <http://www.archdaily.com/?p=4719>
[32] "OCT Shenzhen Clubhouse / Richard Meier & Partners Architects" 04 Sep 2012. ArchDaily. Accessed 09 Jul 2014. <http://www.archdaily.com/?p=270024>
[33] HI-MACS is the first Solid Surface on the market to have been granted European Technical Approval and the ideal material for all different types of structures; www.himacs.eu

can be cleaned easily and stands up to dirt – the purpose very important in terms of whiteness. PAD Architects used this material to create the perforated facade of the headquarters for a boat manufacturer Bénéteau situated in Givrand, France (2011).

Due to the new, advanced technologies for architectural concrete it is also important to mention the privileged use of **white cement** in modern architectural projects. The courthouse in the Danish town of Holstebro, designed by 3XNielsen A/S in 1992 is a worthy representative of white concrete buildings, constructed with Aalborg White cement[34]. White concrete buildings might be constructed of pre-cast elements or in-situ cast segments, depending on the type of technology like e.g. **Glassfibre Reinforced Concrete (GRC), Self-compacting concrete (SCC)** or **One Layer Rendering (OLR)**[35]. GRC was used with success in e.g. Liberal Arts and Sciences Building by Kazuhiro Kojima + Kazuko Akamatsu / CAt at the Education City in Qatar, Doha (2003) or in Contemporary Art Center by Nieto y Sobejano Arqs, Cordoba, Spain (2013). SCC was used e.g. in Gouveia Law Courts by Barbosa – Guimaraes, Gouvieia, Spain (2011) as well as in white apartments The Simona by Jean-Pierre Lott Architecte in Monaco (2012). Classical OLR is present in e.g. New Headquarter of group Azahar by Carlos Ferrater in Castellon de la Plana, Spain (2009).

7. White As A Counterbalance To The Chromatic Colours

Sixth category refers to the relationship between white and the other, chromatic colours, which is according to Wigley, oftentimes "convoluted" (Wigley 1995 [2001:199]). From the beginning, the theory of white wall and the theory of polychrome are intimately bound together. (Wigley 1995 [2001]). Japanese philosophy says that the aesthetic value of achromatic colours - as white - is perceived only by those who can contemplate the beauty and richness of other colours (Rzepińska 1989). Le Corbusier often places colour beside white. In *Almanach d'architecture moderne* (1925) he wrote: "The calcimine glows due to the wall surface that is dark […], due to the wall that is warm […], due to the wall that yields […]. A house that is completely white resembles a cream jug" (De Heer 2010: 98). Thus, "white was the precondition for colour; colour was intensified by its proximity to white"(Batchelor 2000: 45). This use of white as opposite to colour, to achieve effect of Le Corbusier's whiteness: "whiter than white" (Batchelor 2000: 49) is seen oftentimes in modern architecture. As Batchelor points: "the range of contemporary artificial white-coloured materials is usually used to contrast the building volume within its mostly "colourful" urban context" (Batchelor 2000: 49).

So, this category refers to the strong preference for white volume, based on the myth of whiteness of Greek structures as well as white as reference - used both as background as in front of the other colours.

White as opposition for chromatic colours

[34] www.aalborgwhite.com.au
[35] www.arquitecturablanca.com

Problem of the preference for the white volume over the decorated surface, can be traced all the way back to Plato's Ideal – classic versus romantic, *disegno* versus *colore*. Through the history of architecture this conflict is always present in a kind of sinusoid, however Adolf Loos saw "the account of civilization as a progress from the sensuality of decoration to abstraction of form, through the progressive removal of ornament"(Wigley 1995 [2001]). One of the most significant point in this conflicts was "Neoclassicism's strong hold on whiteness in opposition to the polychromy discovered in the new archaeological sites around the 1830s" (Hutton 2010). The fact, that ancient Greek temples were actually brightly coloured was at that time deliberately ignored, thus having contributed to present even today "a conspiracy of collective amnesia", as Ian Jenkins, curator of British Museum calls it[36]. The public perception of Greek architecture and sculptures as white and pure can be seen in all "classical" architectural styles as the Renaissance of the 15th and 16th century, or the Neoclassical styles of 19th century e.g. The Greek Revival Style, where houses were usually painted white to resemble the white marble of impressive and costly public buildings. The myth of whiteness as propagated by Le Corbusier in the late 1920s can be also referred to presumed Greek and Roman Ancient white aesthetics, as a result of Le Corbusier trip to Greece and seeing the "white" Acropolis and Parthenon.
In the late 1960s was established group of architects called The New York Five or commonly "The Whites". Richard Meier, Peter Eisenman, Charles Gwathmey, Michael Graves, and John Hejduk shared an allegiance to modern architecture and pure form, reminiscent of the work of Le Corbusier in the 1920-30s[37]. They performed strongly against the aesthetics of post-modernism and often kitsch colours used, calling back to the geometric, clean forms and consequently also pure colour. White was therefore again called as a talisman of the new style. However only Meier and in some way Gwathmey remained faithful to the ideas of Le Corbusier including white, it is worth mentioning few buildings of the members of the group, where reference to white is present i.a.: Gwathmey's Residence and Studio House New York, USA (1966), described as one of the most influential buildings of the modern era, Hanselmann House (1967) designed by Michael Graves and Eisenman's House VI Cornwall, Connecticut (1975).
Even today, the two "extreme" approaches have lived side by side: those architects that strive for chromatic variety in their work and those who are advocates of the colour white. Juan Serra suggests that there are those who "sometimes do so under a conscious desire of formal and expressive restraint and others due to the almost unconscious desire to line oneself up with the modern architecture that is wrongly associated with white." (Serra 2013).

White as a reference point to the chromatic colours

Nevertheless, white can be treated not only as a contrary, but also as a reference point, playing crucial role in the system of many colours (Eliasson 2006: 241). In this context white can be seen first as the **perfect background**, which brightens the colours that appear

[36] http://www.newscientist.com/article/dn17309#.U711rEA0_XQ
[37] In 1973 another five architects - Romaldo Giurgola, Allan Greenberg, Charles Moore, Jaquelin T. Robertson, and Robert A. M. Stern, known as the "Grays", attacked the "Whites" on the grounds that this pursuit of the pure modernist aesthetic resulted in unworkable buildings that were indifferent to site and users, and divorced from daily life.

against it and renders them decorative. For example in Le Corbusier's work the overall space was nevertheless predominantly painted white, so the coloured areas were seen as interventions played against a neutral background. "The white surface exposes colour, presents it for disciplining" (De Heer 2010:104). As Wigley points it: "Within the white spaces of modern architecture the painter likewise projects colour onto the surfaces" (Wigley 1995 [2001:232]). This approach is also seen in contemporary white objects, which whiteness is treated mainly as background for receiving colour e.g. in Allianz Arena, by Herzog & de Meuron München, Germany (2005). Architects designed translucent white surface of the stadium from rhomboidal inflated ETFE foil panels, thus allowed changing of external colours (due to façade lighting system) depending on the team playing – red/white for Bayern and white/blue for TSV 1860 München[38].
Secondly, **white is always seen in front of the other colours**, which are able to brighten the whiteness of a building. Thus, the brilliance of white wall surface is maximized by contrasting it with coloured surface. (De Heer 2010: 104). White would not be white without green of trees and blue of sea and sky - accents of colour, which both intensify the white and are intensified by it (Wigley 1995 [2001: 210]). Thus, the white surface enters a dynamic relationship with the colours beyond the building and cannot be detached from the sensuous colour it appears to reveal. (Wigley 1995 [2001: 209]).

8. White As A Trademark – Attribute, Identification Mark

The last but not least, seventh category refers to white colour as an attribute - identification mark of both architectural complexes and architects.

White villages and cities

White, though traditionally used mainly for functional reasons, over time became the colour shaping the aesthetics of the architecture and identified with it in many regions such as best known **Mediterranean coast** or some regions in Spain. White colour of the buildings was imposed as a common Greek vernacular trademark and it characterizes all the Cyclades. Consequently, whitewashed houses were established as a tradition and visualized as being representative of the "national architectural colours" (Pantouvaki 2011). Le Corbusier described white walls in the Mediterranean as the buildings "clothed in a majestic coat of the whitewash". (Wigley 1995 [2001]). Definitely, whitewash is here a visual bond, that held the aesthetic of the buildings together.

The white colour is also dominant in **Pueblos Blancos (The White Towns of Andalusia)** - series of towns and large villages in the Spanish provinces of Cádiz and Málaga. All of the villages are characterized by whitewashed walls and reddish or brownish tiled roofs. Reasons for whitewashing buildings have included the chemical properties of the alkaline whitewash to the socially cohesive appearance a wholly whitewashed village presents. The uniformity of Pueblos Blancos is also partially due to the instruction passed by the Spanish dictator Miguel Primo de Rivera (1923-30).

[38] https://www.allianz-arena.de/en/fakten/detaillierte-zahlen/

However, white is a trademark not only for traditional, whitewashed villages but also for **Tel Aviv** (the second most populous city in Israel), known as the **White City**, due to the over 4,000 collection of International Style, mostly white buildings. Recognized as a UNESCO World Heritage Site, as "an outstanding example of new town planning and architecture in the early 20th century", Tel Aviv's buildings were erected mostly in the 1930s and 1940s by German Jewish Bauhaus-trained architects who emigrated after the rise of the Nazis. Today, white architecture successfully integrates the "whiteness" of the Le Corbusier's Modernism with "whiteness" appropriate for hot, Mediterranean climate to create a habitable city by the sea. Worth mentioning is also the White Square, designed in 1988 by Israeli artist Dani Karavan, an environmental sculpture site reflecting Tel Aviv's history and scenery.

White architects

For some architects white colour plays significant role – being their trademark, specific signature. It is significant, that among those architects there is no Le Corbusier, who was in fact responsible for the "white" image of the Modernism. However he was rather the advocate of white in a metaphorical sense, than in practical use, creating only one all-white building: Villa Besnus at Vaucresson (1923). Despite that fact, his rhetoric of white has become the example for many followers throughout the world. Today, rationale to use primarily white in archietcture are various for different architects. Nevertheless only few of them can be called "White architects". Among them it is must to mention **Oscar Niemeyer** (1907-2012), Brazilian architect, best known for his design of civic buildings for Brasília (Brasil's capital). His use of white was deeply connected with material: reinforced concrete, which poured surface painted white was turned into an expressionist masterpiece[39]. However not all of his buildings were pure white, its visual appearance is mainly white, to mention only few in Brazil e.g. Ministry of Education and Health (1936); House at Canoas (1952); Palacio da Alvorada (1957); Ciccillo Matarazzo Pavilion (1957); National Congress of Brazil (1958); The Niterói Contemporary Art Museum (1991) or most contemporary Oscar Niemeyer International Cultural Centre in Asturias, Spain (2006).

Another "white architect" is definitely **Alvaro Siza Vieira**[40] (born 1933). Portuguese architect is an author of numerous building where white is important visual as well as philosophical factor e.g. Vieira de Castro House, Vila Nova de Famalicao, Portugal (1994); Serralves Museum of Contemporary Art, Porto, Portugal (1997); Adega Mayor Winery, Campo Major, Portugal (2006); The headquarters and museum building of the Iberê Camargo Foundation, in Porto Alegre, Brasil (2008) or the last, but not least The Fez House, Porto, Portugal (2010).

Richard Meier[41] (born 1934), American architect, former member of "The Whites" (New York Five Group) is one of the most "white architects" ever. In his Pritzker Award acceptance speech (1984), he said about white: "Whiteness allows the architectural ideas to be understood most clearly - the difference between opacity and transparency, solid and

[39] http://www.theguardian.com/artanddesign/2012/dec/06/oscar-niemeyer-obituary
[40] http://alvarosizavieira.com/
[41] http://www.richardmeier.com/www/

void, structure and surface. These things are more perceptible in a white environment. They have a greater clarity". White colour is present in almost all of his projects and completions e.g. Smith House, Darien, Connecticut (1967), The Atheneum, New Harmony, Indiana (1979), High Museum of Art, Atlanta, Georgia (1983), Ulm Stadthaus Exhibition & Assembly Building, Ulm, Germany (1993), Mutated Panels, Milan, Italy (2011), City Green Court, Prague, Czech Republic (2012). But Meier's white it is definitely not the one kind of white. In 2013 Dutch artist Ine Vermee, based in Tilburg, has created a minimal and tranquil series of colour planes carried out in enamel on steelplate, adopting a colour sample by Richard Meier called 15 Meier's white (preceded by 9 Meier's white in 2007)[42].

One of the youngest white architects is **Santiago Calatrava** from Spain (born 1951), whose clean, white structures are reminiscent of white sailboats flowing through the blue sea of the sky. Among his numerous white buildings it is worth mentioning: The futuristic Palau de les Arts Reina Sofia (2005), built as part of City of Arts and Sciences complex in Valencia. So called "White elephant" is one of Spain's most iconic buildings as well as the world's tallest opera house. White concrete and shimmering white mosaic tiles, or *trencadis*, coat the two laminated steel shells flanking the elevated, metallic feather roof. In Quadracci Pavilion (2001) The Reiman Bridge at Milwaukee Art Museum, Wisconsin white signifies new beginning and development in new direction.

Conclusions

White is traditional and classical both modern and avant-garde colour in architecture. Simple and neutral both complicated and contrasting, appropriate and at the same time radical, both "naked" and "dressed", unambiguous and chameleonic, safe and pure, both dangerous and aggressive. "White or near-white carried the connotations of hygiene and hospitals, of ships and the Mediterranean vernacular (perhaps, too, of ancient temples) but above all of a tabula rasa reshaped only by pure form, space, structure and function" (Wigley 1995 [2001:335]). Nowadays, while the number of white surfaces may have been reduced, their definitive role remains and the white building with a little colour is still an object of desire. (Wigley 1995 [2001:359]). "White has always been used and probably always will be in some form or other, in every dwelling" (Eaton 1930).

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A Study on Color Emotions of Two Color Combinations using Achromatic Colors as Main Color.

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Abstract
The current study carried out a psychophysical experiment to see color emotions of two color combinations using achromatic colors as main color. Eleven basic colors were used. Three achromatic colors, including white, grey and black colors, were used as main color. The rest of basic colors were used as secondary colors. In total, 30 color combinations were used. Thirty-two observers were asked to assess these color combinations on 6 scales, including "harmonious-disharmonious", "active-passive", "heavy-light", "warm-cool", "soft-hard", and "complex-simple". The major results showed that the secondary color determines the emotion of color combinations having achromatic colors as main color.

1. Introduction

In product design practices, the achromatic colors (i.e., white, grey and black colors) are usually used on the appearance of the home appliance, for example, refrigerator, television, air condition, washing machine, etc. Therefore, understanding the color emotions induced by color combinations using achromatic color as main color is necessary for product designers. Many studies[1-10] have done to explore the color emotions or color harmony induced by two color combinations. However, the color emotions induced by color combinations using achromatic color as main color remain unclear. Therefore, this study used three achromatic colors as main color and 11 basic colors as secondary colors to see the color emotions.

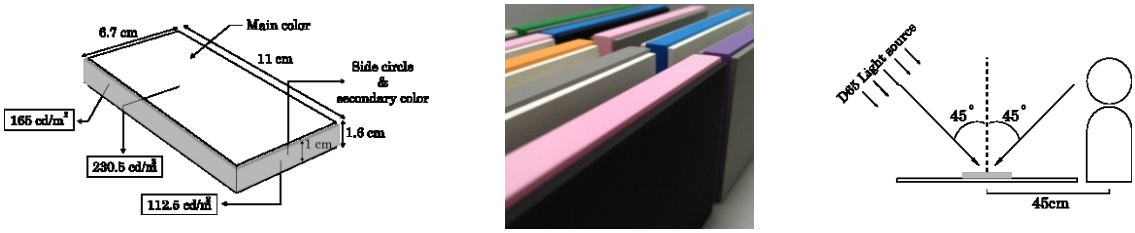
2. Experimental Plan

A psychophysical experiment was conducted to see color emotions of color combinations using achromatic colors as main color. To produce color combinations, 11 basic color terms according to Berlin and Kay [11] (red, orange, yellow, green, blue, brown, purple, pink, white, black and gray colors) were used. Each color was produced according to their boundaries in CIELab space proposed by Lin *et.al*[12-14]. The achromatic colors were used as main color and the rest of color were used as secondary color. Each color was measured by a GretagMacbeth® Eye-One. The CIELAB values were calculated under CIE D65 and 1964 standard colorimetric observer, as shown in Table 1.

Table 1: The colorimetric values of 11 basic colors

	L*	a*	b*	C*	hue angle
White	98	-1	3	2	115∘
Grey	59	-1	1	1	117∘
Black	23	0	0	0	289∘
Red	43	42	23	48	29∘
Green	52	-40	24	46	149∘
Yellow	79	6	79	79	86∘
Blue	55	-14	-38	40	250∘
Brown	45	21	12	24	30∘
Pink	81	19	-5	20	344∘
Orange	70	29	49	57	59∘
Purple	52	14	-24	28	301∘

To produce experimental samples, the main colors were applied on an cuboids and secondary colors were applied on a side circle configured to cuboids, as shown in Figure 1(a). Totally, 30 experimental samples were produced, as shown in Figure 1(b).



(a) experimental sample (b) picture of experimental samples (c) viewing geometry

Figure 1: The experimental samples and viewing geometry

Each experimental sample was assessed on 6 emotion scales, including "harmonious-disharmonious", "active-passive", "heavy-light", "warm-cool", "soft-hard", and "complex-simple". Each scale was given as 7-step categorical judgment. Thirty-two observers, including 13 male and 19 female, with an average age of 21.2 years old were participated. This experiment was conducted in a dark room. Each experimental sample was displayed in a viewing cabinet and illuminated by a D65 simulator. The viewing distance was about 45 cm with a 45/45 illuminating/viewing geometry, as shown in Figure 1(c). The luminance levels for three observational surfaces were measured, 230 cd/m^2, 165 cd/m^2 and 113 cd/m^2, respectively, as shown in Figure 1(a).

3. Intra- And Inter-Observer Variation

In prior to analysis, intra- and inter-observer variations were examined by root mean square (RMS). The former is to see whether the observers can repeat judgment or not. The latter is to examine how well the individual observer agrees with the mean results. For RMS of 0, it represents a perfect agreement between two data array.

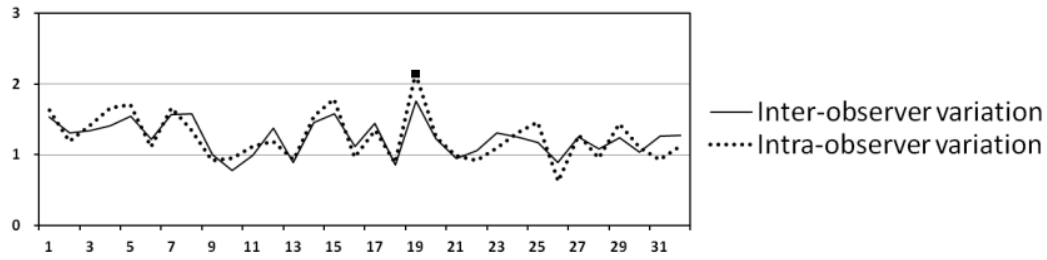


Figure 2: Intra- and inter-observer variation

The results are illustrated in Figure 2. It can be seen that intra-observer variation and inter-observer variation were ranged between RMS of 0.62 and 2.15. One observer was found to have RMS value exceeding 2.0 on intra-observer variation, indicating this observer can't repeat consistent judgment. Therefore, the data of this observer was excluded from further analysis.

4. Result

In order to understand color emotion of two color combination using achromatic colors as main color, the mean results were used to rank color combinations in order of color emotion scales. The results are illustrated in Figure 3 and Figure 4.

In Figure 3, color combinations are sorted according to each emotion scale. In each diagram, top row shows the results obtained from color combinations having white color as main color, middle row grey color and bottom row black color. In Figure 4, the emotion values of color combinations are illustrated in line chart. Note that two-achromatic-colors combinations are excluded from Figure 4.

Both Figure 3 and Figure 4 reveal that

(1) except "harmonious-disharmonious" scale, on the rest emotional scales, including "active-passive", "heavy-light", "soft-hard", "warm-cool" and "simple-complex" scales, the order sequence of secondary color remained consistent no matter which achromatic color was used as main color. This implies that secondary color determined the emotion of color combinations having achromatic color as main color. The difference lies on the white main color is "more active", "lighter", "softer" and "simpler" than those having grey and black colors as main color.

(2) two-achromatic-colors combinations, i.e., white-grey, white-black and grey-black combinations, tended to be "passive", "heave", "harmonious", "hard", "cool" and "simple." Little exception was found that the main color of grey and black colors with the secondary color of white color tended to be "light", and the main color of white with secondary color of black tended to be "disharmonious."

(3) on "harmonious-disharmonious" scale, roughly speaking, the color combinations having white color as main color were the most harmonious, followed by those using grey main color and black main color. However, brown, pink, red, orange and purple colors used as secondary color were found to influence the order sequence of color combinations having achromatic main color on color harmony scale.

As above mentioned that the secondary color determined the emotion of color combinations having achromatic color as main color, the color emotion models developed by Lee[15] were

used to predict the color emotion obtained in the present study. To discard the influence of main color, the emotion values of the color combination having same main color were
averaged. The averaged emotion values were compared with the predicted values obtained from the models of "active-passive", "heavy-light", "soft-hard" and "warm-cool" by using correlation coefficient. High positive correlation was found, 0.91 for "active-passive", 0.89 for "heavy-light", 0.98 for "soft-hard" and 0.80 for "warm-cool". This confirms the secondary color determines the emotion of color combinations having achromatic color as main color.

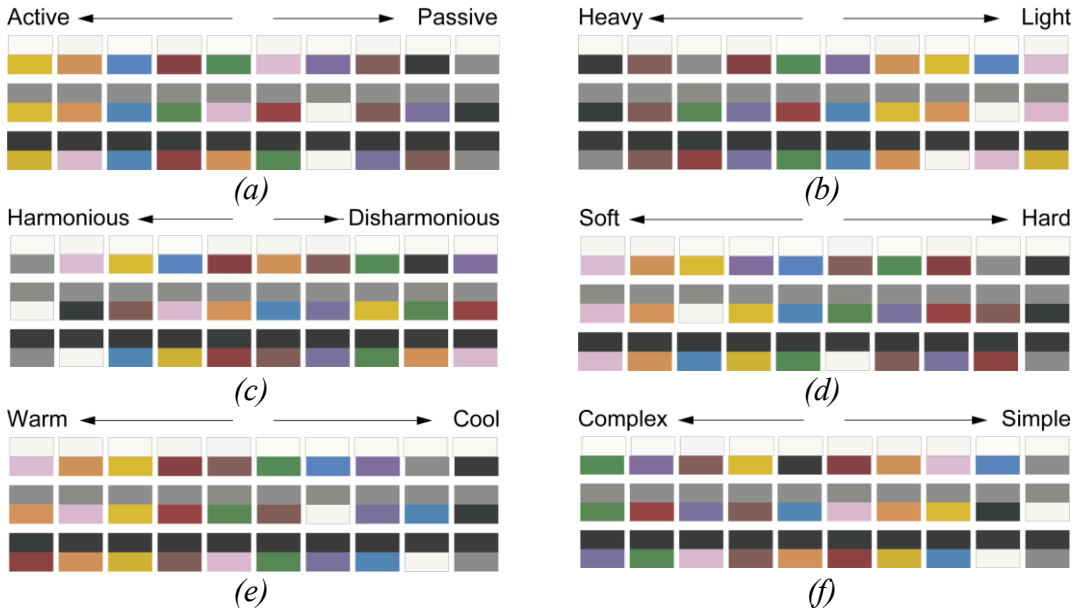
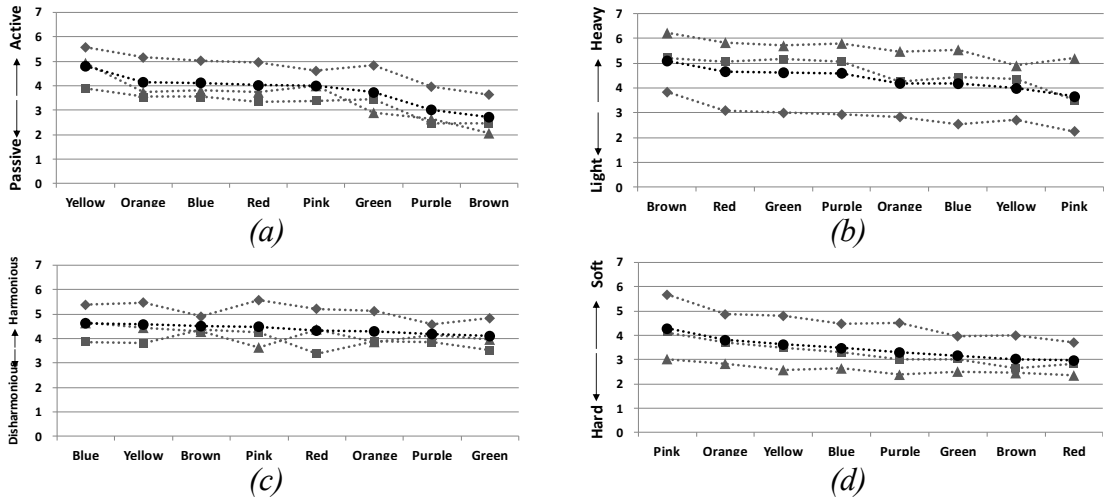
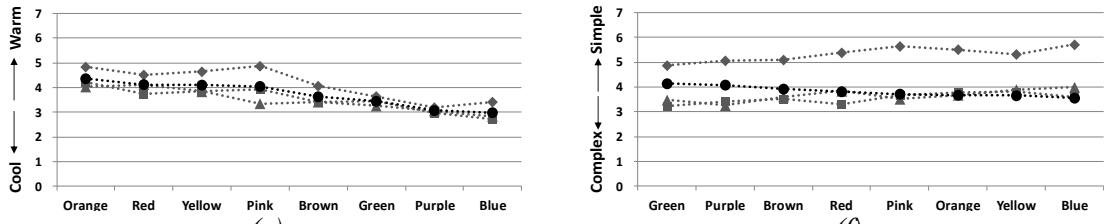


Figure 3: The order of color combination on color emotions.





(e) *(f)*

Figure 4: The profile of color emotion. A diamond symbol indicates the color combinations using white color as main color, square grey color, triangle black color and circle mean vales.

5. Conclusions

The current study conducted a psychophysical experiment to see color emotion of two color combination using achromatic as main color. The major finding is that the secondary color determines the emotion of color combinations having achromatic color as main color. This tells designers when dealing with the appearance of products which appear achromatic colors in large area, the emotion of product can be foreseen according to its secondary color, only shift emotion direction according to which achromatic color is used as main color. The white main color has strongest impact on emotion, followed by grey and black colors.

Acknowledgements
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Color Naming of Deutranomals Largely Influenced by Luminance and Size of Light

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Abstract

Color light is widely used in our daily life. The recent development of Light-Emitting Diode (LED) light facilitates the production of light with various color, luminance, and size. People with color vision deficiency, however, could have difficulty in recognizing the color of light depending on the combination of those color, size and luminance. We investigated how the color appearance of LED light was influenced by its size and luminance for deuteranomal and color normal observers. Test stimulus was a mixture of light consisted of a red, a green and a blue LED. We tested those stimuli with a wide range of luminance levels and two visual angles. In the experiment, a circle stimulus with different color was presented one by one. Observers evaluated the color of the stimulus each time using a color naming method, which they answered up to three most intense colors from six color names. Our results show that the color naming of deuteranomals changes dramatically depending on luminance level and the luminance dependency is stronger for smaller stimulus, whereas those of color normal observers changes a little. The manner of color shift suggests that the Bezold-Brücke effect is stronger for deuteranomals. A selection of size and luminance level in color light is important for a color sign recognizable to people with color vision deficiency.

1. Introduction

We are surrounded by a variety of color lights in our daily life, such as traffic signs, display devices, the power buttons of electrics. The recent development of Light-Emitting Diode (LED) light facilitates the production of light with various color, luminance, and size, because of its flexibility. People with color vision deficiency, however, could have difficulty in recognizing the color of light depending on the combination of those color, size and luminance.

It is known that the size and luminance of light affect color appearance and color discrimination such as small-field tritanopia, large-field size effect, the Bezold-Brücke hue shift (e.g. Wyszecki & Stiles 1982). Besides, it has been shown that the color perception of people with color vision deficiency is largely influenced by size, luminance and viewing condition than people with normal color vision (e.g. Fletcher & Voke 1985; Paramei et al. 1998; Montag & Boynton 1987).

Color appearance is also different in surface color and light-source color (Uchikawa et al. 1989). The color perception of people with color vision deficiency could be different in surface color and light source color. Therefore, it would be predicted that they have problem in recognizing the color of LED signs in certain conditions since they could be very small, too dim, or too bright. Although there are many researches testing the influence of luminance and size on the color perception of color deficit observers (Paramei et al. 1998; Montag & Boynton 1987; Montag 1994), it is not clear how their color perception changes depending on both size and luminance, and what size and luminance level would be good for them in recognizing color.

One of important aspects of color perception is color appearance described by categorical color or the ratio of color component, especially for signs or examples descried above. In our daily life, we usually do not need fine color discrimination, but often use color categories for the recognition of objects and communication with other people. More detailed color appearance can be specified by six elementary colors: red, green, blue, yellow, black, and white, as used in Swedish Natural Color System (NCS). It is known that people with color deficiency have color categories or color names relatively close to color normal people even though they often cannot discriminate colors varying along red-green direction (Kagawa et al. 2012, 2013; Lillo et al. 2014). This categorical color perception cannot be predicted by simulation models based on color confusion lines (Brettel et al. 1997).

In this study, we investigate how the color appearance of deuteranomals changes depending on the size and luminance level of LED light using a color naming method. Our results would be helpful to find what condition would be easy to recognize color for deuteranomals, and what colors would be easy to recognize for both deuteranomalous and color normal people.

2. Experiment

Experimental settings and Stimulus

An integrating sphere (SPH-8-4, Sphere Optics) was placed in a dark experimental booth. The aperture of integrating sphere was used as a test stimulus. A black board with a circular aperture was put in front of the integrating sphere so that an observer only saw light from the aperture. He or she viewed the test stimulus binocularly with a chin rest. The viewing distance was 57 cm, and the diameter of the test stimulus was 2 or 0.5 degrees.

A test light for color judgment was a mixture of red, green and blue LED lights installed to the integrating sphere. The color of test light was controlled by a PC via a DMX512 controller. Figure 1 shows the relative spectral power distributions of red, green and blue LED lights. The luminance of test stimulus was controlled by reflective ND filters (Sigma Koki) and set to 6 levels: 1000, 500, 100, 10, 1, and 0.1 cd/m^2. These stimuli basically appeared in light source (or aperture) color mode, but 1, and 0.1 cd/m^2 light was too dim to appear as light source for some observers.

We prepared 21 test color stimuli for each luminance level. Figure 2 shows the chromaticity coordinates of test colors measured by a spectroradiometer (CS-1000, Konica Minolta) on the u'v' chromaticity diagram. Test colors were chosen to align along the

confusion lines of deuteranomals in equal color differences, but they slightly shifted among luminance levels because of the ND filters.

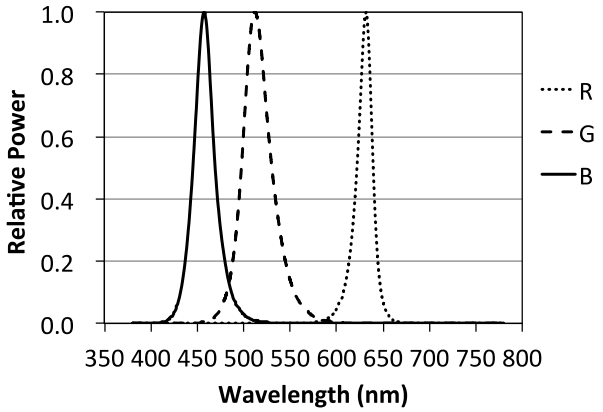

Figure 1. The relative spectral power of LED lamps used for test stimuli.

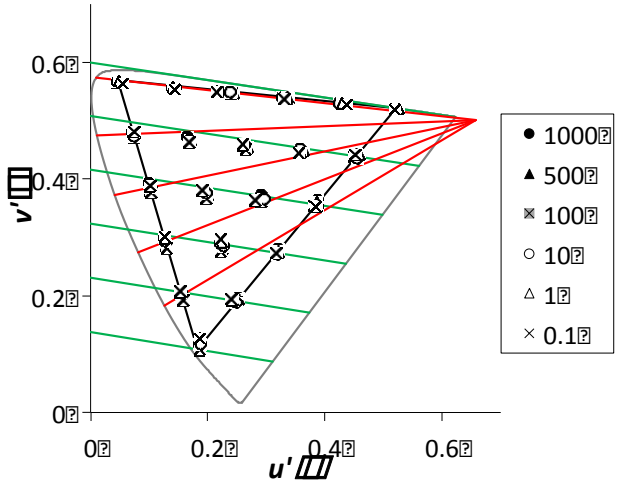

Figure 2. The chromaticity coordinates of test colors in six luminance levels (1000, 500, 100, 10, 1, and 0.1 cd/m^2) on the u'v' chromaticity diagram.

Observers

Three normal trichromat and five deuteranomalous observers participated. Normal trichromat observers were confirmed their color vision by a 100-hue test (ND-100, Japan Color Research Institute). We classified deuteranomalous observers (DA1, Mild; DA2, Moderate; DA3, DA4, DA5, Severe) based on color vision tests examined by a Ishihara's test for colour deficiency (38 Plates Edition) The Standard Pseudoisochromatic Plates (SPP) color vision test Part 1, a Panel D15 (Murakami Colour Research Lab.), and an anomaloscope (OT-Ⅱ, Neitz). The red/green mixture scale of the anomaloscope is from 0 (pure green) to 73 (pure red).

Procedure

After 10 minutes of dark adaptation, a test stimulus was presented for 3 sec. During 15 sec re-adaptation to darkness, an observer made a color judgment of test stimulus using a color

naming method. They were instructed to identify the color of test stimulus by the use of up to three colors out of six color names: red (R), yellow (Y), green (G), blue (B), white (W), black (K). If they felt that they saw only one of these colors, responded only with that name. If they felt that they saw two of these colors, responded first with the one that seemed most intense and second with the one that seemed less intense. For example, a response to a greenish blue would be 'blue,' 'green,' in that order. He or she made color evaluation verbally, and it was recorded each time a test stimulus was presented. The judgments of all colors for a certain size and luminance level were made in random order during one session. The same procedure was repeated for the combination of two stimulus sizes and six luminance levels in separate sessions. Three sessions were conducted for each observer and each condition in total.

3. Result and Discussion

There were various possible responses that an observer could make such as R, RW and RBW. Each response was assigned an arbitrary score value of ten. When only one name was given, this value was assigned entirely to the corresponding response category. When two names were given, a value of six was assigned to the category of the first response name, a value of four to the category of the second. When three names were given, a value of five was assigned to the category of the first response name, a value of three to the category of the second, and a value of two to the category of the third.

Figure 3 shows the examples of color naming judgments for 2-degree test stimulus with luminance 1000 cd/m^2 and 0.1 cd/m^2 on the u'v' chromaticity diagram. Each circle indicates the ratio of color names answered for a test color on corresponding chromaticity coordinates. Each circle consists of the total responses of 3 sessions from a deuteranomalous observer (DA3). In the case of color normal observer (Normal), the total responses of 9 sessions from 3 observers were put together. The overall color-naming map of color normal observer is relatively stable. In the case of deuteranomalous observer, the ratio of white response is higher for bright test stimuli and Green responses take over some of white responses as the test stimuli become dimmer. Other deuteranomalous observers showed similar trend. These results suggest that the influence of luminance is much larger for deuteranomalous observers than color normal observers.

Figure 4 shows the examples of color naming judgments for 2-degree and 0.5-degree test stimulus with 0.1 cd/m^2. The overall color-naming map of color normal observer is relatively stable even when the size of test is different. In the case of deuteranomalous observer, the ratio of Black responses increase and hue (RGBY) responses decrease for small test stimuli. There are large individual differences among deuteranomalous observers, but the responses for small stimuli are unstable in general. These results suggest that recognizing small light is more difficult than large light and the luminance dependency tends to be stronger for smaller stimulus.

To examine the color shift due to luminance, the ratio of each color response for a 2-degree yellowish stimulus are shown in Figure 5. An abscissa shows luminance level and an ordinate indicates the ratio of response. All observers show a trend that Yellow responses decrease as luminance decreases. The green responses of deuteranomalous

observers largely increase as luminance decreases. This color shift is consistent with the characteristics of the Bezold-Brücke effect (Purdy 1937; Boynton & Gordon 1965).

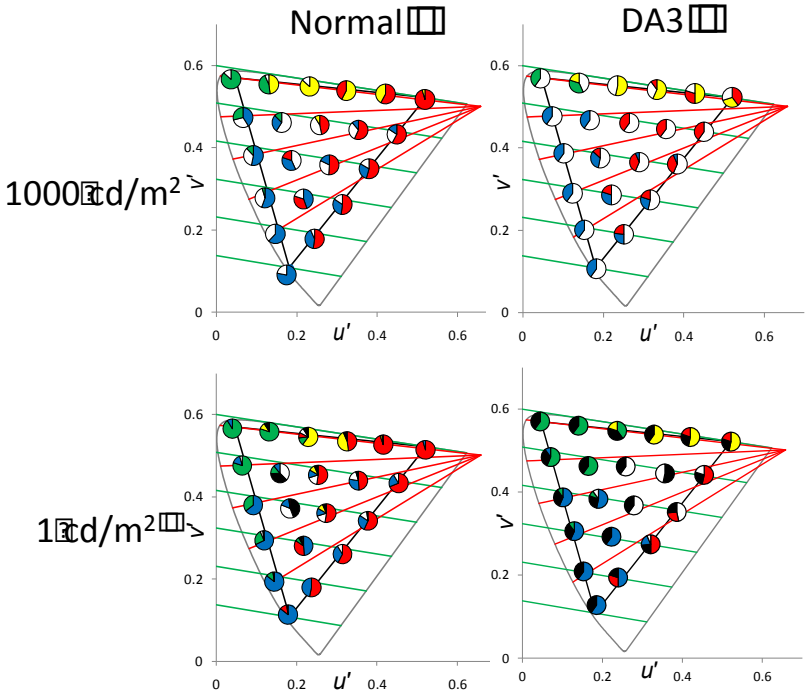

Figure 3. Results of color naming for bright (1000 cd/m^2) and dark (0.1 cd/m^2) stimuli on the u'v' chromaticity diagram. Visual angle of stimuli is 2-degree.

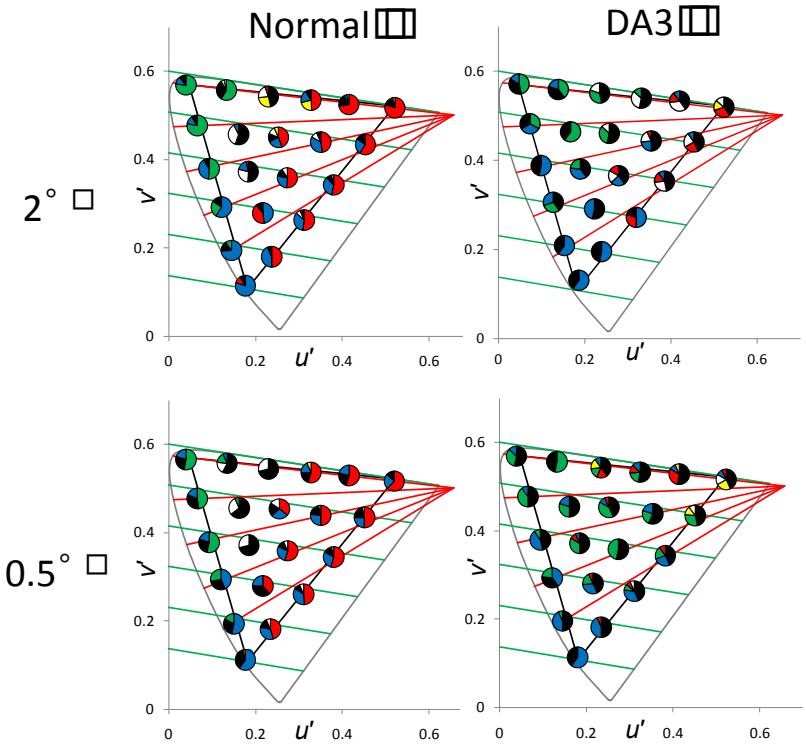

Figure 4. Results of color naming for 2-degree and 0.5-degree stimuli on the u'v' chromaticity diagram. Luminance of stimuli is 0.1 cd/m^2.

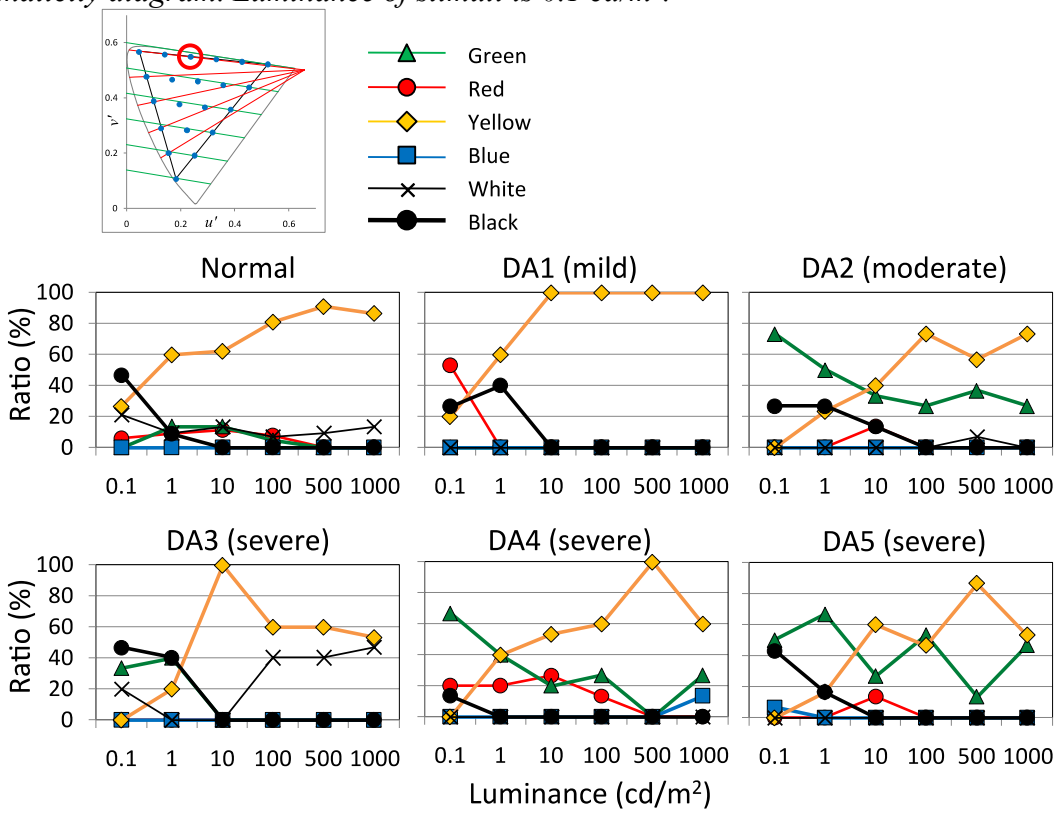

Figure 5. Change in the ratio of each color response for a stimulus (shown by a sred circle on the u'v' chromaticity diagram on the top) among wide range of luminance level.

In contrast, the change in Green response of color normal observers among different luminance levels is small. This suggests that the Bezold-Brücke effect is stronger for deuteranomalous observers. The strong influence of luminance on the color appearance of people with color deficiency was also consistent with previous research (Paramei et al. 1998; Montag 1994).

4. Conclusion

Our results show that the color naming of deuteranomals changes dramatically depending on luminance level and the luminance dependency is stronger for smaller stimulus, whereas those of color normal observers changes a little. The manner of color shift suggests that the Bezold-Brücke effect is stronger for deuteranomals. It is important to select the size and luminance level in color light carefully to make it recognizable to people with color vision deficiency.

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Optical Designof Sunglass Lensesfor Archery Competitions Using CIECAM02

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Abstract

For the sunglass used by archers in competitions, lenses that allow for easy identification of the color yellow, in the center of the target, as well as sufficient color discriminationare required. In this study, we examined how the individual colorfulness of the yellow, red and cyan which form the target in archery competitions, change through the spectral transmittance distribution of sunglass lenses using the CIECAM02 color appearance model. The results showed that when we blocked the wavelength component in the vicinity of 505nm, it was possible to simultaneously have a colorfulness enhancement effect for the color yellow and improved color discrimination.

1. Introduction

In archery competitions, a target painted with concentric rings, colored from the center outwards in yellow, red, cyan, black, and white is used, as shown in Figure1, with the highest score being attained when the arrow hits the yellow area in the center. Therefore, a vivid appearance of the yellow-colored region is required, even when players wearantiglare sunglasses. Up until now, together with proposing a color discrimination evaluation index for sunglass lenses, we have revealed the spectral transmittance characteristics of lenses which have superior color discrimination properties (Katayama 2013). Lenses with excellent color discrimination have the effect of enhancing the color contrast between red and green; thus extremely brilliant color appearance can be obtained. However, when used in competition, there is a tendency for the yellow region in the center of the target, which is

Figure1.Target used in archery competitions

surrounded by red, to be less prominent, an aspect that archers have pointed this out as having room for improvement. Therefore, in this study, we have attempted to develop sunglass lenses which have superior color discrimination and allow for the vivid appearance of the yellow color, suitable and desirable for use in competitions.

2. Color discrimination evaluation index based on color gamut area ratio

With the gamut area (Thornton 1972), *A*r, which was formed by the three colors, yellow, red and cyan of the archery target on the CIECAM02 colorfulness plane (CIE 2004) under standard illuminant D65, and the gamut area, *A*t, which was formed by the same colors on the plane under standard illuminant D65 after passing through the lens being tested, the ratio, *G*a, of those areas was obtained as the index for color discrimination evaluation of the lens, as shown in Equation (1),

$$Ga = \frac{At}{Ar} \times 100 = \frac{\sum_{i=1}^{3}\left(a_{\mathrm{Mt},i-1}b_{\mathrm{Mt},i} - b_{\mathrm{Mt},i-1}a_{\mathrm{Mt},i}\right)}{\sum_{i=1}^{3}\left(a_{\mathrm{Mr},i-1}b_{\mathrm{Mr},i} - b_{\mathrm{Mr},i-1}a_{\mathrm{Mr},i}\right)} \times 100 \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (1)$$

Where, $a_{\mathrm{Mr,i}}$ and$b_{\mathrm{Mr,i}}$ are the coordinates of the three colors of the target on the CIECAM02 colorfulness plane under standard illuminant D65, and $a_{\mathrm{Mt,i}}$and $b_{\mathrm{Mt,i}}$ are the coordinates of the same colors under standard illuminant D65 after passing through the lens being tested. When the subscript "*i*" is 1, it is treated cyclically as "*i*-1=3". The adaptation luminance for thecolorfulness calculation was set to 318cd / m², regardless of the presence or absence of the lenses.

Figure 2 shows an example of the spectral transmittance distribution of a sunglass lens where the color contrast between red and green has been enhanced to improve the color discrimination. Figure 3 shows the changes in the color gamut area after the lenses have been fitted. Due to the fact that *G*a becomes 108, an improvement in color discrimination, compared to the naked eye, is predicted.

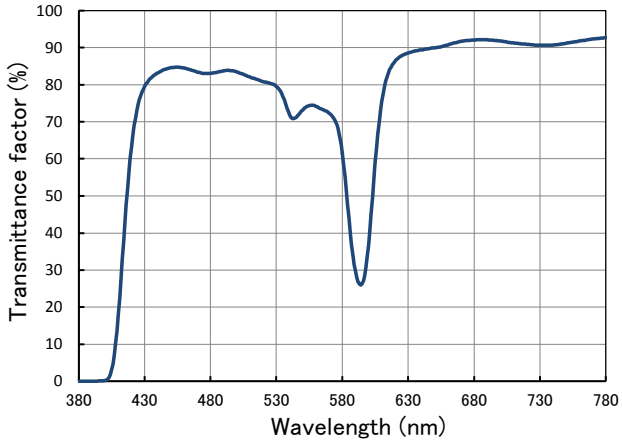

Figure 2. Spectral transmittance distribution of a sunglass lens where the color contrast between red and green has been enhanced to improve the color discrimination

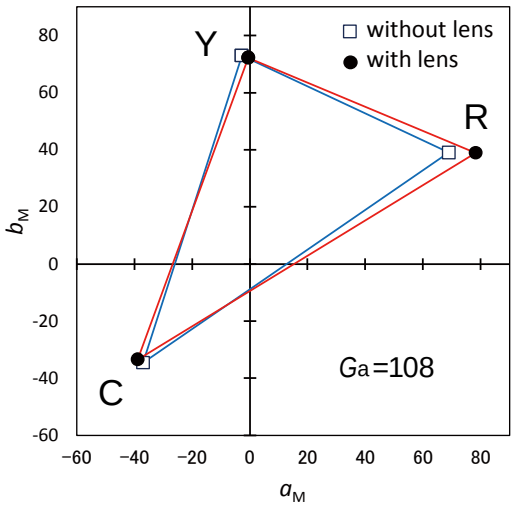

Figure 3.Changes in the color gamut area after the lenses have been fitted

3. Calculating method for the colorfulness enhancement effect of yellow against red

Focusing on the yellow and red portions of the target, the colorfulness for yellow (*M*r-Y) and for red (*M*r-R) under standard illuminant D65 were calculated; then, the colorfulness for yellow (*M*t-Y) and for red (*M*t-R) under standard illuminant D65after passing through the sunglass lens were calculated. And the ratios of the colorfulness, with and without the lens, *M*t-Y/*M*r-Y and *M*t-R/*M*r-R, were calculated. Next, their ratio, (*M*t-Y/*M*r-Y)/(*M*t-R/*M*r-R), was calculated and set as ε*M*-Y/ε*M*-R. When ε*M*-Y/ε*M*-R is 1, the colorfulness enhancement effect for yellow due to the sunglasses lens is equivalent to the colorfulness enhancement effect for red. The smaller ε*M*-Y/ε*M*-R becomes, the smaller the colorfulness enhancement effect for yellow becomes, compared to the colorfulness enhancement effect for red.

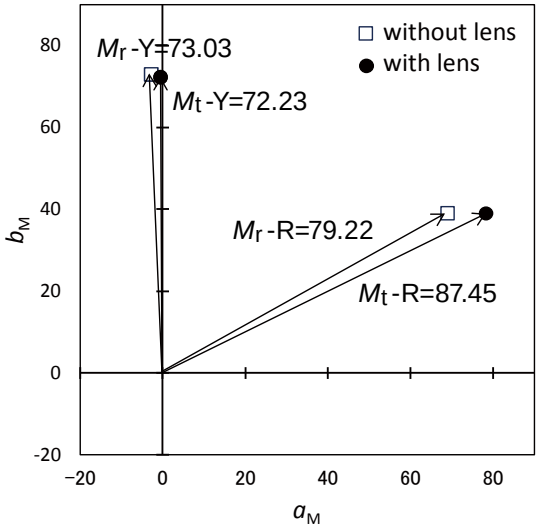

Figure 4. Change in the individual colorfulness of the red and yellow of the target, with and without the lens shown in Figure 2

Figure 4 shows the change in the individual colorfulness of the red and yellow of the target, with and without the lens shown in Figure 2. Figure 4 shows that only the colorfulness of the red of the target has increased, while the colorfulness of the yellow has decreased slightly. The ε*M*-Y/ε*M*-Rof this lens is 0.90, and when used in competition, it is predicted that the central yellow region, surrounded by red, will not relatively stand out.

4. Relationship between color discrimination and colorfulness enhancement effect of yellow

Instead of the lens being tested, we assumed a notch filter with a FWHM of 10nm and calculated *G*a and ε*M*-Y/ε*M*-R for the standard illuminant D65 which passed through it. Figure 5 shows the results in which the center wavelength of the notch filter was made to change from 380nm to 780nm. The abscissa in Figure 5 is the center wavelength of the notch filter. There was generally a trade-off between *G*a and ε*M*-Y/ε*M*-R; however, it was found that if the wavelength component in the vicinity of 505nm was blocked, it was possible to have both improved color discrimination and emphasized colorfulness of yellow at the same time.

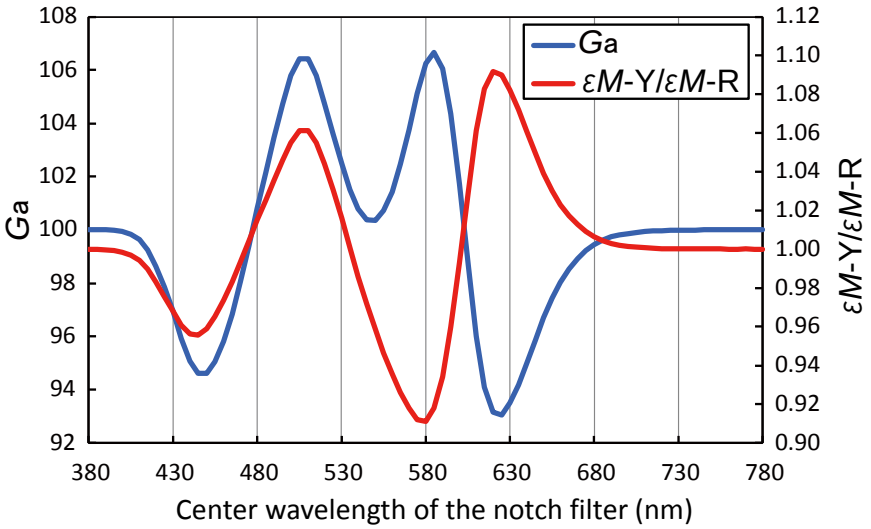

Figure 5.Relationship between color discrimination and colorfulness enhancement effect of yellow

5. Visual evaluation experiment using a prototype lens

We developed an experimental lens in which the characteristic of blocking the wavelength component in the vicinity of 505nm was added for the lens shown in Figure 2. In Figure 6, (I) shows the spectral transmittance distribution of the lens shown in Figure 2, and (II) shows the spectral transmittance distribution of the lens which was newly developed for the trial. Table 1 shows the values of *Y*, *G*a and ε*M*-Y/ε*M*-R for each lens.

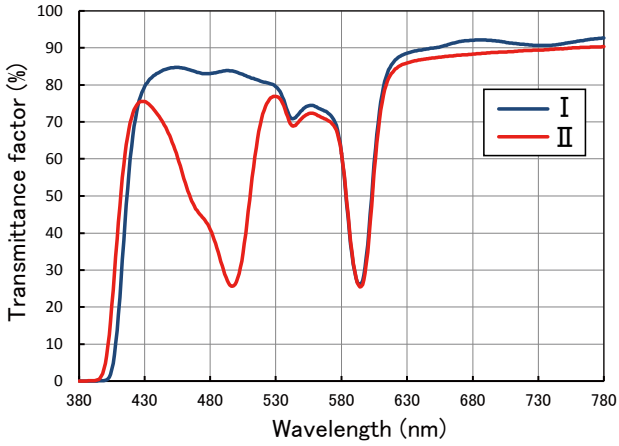

Figure 6.Spectral transmittance distribution of the lens used in the visual evaluation experiment

We presented evaluation target stimuli of the four adjacent chromatic colors which make up the archery target to 14 observers with normal color vision under D65 fluorescent lamp lighting. The illuminanceon the surface of the stimuli was 1300lx. We prepared test Glasses A, in which lens (I) was mounted on the side of the left eye, and lens (II) was mounted on the side of the right eye, and Glasses B, in which lens (II) was mounted on the side of the left eye, and lens (I) was mounted on the side of the right eye, and we had each observer wear said glasses in a random order. After one minute for chromatic adaptation, we had them select the lens which enabled them to see the yellow more vividly with the assistance of an occluder. The observers were not informed that Glasses A and Glasses B consisted of the same lenses

only with the positions of right and left lenses having been switched. As a result, 10 out of 14 observers gave consistent answers. Seven out of those 10 observers responded that they could see the yellow more vividly through lens (II).

Table 1. Values of Y, Ga and εM-Y/εM-R for each lens

	Y	*Ga*	*εM*-Y/*εM*-R
Ⅰ	71.4	108	0.90
Ⅱ	63.3	115	0.96

6. Summary

It was shown that to simultaneously achieve the improvement of color discrimination and an enhancement of colorfulness for the color yellow required for archery competition sunglass lenses, a spectral transmittance distribution which blocks wavelength components in the vicinity of 505nm is effective. In the near future, we will conduct field testing with a sample group of archers.

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TOWN PLANNING

Please, No More White At Workplace Environments

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Abstract

The colour design in workplace environments involves a multidisciplinary knowledge; however, the principle that supports its conception is repeatedly grounded on aesthetical considerations and colour preferences rather than physical and emotional effects.
Institutions' management is more concerned with the image of the organisation than with the ergonomics considerations, comfort and wellbeing. When the decision has to be made between cost control and a humanised workplace, the economics won and the user/employee, the most valuable asset of an organisation, is mistreated.
In nowadays, co-design and user centred design are significant principles to achieve more interested interior environments for human being and consequently to an efficient professional performance, thus more studies are required to understand and validate how colour influences the mood, wellbeing and motivation of employees. Colour should be used to relieve the so-called eyestrain as well as a parameter to encourage a positive emotional and physiological human effect. The image of the organisation is very often associated with a high-tech one, and normally this is a synonymous of the use of the white, black and grey shades performing a monochromatic environment. However, the reflectance of those surfaces will result in a highly contrast ratio. Therecommended reflectance for surfaces should be 3 to 1, so the colours of the furniture, walls, ceiling and floor should not be (just) white or black.
A careful control of light and colour will contribute for a comfortable interior environment, especially a workplace where the individual live for at least 8 hours per day. Human beings need sensorial diversity and colour is the first parameter perceived in any space that humans interact with.
Coworking spaces are emerging as a new model of workplaces. Coworking environments, due to their nature, require a deep understanding as they shelter people from different professional, cultural and social backgrounds with different gender and age issues. An architectural space should be a result of the understanding of different aspects and the colour is an important one and repeatedly forgotten.
This paper aims to study the "do´s and don'ts" of a colour design in a workplace layout in a way that can be useful to a future humanised planning of coworking environments. To achieve such goals the research will be conducted throughout literature review from elected keywords and the analysis of two case studies: Lx CoWorking and Ávila CoWorking, in Lisbon, Portugal.

Keywords: Color, Workplace, Ergonomics, Wellbeing, Visual Comfort, Emotional Design

Introduction

The purpose of this paper is to contribute to complementarity between light and colour in the workplace. To achieve such goal requires the understanding of the impact of colour in comfort, particularly the visual, and also to understand the wellbeing of the individual.

Companies are more interested and concerned about the corporate image, i. e. aesthetics, than with the impact of light and colour on the workers. The image seemed more important that the collateral damage of a bad planned workplace, and the real cost is the increased absenteeism, and the lower productivity.

The constant devaluation of colour and the ineffective use of it have an impact on human life in many ways, including physical, psychological and biological, and this happens because the human being spends much of his/her life indoors which makes the colour design a crucial focus for promoting the comfort and health.

Colours have an enormous impact on workers and we can not continue to ignore how it affect them, because in the end it affect all human beings, which are all of us. And for achieving this we must understand better how colour affects our body and mind, and thus our wellbeing.

Moreover, the different tasks have different characteristics, which must be taken into account. If the functional aspects are different, so the work environment should be. In a workplace where concentration is a crucial needed, the brightness should not be very high simply because it could distract which jeopardize the capacity of maintain concentration.

Besides, all of that aspects we also have to think about the colours preferences. And this is more complex that it seems at first place, our memories affect our way of interaction with everything around us, including the indoor environment and its characteristics.

Colour Design standard solutions must be challenged by solutions driven by tasks and users. More than a space full of colour, its understanding is crucial to promote human concentration, to increase visual acuity, to create different atmospheres to respond to task demands as users' expectations.

Influential parameters of colour at orkplace Environs

Colour

> "Colour is life, for a world without colours appears to us as dead." (Itten, 2003, p. 8)

Let us start by the definition of colour. "The Latin *colorem* is related to *celare*, to hide or conceal; in Middle English 'to colour' is to embellish or adorn, to disguise, to render specious or plausible, and to misrepresent". (Batchelor 2000: 52)

But, colour is much more than that. According to Faber Birren (1950) colour does have a physical effect upon the human organism. Like, for instance, the blood pressure and pulse rate actually do increase, the flesh will become warmer and the body temperature will rise. On the other hand, dimness and coolness of colour will decrease the blood pressure, pulse, and the flesh will become relatively cooler.

Colours, however, has various influences over the Human Being. For instance, the spectrum could colour be associated with two moods, the warm, and active, as a reaction of red and its analogous hues. And in opposition, the cool, and passive colours will induce the serenity and calm, as a response to blue, violet and green, as Faber Birren (1950) stated. Besides, the spectrum colour, the wavelengths is another factor to have in attention, colours richer in long wavelengths, as red and orange, are more arousing than those of short wavelengths like blue and green. (Mahnke 1996)

But, colour not only produces mood associations and subjective and objective impressions, but also influences our estimation of volume, weight, temperature, time, and noise. An example when colour influence our perception of time, could be an audience in a blue theater and the result will be some kind of boredom and will give the impression that the lecture had lasted longer than it had. Meanwhile, in a red theater the time will seem to pass more quickly and that the lecture had been interesting. As for weight, we just have to think in darker colors and the environment will appear to us heavier, whereas lighter and less saturated (pastel) tones seem less dense. The background color could be used to make an environment seem to have more or less depth. If we want a space that look closer than it really is, we could paint the wall with a dark colour. And if we want to give the impression that the space in bigger or wider than it really is we could paint the walls with light colours, such as white. (Mahnke 1996; Itten 2003) Blue, for instance, is a calming colour and red is a stimulating colour. As David Canter (1974) stated blue makes things seem farther away and red makes them seem nearer. (Yildirim, Akalin-Baskaya and Hidayetoglu 2007; Durão and Favata 2003)

> Faber Birren stated that under the influence of red light time is likely to be overestimated. Conversely, under the influence of green or blue light, time is likely to be underestimated. So, whereas is needed to make Mental judgments or common tasks it may also be useful to have this though in mind, since the notion of time is influenced by colour. (Birren 1950:

In the functional application of colour, cool hues would thus seem best where routine and monotonous tasks are performed, such as in offices and factories. (Birren 1950, Durão and Favata 2003)

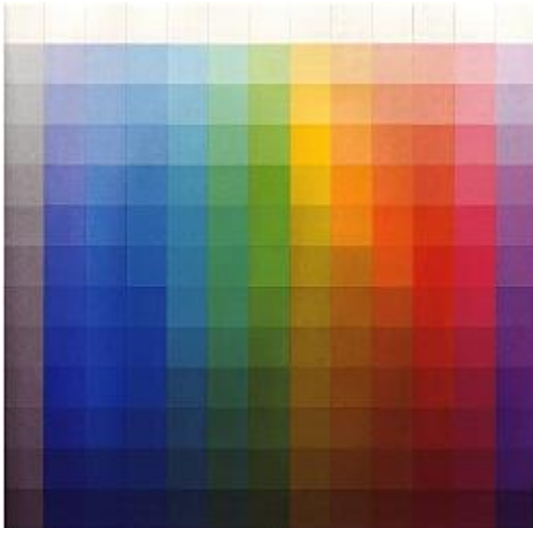


Figure 1 – Twelve steps of gray from white to black, and the twelve hues of the colour circle in matching brilliancies. (Itten 2003: 43)

> The age is other conditioning, for example when we are young (childhood) we are more influenced by visual attraction than by emotionally pleasure, and the luminous colours such as yellow, white, pink, red will be stared at longest. With ageing (adulthood) comes a greater liking for hues of shorter wavelength, such as blue and green, than for hues of longer wavelength like red, orange, for example. (Birren 1978: 65)

So, we can see that are very reactions at different colour affects human lives, psychological, physiological and emotionally. When, the choice is between dark tones and light tones, the light tones will be preferred. (Birren 1978; Jalil, Yunus and Said 2012)

The memory, experiences, and cultural background, all affect the way a colour's impact can vary from individual to individual as Edith Feisner (2006) stated. Perception, for instance, will *meant* different things to different people. In most western cultures, for example, black is associated with death, but in China and India white is regarded as a symbol of death.

Workplace

> "An architectural space should not have a color (for color´s sake), but rather its appropriate color that fits the purpose of the building or space." (Mahnke 1996: 131)

> Corporate image is a big business these days. (Manhke 1996: 136) It is a disappointment, however, that the modern office often chooses an image of a giant gray cement cubes with dark-tinted glass. This kind of impression that is given by "corporate power", must be avoided. And, even psychologists are in agreement that institutions should look anything but institutional. (Mahnke 1996: 81)

Another very popular but totally incorrect ambience is the high-tech image, whereas heavy emphasis is to be found on sterility created by grays, white and black, according with Faber Birren (1978).

However, in interior design, colour is an easiest form to change the environment. And, it can do a significant impact. (Jalil, Yunus and Said,2012)

> Besides that, there is a compelling attraction of the bright surrounding may set up annoying distractions to make the concentration of attention on tasks quite difficult. For a real ideal interior, no colors should reflect less than 25% nor more than 60% (except ceilings) that could reach 70%. (Birren 1950: 241)

As for the space, the location (top, sides, and bottom) of a color within the interior space can make a difference in influencing a space´s character, by the way it is perceived psychologically, and subsequent reactions to it. (Mahnke 1996)

> For example, a gray ceiling will seem shadowy, while a gray wall will appear as neutral to boring, and a gray floor is look neutral. Another example, when the ceiling is white, it is not necessarily a bad choice, since it will help to diffuse light sources and reduce shadows, but when the white is on the walls it will give the impression of a neutral, empty, sterile, a space without energy. As for a white floor it will give the idea that we cannot walk upon it, so it seems touch-inhibiting. (Mahnke 1996: 69)

But, colors could promote and give the worker a sense of individuality and for that the workplace could have different partition colours for example, or it could help in orientation within the space.

The sum of all elements, such as color, light, pattern, furnishings, and accessories, in an interior space communicate an impression to the viewer, which engenders a reaction that carries some type of emotional content. (Mahnke 1996)

> As for furniture, for instance, the working surfaces (desktops) should be a warm gray (30% light reflection). The color is neutral and nondistracting, and it strikes a good brightness balance between white and black, keeping the eyes at a uniform and comfortable level of adjustment. Wood desktops are also acceptable since the pattern helps to diffuse reflection. Desktops should never be too dark or too light – especially black or white tops should never be specified. The desk´s body may be darker than the top. (Mahnke 1996: 135)

The colours light blue, yellow, yellow-green, and orange also stimulated alertness and creativity; while the colours white, black, and brown seem duller. (Birren 1978)

> Colour's most important function is to provide information, both visual and psychological. However, in providing this information colour can create opposing reactions – the architect, and designer must control what the viewer perceives. This influence on the viewer´s perception allows the architects, and designers to impart their messages be they aesthetic, commercial, or political. (Feisner 2006: 120)

The appropriate colour may contribute to extent concentration, improve performance and influence positive emotion and perception of the surrounding. And, when the colour is not well chosen it can contribute to salient impact as leading to mistakes in carrying out a task, feeling somnolent and lack of concentration and all of them can affect performance. (Jalil, Yunus and Said 2012)

According to Julie Baker (1986), atmospheric attributes for interior spaces consist of three components: ambient factors (temperature, noise, and lighting), design factors (architecture, colour, materials, pattern, texture, and layout), and social factors. (Yildirim, Akalin-Baskaya and Hidayetoglu 2007)

In a study of L. D. Rosenstein (1985), was stated that when college students worked in the blue room rated themselves as calm or in good moods. But, they also rated their mood as good in the red room relative to the yellow and neutral rooms. In another study, Nancy Kwallek and Carol Lewis (1990) it was found that individuals who worked in a red environment as opposed to a white or green environment felt less confused. Yellow, for instance, has been suggested as a colour that stimulate the intellect, but art therapists have observed that who has a suicidal tendency use yellow greatly in their paintings and person with some kind of mental illness (schizophrenia). (Birren, 1978; Yildirim, Akalin-Baskaya and Hidayetoglu 2007)

So, colour is not an irrelevant factor and we have to learn how to conceptualize work environment accordingly with the tasks that are carried out. Ergonomics could also help in understanding how.

Ergonomics

> "The total disregard of visual ergonomics. White walls reflect 80% of light and black about 5%, the brightness contrast ratio is 16:1. This is outrageous." (Mahnke 1996: 137)

Vision should be held at midtones, an ideal light-to-reflection ratio being 3 to 1. This means that is very important the control of the light-reflection ratio of walls, furniture, and floors. Recommended reflectance for surface are 20% for floors, 25-40% for furniture, 40-60% for walls (which can be stretched to 70% depending on lighting conditions) and 80-90% for ceilings. (Mahnke 1996; Birren 1978)

As already stated, the direct effects of light and colour upon the eye and upon the body arise the more complex psychological reactions of the brain. And these reactions, in turn, influence seeing. So, visual ergonomics depend on the colours used and on contrast. (Birren 1978; Mahnke 1996)

To clarify this, let us exemplify, when we are under red light, our central vision is fairly clear and sharp, but peripheral vision is poor. Conversely, when we are under blue light, our central vision is blurred and the peripheral vision operates fairly well. (Birren 1950)

But, colour could influence much more our workplace, according with Mahnke (1996). When, we have to perform, difficult task, such as mental and visual, colours with high levels of light could be used to produce a centrifugal action, directing attention outward, toward to a cheerfulness and active environment. Contrariwise, softer surroundings, cooler colors, and lower levels of illumination could be used in order to produce centripetal action, and this environments encourage inward orientation and enhance the ability to concentrate.

> We must have in mind that just like any muscle subjected to excessive activity, eye muscles will tire. Glare, constant adjustment to extreme brightness differences, prolonged fixation of the eyes, and constant shifts in accommodation will tire the eyes quickly, causing headaches, tension, nausea, and other disturbances. (Mahnke 1996: 96)

Glare, could be a big problem for our visual comfort. There a reason for the furniture have a matte finish, since reflected glare could be the result from specular reflections of high luminance on polished surfaces. (Mahnke 1996)

However, we have to have in mind another aspects in order to create a humanized space, we have to perceive and to promote the comfort as well as wellbeing, in a way that stress does not compromise it. (Warr 2002)

Wellbeing

> "White is considered a safe choice (…) gray will fall into the same category. But it does really justify aesthetically and psychologically sterile environments?" (Mahnke 1996: 82)

The use of white in indoors environments began in 1955 and was very popular. The peak of this trend was in 1975 and afterwards the use of white walls diminished somewhat, especially in the mid-80s. But then it reappeared and it was no longer white solely but along with gray. (Mahnke 1996)

White can be seen as synonymous of perfection, purity, according to David Batchelor (2000), it was the colour of the modern times. And he add that white can be an aggressive colour, when it is pure white. White create an impression of emptiness, a space without vitality. A white environment seem empty even when it is full. (Batchelor 2000; Mahnke 1996)

Can you imagine a world without colour? What kind of emotions a monochromatic (black, white and shades of gray) world would produce?

"This neutral trend is still present in most office building in order to give a high-tech image" (Mahnke. 1996, p. 90). For Frank Mahnke this trend intended to display a modern technological world, which as to be unadorned, clean, impersonal, within a computer technology surrounding. However, this idea of efficiency without color defies any logical explanation. And even when a space has white and colored accessories, the contrast between the colours may necessitate some kind of adaptive measures in order to reduce the difference from light to dark, which causes of eye fatigue. (Mahnke 1996)

Another aspect to have in mind is that white, when accompanied by rich levels of natural or artificial light, may also jeopardize human vision. (Mahnke 1996)

Other incorrect belief about white is that it makes interiors brighter. In workplaces light levels tend to remain constant during the day, but in our homes this do not happen at least all day long. So, this depends on the light it reflects and not along on the whiteness of walls. (Mahnke 1996)

> Since our professional responsibility is to create environments that do not put unnecessary strain on psychological and physiological wellbeing, we must familiarize ourselves with psychosomatics. Decisions about visual design in our environment should be based on an understanding of aspects of architectural psychology - especially color psychology. (Mahnke 1996: 49)

Reactions to colour can be depressing or inspiring. When we are in a bright, and harmonious space, we will find our dispositions improved. Like Faber Birren (1978) stated warm colours may calm one person and excite another.

So, it is important to observe the brightness in space. For achieving a space that does not handicap our vision, we have to control glare and brightness levels, since them tires our eyes muscles by constantly pupil adaptations. (Mahnke 1996)

Visual Comfort

> "Color vision itself is a potent aid to visual acuity in its broad sense, and was certainly evolved for this application rather than for the aesthetic ones which it has come to have in human vision." (Birren 1978: 96)

But, before we analyze color we must acknowledge that prolonged exposure to high brightness can cause damage to our eyes, or aggravate existing eye problems. Many complaints of eyestrain often can be corrected by simply removing glare of walls and it may not be necessary to change light levels. (Mahnke 1996)

> White walls may force the pupil opening, make seeing difficult, and set up annoying distractions. "For the sake of a 5 or 10% increase in lighting efficiency, there may be a drop of 25% or more in human efficiency". (Birren 1950: 246)

According Faber Birren (1950), we have to remember that the fluids in the human eye grow yellowish with age. He also stated that the lens of the eye of a child will absorb about 10% of blue light, that of an old man, 85%.

Emotional Design

> "When does the interaction between the mind and the body commence? Felten answered "The moment we begin to perceive sensory stimulation". (Mahnke 1996: 49)

People need sensory variety, which includes colour. Monotony only induces anxiety, tension, fear, and distress. As said before, environments that are predominantly neutral are beyond any positive value and will always appear static, and dull. (Mahnke 1996)

> A relatively new research science named Psycho-Neuro-Immunology (PNI) gives additional proof that a close bond exists between the psyche and physical wellbeing. Neurobiologists, bio-chemists, and immunologists are increasingly discovering new networks of nerve fibers and molecular bridges that connect the psyche and the body. It has become evident that emotions penetrate completely into the cell of the organism. "PNI research indicates that positive emotional mood strengthens the body´s defensive system against illness, whereas a negative frame of mind has a weakening effect". (Mahnke 1996: 49)

And colour is a major factor in establishing a desired room experience, since it contributes heavily to the "emotional loading". (Mahnke 1996)

In the past personal comfort was rarely a concern. If a decision had to be made between employee comfort and cost control, the second won. (Mahnke 1996)

An example of that is that blue tends to cause retardation, and later responses may rise above normal. It is clear that physiological and psychological colour reactions, to be actively maintained, require constant change and sequence. So, change is precisely a tool that can counteract sensory deprivation. (Birren 1978)

Our emotions are influenced by our perception of colour, just recall the times that you have said "I´m feeling blue". (Feisner 2006)

So, colours can provoke negative effects. Negative effects were also detected on several colours such as blue (Knez 2001; Stone 2003), gray and beige (Dalke *et al.* 2005) able to minimize attention. Blue is also said to have a tired and somnolent effect. Therefore, colour is an important factor of information that will influence human behaviour. (Jalil, Yunus and Said 2012)

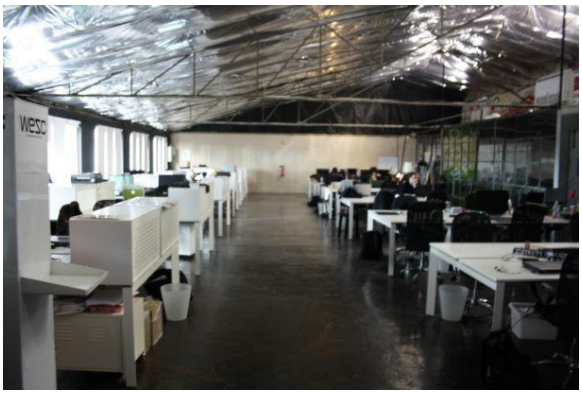
There is another element to pay attention, the gender reaction to colour. In a study by Laurette Dube and Michael Morgan (1996) was found that women's satisfaction were influenced by their initial negative emotions, whereas men's satisfaction depended on their first positive emotions. And if gender is important so is the age and other sociocultural backgrounds. (Yildirim, Akalin-Baskaya and Hidayetoglu 2007)

Case Studies

Workplace layout expose a poor design ignoring the growing collaborative work style of contemporaneous knowledge workers, and this could be one of the causes for less productivity, poor levels of work stimulus and high costs due to the ineffective use of the space.

Policies driven to flexible workplace layouts are required and expected to settle the rising mobile workforce: users demand flexible work environs with high-tech descriptions. Collaborative working environments emerge as a reaction to team and project-oriented work styles. The technological development tried in the last years encourages the promotion of nomadic professionals searching for new models of work where flexibility is the slogan. Coworking is the expected development from dissimilar ways of remote work.

Coworking is about working with others in a shared physical layout. In spite of individual professional status or the project to be dedicated to, people work with technical apparatus and share the same amenities. Interaction between individuals emerges in spite of its physical, analogical or digital nature. Coworking is also a place where the workers choose the place where they want to work, which makes the environment very important, since no one choose to work in an uncomfortable, boring and stressful place.



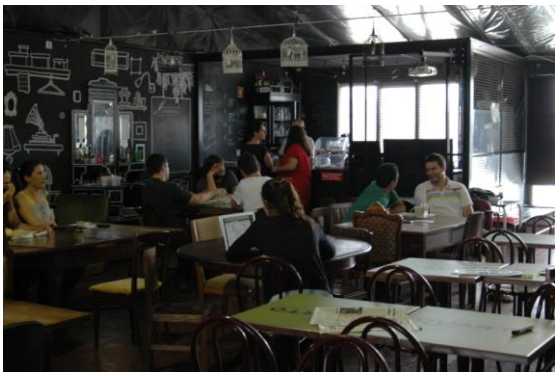
Figures 2 and 3 – Cowork Lisboa, the first coworking place in Lisbon - Contributor of Photographic material: Caramelo Gomes

To illustrate collaborative work environs, the authors studied two examples: Lx Coworking and Ávila Coworking; similar on the concept to provide a workplace to collaborative and flexible forms of work they diverge on the type of individuals and corporate entities to attract.

Lx Coworking was the first working place conceived with the spirit of creating a community of persons that by chance work in the same physical space. This work environment was conceived and is managed by Fernando Mendes, a professional designer with strong commitment with humanitarian/communitarian activities such as Banco Alimentar[1] and Cais[2]. The working facility is located within Lisbon city in an old industrial building block in an ancient industrial neighbourhood (see figure 2). Lx Cowork or Cowork Lisboa started in 2010 and a considerable percentage of the coworkers are there from launch. The spatial layout, based on open space, is structured in informal areas, designated or hot desks, meeting rooms and cubicles oriented to small enterprises (see figure 3). Being part of this community does not oblige to a minimum contract period. Workplace although its designated or hot character, allows its use from 9AM to 9PM; the cubicles allow the 24/7 access and/or use. Since the beginning workplace occupancy ranges from 60 to 70%, with individuals from 18 to 66 years old.

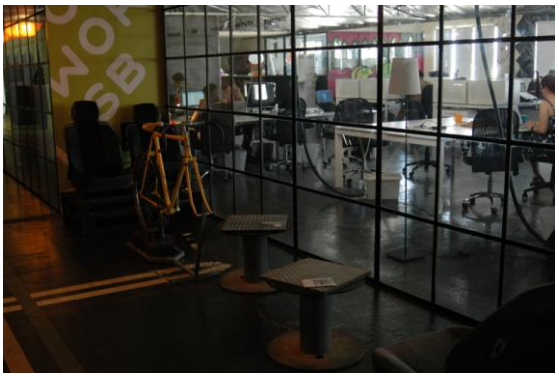
[1] Banco Alimentar – Food Banks are Private Institutions of Social Solidarity.

[2] Cais – Homeless magazine.

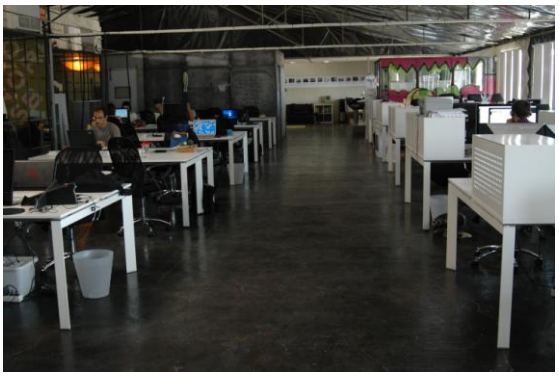
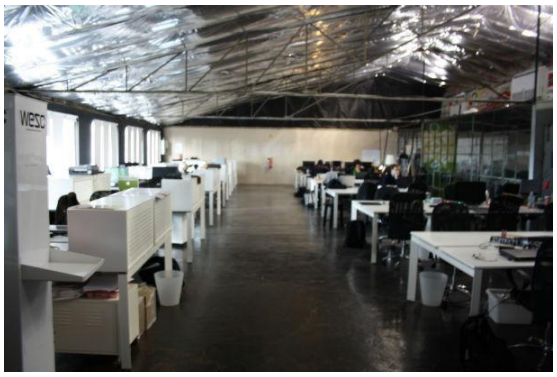
Figures 4 and 5 – Cowork Lisbon lounge - Contributor of Photographic material: Caramelo Gomes and Fernando Mendes

Informal areas are available to chat and/or work (see figures 4 and 5), and they function as relaxed atmospheres inviting to concentration. The spatial atmosphere is pleasant; generous windows permit a delightful and stimulating standpoint to the river Tagus and to the city, granting natural light and interaction with the exterior.

Figures 6 and 7 – Cowork Lisbon interior hallways inviting to relax and chat instants - Contributor of Photographic material: Caramelo Gomes and Fernando Mendes

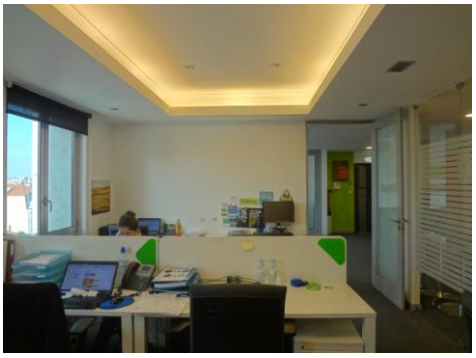
The use of colour in the interior space is crucial to define the ambience of a place. Although the colours are mainly black and white, there are also places where are walls where we can find orange (in the light on the corridors, see figure 6), green (see figure 7) at the corridors and pink (see figure 7) in the interior of the workplace itself.

Figures 8 and 9 – Cowork Lisbon interior space, fixed and hot desks. - Contributor of Photographic material: Caramelo Gomes and Fernando Mendes

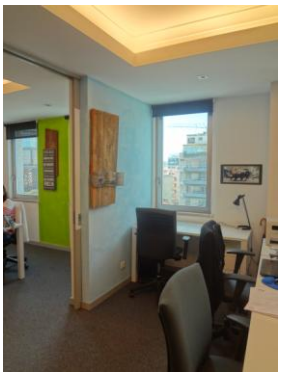
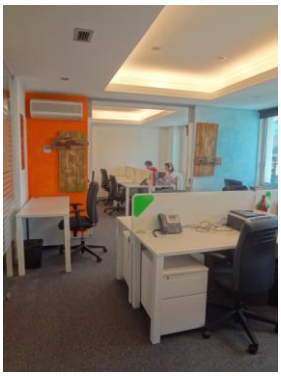
The corporate image is intentionally an avant-garde and minimalist one as is the image and spirit experienced at this neighbourhood. The ambience is grounded on an achromatic composition performed by floor, chairs and desks, which are black and white. Certainly natural light, natural ventilation and particularly the gorgeous outlook over the river Tagus are causes that influence significantly the individual decision.

The second example to illustrate a cowork environment is Avila Coworking, located on a central area of the tertiary tissue of Lisbon, oriented to professionals and companies that search for a high standard workplace in Lisbon city centre offering workplaces and secretariat, meeting and work rooms. The furniture is Steelcase (chairs and tables), a brand that ensures the ergonomic requirements of function and users; working areas are complemented by a cokitchen for the provision of quick meals, a locker and a lounge area to socialise, informal meetings and coffee breaks (see figure 11). The accessibility by public and private transportation is enabled by the several types of public transportation that stops nearby and public car parking including a private one inside the building. Avila Coworking also offers a complete virtual office service.



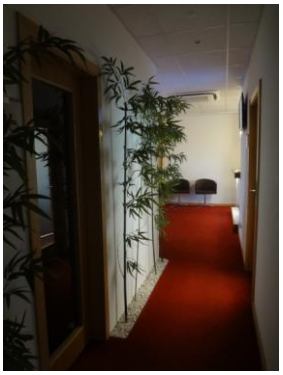

Figures 10, and 11 – Ávila Cowork - coworking areas, and lounge - Contributor of Photographic material: Caramelo Gomes and Preto

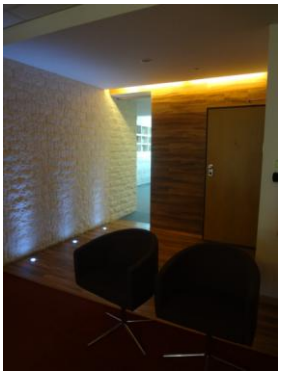
Working areas are peaceful and comfortable. Interior layout is divided into functional areas and not have an openspace layout. The geographical orientation of the building is West (main façade) and East (posterior façade) defining the entering points of natural light. Walls, ceiling and furniture are white to improve the reflected light. The generous windows encourage the contact with exterior; both geographic orientations (of the façades where the windows are located) reveal busy arteries of the city. Hallways and social areas have walls in other colours, such as green, orange and in a third room has pictures with more colours in order to make a cheerful and colourful space (see figures 12, 13, 14).


Figures 12, 13 and 14 – Ávila Cowork - coworking areas - Contributor of Photographic material: Caramelo Gomes and Preto

The walls show diverse types of materials, from smooth wood to textured stone appealing to our senses (see figure 17). The floor surface is coated carpet which muffles the sound of individual movements and its colour is a dark red. Some walls have touches of bold colours to coloured the ambience, to identify places and to give some dynamism to interior layout. The desks are white with matt finishing minimising the possibilities of glare created by the luminance of the spatial area. Informal areas have different types of chairs and tables encouraging different postures and behaviours. The colours of the furniture remain on black chairs and white desks.



Figures 15, 16 and 17 – Ávila Cowork, corridor, and main entrance - Contributor of Photographic material: Caramelo Gomes and Preto

Even though these two spaces of coworking are oriented towards different targets, both of them show the success of this type of facilities for flexible forms of work and both convey a corporate image to the choice of their clients. In spite of an avant-garde and minimalist or a luxury ambience these are working environs chosen by users. In a contemporaneous society where sustainability is the motto, the employment tissue changes, the professional performance of professionals is challenged and technology improves too quickly, coworking environments emerge as a solution to adapt and improve towards comfortable and pleasant working ambiences.

Results

We can see, in both workplaces, that the colours of walls, light, furniture are alike. The colours of the chairs are always black, the tables are always white, there are some walls or part of them coloured, and the colours chosen are basically the same, green and orange. Although in Ávila Cowork we have more colours at different places.

In Lx Cowork the colours are mostly black or dark grey. And the result, since the furniture and walls are white, is that the contrast ratio is 16:1, instead of 3:1, which leads to distractions, eye strain, and will appear boring, sterile and the space seem lifeless.

The simple fact that the orientation of the building is east-west and the workplace area is near the west façade will affect the light, and thus the perception of the colours. In the afternoon, the sun begins to descend and the light temperature becomes warmer (reddish) and the saturation glare could be so bright that the reaction to it is protect our eyes from it.

In Ávila Cowork, there is a visible concern with colour in the workplace, but this happen because the corporate is more worried about with the customer target. The colours in the workplace and amenities are more diverse and the bet is in bright and active colours, such as orange. The result is a better one than in the LX Cowork, since the contrast ratio is more balanced.

The orientation of the Ávila Cowork is the same that in LX Cowork. However, while Lx Cowork is located in an area there are not buildings around it and the sun is not blocked, Ávila Cowork is situated in a main avenue in Lisbon. And because of that, the buildings in the other side of the avenue blocks the sun rays.

There seems to be some rules that always work out, so the architects, designers and engineers always select them. The tasks, the emotional impact, the people´s preferences, the visual comfort are aspects that are repeatedly forgotten or ignored.

The use of other colours, instead of the use of black and white, is a proof that the architects, designers and engineers are more conscious of the need and the importance of it. But, they can not keep on copy paste, as if the space, the people and the task are always the same and use the same criteria.

Both workplaces are oriented to west, and the colour temperature of the afternoon tends to be warmer (reddish). So it is a fact that it should have some impact in the environment.

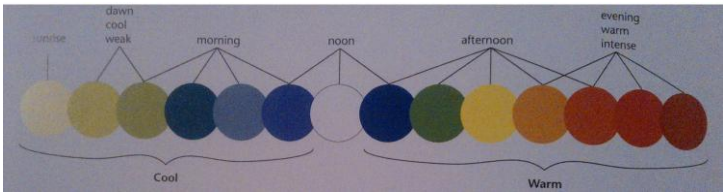


Figure 18 – Light rays related to the time of day. Cooler green-blue colours predominate in the morning, but warmer orange-red colours feature in the late afternoon and early evenings. (Feisner, 2006, p. 110)

Conclusions

Light, colour and the way we use them are vital for the management of our entire body, since it has impact on our wellbeing in many different ways. An important one is that bright light and bright colours induce our master glands (pineal and pituitary) to produce cortisol, a stress hormone. At the same time it stops the production of melatonin. So, in order to maintain our balance we need spaces that respect this and promote a healthy workplace with a sensory variety.

White, gray and black are not the best choice to use in indoor environs and they are not the safe choice either. It seems that they are not neutral at all.

We must not forget that everything around us has an impact, positive or negative. Architects and designers have to take this into account and promote a positive use of colour, and for that they must understand how the colour affect our wellbeing in order to promote it. But also have in mind what colours to use in workplaces, since the performed tasks could require concentration or the opposite.

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The Chromatic Project as a Proposal to Reappraise the Urban Image, Co-management Experience Between the Municipal Government and the University

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ABSTRACT

The contemporary city is expressed in the building of complex scenarios, and thus inhabitants find it more and more difficult to represent, understand or signify it. In this context, color, textures, cesias and other components of urban language become essential in the structuring of the physical environment and in the construction of memorable spaces.

The traditional perception and familiarity with the public space is replaced by new experiences that bring about new ways of communication and experimentation. It is therefore necessary to recover a coherence principle which allows the construction of a contemporary urban reality and its all-embracing image. (Améndola, 2000).

The public management of towns sets as an objective the search for specific urban instruments with the aim of reinforcing local identity.

Within the Institute of Color of the Faculty of Architecture, Town Planning and Design of the National University of Córdoba a proposal is shaped up to reappraise the image of the public space in the micro-area "Center West" in the city of Villa Carlos Paz. The municipal management, with the participation of the university and neighbors, works towards the reappraisal of the image expression of this area, mainly by means of chromatic design of facades and other language components to foster in residents experiences of belonging, remembrances and construction of the sense of urban living.

Concerning this and taking into account the landscape and the architectural, urban, touristic and commercial values that distinguish the hilly village, the chromatic project sets out a palette of colors with a clear aim to contributing to the reinforcement of the area's identity.

In this way, the urban color plays the role of a leading instrument that structures and defines the environment allowing the residents to signify if and in time make it their own.

Strategic action to reappraise the "Center-West Area" Urban Image, Villa Carlos Paz

The city of Villa Carlos Paz is located 36 km west of the city of Córdoba with an estimated population of 57,000 inhabitants. Founded in 1913, the village has experienced a sustained growth since the construction of the Chair Lift in 1955 and the Cuckoo Clock in 1958 being at present one of the main touristic resorts of the country. Therefore, its logic of growth brings about important problems in the city functioning as an urban system. For example, the great variety of uses, the real estate speculation and their negative influence on the global image of the city top off a complex landscape panorama (figure 1).

Figure 1. The urban and natural landscape of Villa Carlos Paz.

The local government, aware of this situation, realizes the need for specific action instruments to avoid the alteration or disappearance of natural, architectural or urban landscapes in the city. The government together with CPUA (Environmental Urban Planning Council) develops proposals to protect paradigmatic areas so as to promote sustainable tourism.

The reappraisal of the image of the "Center-West" micro-area of the village has been an unresolved matter for many local governments. The area goes from the Cuckoo clock along the imaginary line drawn by Sarmiento Boulevard and 9 de Julio Boulevard to Puente Viejo, which constitutes the entrance to the central area.

The area is defined by a diversity of commercial activities which take place in architectural typologies of significant value that existed before and were not originally designed as commercial architecture. This commercial characteristic is strongly supported by advertising signs with different shapes, brackets, typographies and colors that do not follow any legislation and turn the buildings into de-materialized facades with no distinctive identity. On top of this, the components of urban furniture are not systematized causing a clear disorder in the visual morphological expression of the city.

As a result, residents and tourists find it difficult to interpret or understand the area being unable to recognize the origins of the hilly village in its image (figures 2 and 3).

Figure 2. The urban image of "Center-West".

The Community Center The Cuckoo, on behalf of the shopkeepers of the area, collected opinions on the general condition of the area by spotting problems, prioritizing needs and identifying the trends as regards the urban profile of the area. This information, which was presented to the Municipality, contributed to assess the feasibility of the reappraisal, which clearly shows the concern of neighbors to actively participate in the improvement of the area.

Figure 3. The urban image of "Center-West".

The Physical-Urban Planning Secretariat of Villa Carlos Paz Municipality, the CPUA, the university and neighbors carry out a collaborative work studying legislation tools to recover and reappraise the original urban image to assimilate it in the construction of the city.

Within the global frame of legislation of public spaces in the city, the intervention in the area sets as goals:

- solving infrastructure problems such as rain drains, aerial cabling, etc
- widening sidewalks for better circulation of residents
- standardizing and adapting urban furniture, advertising elements and street trees
- incorporating and/or altering those components of urban language that contribute to the construction of the urban image focusing on the chromatic design of facades.

Besides, it was agreed to respect the present hallmark of the area, defined by the recreational, commercial and touristic activities of a promenade, recovering the street as a typological and structuring element which allows the gradual recognition of the area with its own clear, memorable identity of the city.

The urban chromatic project

As part of the celebration of the 100th Anniversary of the founding of the city, the local government decided to reappraise the public spaces in the area under discussion as a quick *strategic action.* The Institute of Color of the Faculty of Architecture, Town Planning and Design of the National University of Córdoba is requested to collaborate as a technical consulting group and thus it proposes the *Project of Chromatic Design of Facades in the area.*

Therefore, the Institute of Color of the Faculty of Architecture, Town Planning and Design of the National University of Córdoba and the municipal government sign an agreement of Specific Technical Assistance and Counseling which states the actions to be carried out by both parties.

The vast experience of the Institute of Color in the chromatic design of different urban spaces in the Province of Córdoba confirms that color is a very valuable tool in the structuring and definition of the urban image. This is supported by the fact that color is present in every use, in the appropriation and significance systems, in the construction of the urban environment and its identity (Avila, 1996).

Color and other elements of urban language participate actively in the process of social construction of space. The resulting urban image does not belong to the city; it is the property of the inhabitants, since it is created in the way it is represented in their minds. The city makes sense when it satisfies the wishes of the residents (Pérgolis, 2005).

The chromatic intervention was proposed taking into account the design of a color chart flexible enough to last in time and to be modified according to the changes the area might undergo.

The work team considered that the process in the project was of great relevance and held meetings with the different participants, including neighbors, so the information collected was an invaluable contribution to the chromatic proposal.

Work methodology

- *Collecting key information about the urban image and the environmental color.*

Considering the collected information, it is impossible to define a color or spectrum of colors that identify the area. On the other hand, the participants repeatedly associated the image of the city with the hills and the distinguishing original architecture of the village.

- *Studying and drawing up the chromatic chart*

It was agreed that the chromatic chart should be defined according to the following general principles:
- achieving unity and identity in the area
- being open-ended and flexible according to the distinctive and diverse requirements of commercial, touristic and residential uses in the area
- being proposed for inclusion in legislation

Several chromatic charts complying with the general requirements above mentioned are presented to the participants for discussion and after an agreement is reached, the specific chromatic design of facades are developed.

The elements considered for the proposal of the chromatic palette were:

- *The natural hilly landscape*, with prevailing earth colors (oranges and reddish browns) and greens in different ranges (from greenish ochres to bluish greens)

- *The distinctive architecture of the hilly village* since its founding at the beginning of the 20th Century until the late 70s (chalets, hotels, sailing clubs, etc) characterized by the use of traditional materials such as stones, flagstone, tiles, wood and brick among others (figure 4).

- *The present urban landscape of the area*, mainly commercial, with a predominance of saturated colors, especially in advertising signs (figure 5).

Figure 4. The natural hilly landscape and the distinctive architecture of the hilly village.

Figure 5. The present urban landscape of the area

Afterwards, the chromas of a polychromatic color chart are defined and it comprises two groups of harmonious colors. The first one includes the reddish-dun hues, with prevailing ochres of medium values and saturation and warm temperature. These are used in facades background wall and for details. The second group is made up of bluish greens, of medium saturation, low values and cold temperatures. These are used in carpentry work, closures, iron bars and other elements of facades (figure 6).

Figura 6. First polychromatic color chart

As the area is mainly commercial and touristic, the *advertising artwork* is also designed for each typology. Rules and systematization are stated to be included in legislation as regards size and position on facades. Likewise, the proposal includes the position, size and chromas possibilities of awnings as an optional item for shopkeepers.

- *Chromatic design of front facades*

A specific design of facades is drawn for each block of the area (figures 7 and 8) and an individual file is kept for each typology (figure 9)

According to the proposed chromatic palette, colors are applied using surface and saturation contrast in each typology, considering the concept figure-background. The purpose is to achieve better visual comfort

Figure 7. Chromatic design of facades

Figure 8. Chromatic design of facades and the advertising artwork

Figure 9. Chromatic design of facades – Individual typology

- *On site work follow-up*
- *Action verification and re-formulation and/or adjustment of chromatic design*

At present, the project is in its first phase of execution. Infrastructure works and sidewalk widening are being carried out. The chromatic project is to be executed in the second phase of the project (figures 10 and 11).

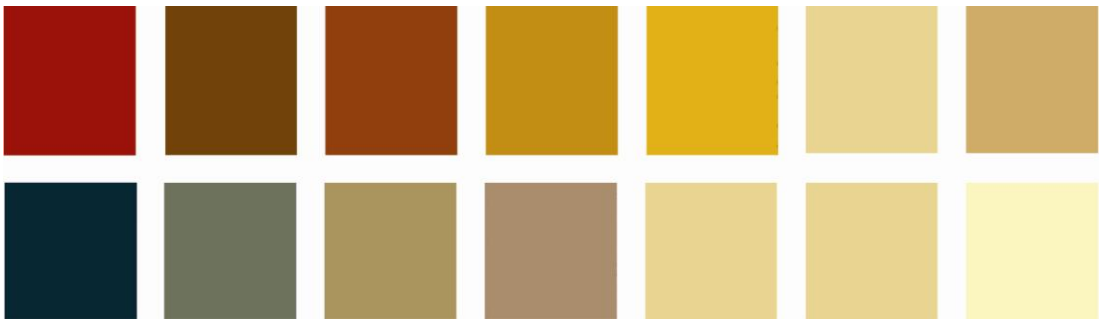

Figure 10. Final polychromatic color chart

Figure 11. Project of urban chromatic design - before and after

Within the frame of general strategic action for the area, it is important to point out that each front facade will have to comply with the current municipal legislation and solve individual problems. The project is quite feasible since both the chromatic design of facades and the advertising artwork and awnings were agreed on by the shopkeepers.

As an additional action, the Institute of Color contacted paint-selling businesses in the area and asked them to support and contribute to this project of urban reappraisal. The Municipal Government signs agreements with Alba and Quimex, which in exchange for urban advertising donate paint and materials for the chromatic intervention.

Final Considerations

The promotion of this kind of innovative actions for the hilly village will get environmentally sustainable feedback and fair opportunities for society by harmonizing the different criteria to satisfy the interests of all the participants.

The low cost of execution to reappraise urban micro-areas by means of color both in architectural typologies of interest and in partial or global urban syntax encouraged the Municipal Government to foster the intervention.

To summarize, the chromatic Project reinforces the construction of the image of the area and the city. The vital influence of color in the urban scene allows residents to use and appropriate the public space. In this way, experience will consolidate the sense of belonging of inhabitants, reinforcing their identity and contributing to a memorable city.

> The color of each city depends, to a large extent, on its natural determinants and its history. The natural determinants are decisive for the choice of materials or the predominance of one material over others; history decides by leaving traces of periods of time with special vitality or peculiar dynamisms: times, therefore, responsible for many of the final aspects that make up the urban physiognomy. (Düttmann 1982:111)

The reappraisal of the "Center-West" area, in a context of a weak urban image, will contribute to a spatial configuration that identifies the place promoting unity and identity and putting emphasis on the commercial-touristic character of the area. Besides, it will stimulate the necessary synergy to reconsider the management and planning of the city.

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Image of the City: Colours, Cultures, Architectures

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Abstract

The city with its colour harmonies, rhythm and perspective is a self-portrait of our society. In the process of social development and perfecting of urban art a variety of different types of colour harmonies and architectural styles was created. The introduction of colour combinations in correspondence with different styles of urban art creates a visual composition of the city which is a synthesis of the superposition of its historical layers. The city's image (colours, cultures, architectures) is enriched by the perception of all visual elements of our built environment (architecture, urban and landscape design, infrastructure). It is vital for urban space understanding and improvement of city's environment quality to have the knowledge about both national and local tradition, historical and modern colour preferences and cultural particularity.

Our work study a historic panorama of colour in the city of Saint-Petersburg during the XVIII-XXIth century, highlighting certain symbolic movements such as the Baroque, the Classicism, the Empire, the Rococo, the Art nouveau, the Russian avant-garde, the modernism or the street art. It depicts the system of colour harmonies and describes the palettes which allow us to understand their evolution. The art of colour as a separate material and colour-light reinvests the image of the city. There are many factors showing that the question of colour in the city, far from being marginal has now become critical.

Image of the city is the quality of architectural environment. The palette of styles which Saint-Petersburg offers is one of the important elements of historical and traditional town heritage, the important element of national culture, which is also one of the most important components of modern environmental town evolution.

Polychromy (poly, "many", and chroma, "color") is the appearance of a multicolored architecture, made both by the use of natural materials (stone, wood, etc.) or by layers applied to construction materials (painting, mosaic, use of semi-precious stones or precious metals, etc.)

The image of the city of Saint-Petersburg, with its many nuances and complex harmonies,

is a rich phenomenon that affects all human activities. It takes full part in the city itself and its history. Planning and Architecture, Literature and Art, all styles contribute to its diversity and uniqueness. The unique image of St. Petersburg was built by the superposition of layers of history and represents the sum of different styles that evolve in space and time: the Baroque era of Peter the Great, the High Baroque ("developed") Classicism, Empire, Early eclectic, eclectic late Modern / Belle Epoque, Constructivism, Neoclassicism Stalinist contemporary Architecture: functionalism, minimalism, brutalism, Hi Tech.

The Dopetrovskaya architecture, prior to the first Pierre seventeenth century in Russia reminds us "Russian Uzorochie" embodied mainly by the architecture of churches and bears traces of Byzantine traditions in Russia.

Founded by Peter the Great in 1703, St. Petersburg is the new maritime capital. General Plan of the city is conceived in 1716-1717 by Domenico Trezzini. The Petrine baroque ruled from 1703 to 1740. Rational German and Dutch influence is considerable, but is retained in the form of architecture. Therefore, the baroque stone building differs from French contemporary buildings and the Italian Baroque. During this period, the city was built mostly with simple architectures (rectangular) and, seen from the outside, unpretentious buildings. Fretwork, colonnades, porticoes were often applied. Sometimes, ornamental elements on the front are marked in white and contrast with the intensity of red, blue or pink facades. The facades are often enriched gables, pilasters, scrolls, roofs, emphasizing the vertical and horizontal elements. The interior spaces are often included in a suite.

Trezzini also built the Fortress of Peter and Paul Cathedral with the same name - future dynastic crypt for Russian sovereigns after Peter I - the Alexander Nevsky crypt, the seat of the Senate and the Twelve Colleges, and the palace of Peter I. All these buildings have obvious features of baroque and are characterized by the contrast between the white and blue decor, green, red and ocher franc wall surfaces.

In 1716, Peter I brought in Petersburg the French Jean-Baptiste Le Blond. He developped the new plan of the city, studied in terms of constructions the Vasilevsky island designed as part of the capital and made a few other projects.

He designed the fountains and the residence of the emperor of Peterhof, near Petersburg. It's Peter the Great, Tsar of Russia, after a trip to France, who ordered to erect a grandiose palace that exceeds in beauty the palace of Versailles. Work began in 1714 in the park of Peterhof. Peter himself supervised the construction of his palace and lived during this time in the house Montplaisir, still visible today. Red-white-black contrast dominates the decor.

The regular structure of the city plan would naturally lead to a reordering of the general polychrome. This chromatic remodeling will only be accomplished a century later into an architectural ensemble sufficiently dense to form the city. Among the works of this period we find the Kikin Palace, 1714-1720, architect Andreas Schlüter, Menshikov Palace, 1710-1711, and architect Giovanni Maria Fontana, Johann Gottfried Schadel.

To please Peter the Great who loved art and Dutch culture, Menshikov decorated his Palace inside with Delftware or "azulejos". The architects of the seventeenth and eighteenth century often apply architectural decoration using "azulejos" (the term "azulejos" derived from the Spanish word "azul" which means "blue"). It is widespread in Europe and arrived in the Russian baroque architecture following Dutch, Spanish and Portuguese influences.
Under the reign of Elizabeth Petrovna, from 1741 Petersburg flourished with luxurious palace and decorated Italian extensive gardens. The Empress is sensitive to luxury and nobility hastens to imitate her. The lords are building palaces and spacious hotels whose facades are painted in bright colors and ornaments, statues and domes alike are golden. Throughout this period, the color of the city can hardly order into a coherent system.

The most remarkable architect of that time is Francesco Bartolomeo Rastrelli (1700-1771), son of an Italian sculptor. He came in Russia when very young; he knows the architecture of Saint Petersburg as well as Italy and Germany. Rastrelli led the pursuit of Russian baroque to its summits, including making several palaces for relatives of the Empress, the Grand Peterhof Palace, and Catherine Palace in Tsarskoye Selo, the new Winter Palace and Smolny Convent.

The expression of Baroque outside buildings is reinforced by the contrast between the polychrome frescoes walls and the pace of architectural elements. This creates an urban atmosphere in which different shows and festivals were organized: tournaments, proclamations of kings, royal weddings, bonfires, executions and festivals. The splendor of this style of architecture with complex curved shapes, dynamism, is sometimes enriched with "trompe l'oeil" and "quadrature".

The Grand Palace of Peterhof of the architect Bartolomeo Rastrelli, 1702-1800, spreads on 268 meters and overlooks the Gulf of Finland. With its ocher and white facades, it is impressive when viewed from the upper and lower gardens, but in fact is rather narrow and low. It contains about thirty rooms, the most notable are the staterooms, all richly decorated with stucco, polychrome ceilings, inlaid floors and walls lined with fine gold ... The most surprising is probably the harmony of pastel colors: almond green color with yellow ocher tones through most daring, purple or red.

Yellow gold is very symbolic in the image of the city.
As in the East Chapel in the park Peterhof (architect Bartolomeo Rastrelli, 1747-1751) steeples and domes are covered with pure gold so that the Lord can see them better. The convent building Smolniy (Architect Bartolomeo Rastrelli, 1744-1764) was intended for Elisabeth Petrovna, daughter of Emperor Peter the Great. The cathedral is considered one of the masterpieces of the late Baroque.

By its splendor, this work can be compared to a palace, in addition the luxury of colors used (blue, white, gold) makes it particularly picturesque and emotionally charged.

In the early eighteenth century and succeeding Baroque, appeared a new system without decorative order within large and rich palate. This is the Rococo style. The most characteristic palette of this style included mild and dull pastel colors with dominant shades of pink, gray, olive, blue, and beige, such as the decoration of Beloselsky-Belozersky

palace that copies Stroganov (Architects Andrei Stackenschneider and David Jensen, painter Charles Amédée Philippe van Loo, 1799-1848)

Rococo of second generation (Palace of the Hermitage and Palace Gatchina) exhibits a new taste on the basis of rock, ie imitations of caves, shells, crushed rocks. Rococo motives are always reserved for the interior space and rarely appear on facades. Fairs with rococo style are characterized by visual and conceptual flamboyance. They symbolize both the social status of families with a refined taste. Art of pleasure, a symbol of enjoyment and luxury, Rococo remained popular until the late nineteenth century.

The new plan of the city and fortress of St. Petersburg, executed By CM Roth in 1776 with these great avenues and urban perspectives show us the beginning of classicism. At the end of the eighteenth century and early nineteenth century, the ideas of classicism definitely take precedence over the baroque ideology, both in isolated buildings and in sets and major urban areas. The new face of the capital is recognized especially in the coating granite quays of the Neva, Fontanka and Ekatérinenski channel, the most significant works. The streets are paved with stone and wood.

The contrast between particularly elegant buildings and roads abandoned gradually fades and the city thus provides a more uniform appearance, particularly with natural stone that can be found everywhere. Nevertheless, the Russian classicism Petersburg, mainly opts for yellow and ocher tones. Traditionally, yellow color takes the place of gold, expression of both the Supreme Spirit and power. In addition, the yellow tones of architectures fit well with dark and dense green tones of green in summer with bright snowy landscape of winter. Another advantage: the yellow clay required for the manufacture of these pigments is available in quantity throughout the territory: Admiralty of Saint-Petersburg, Architect Zakharov, 1806-1823, Alexandrino Palace near Saint-Petersburg, architect Vallin de la Mothe, 1762.

This remodeling of the architecture and urbanism of Petersburg - as many other Russian cities (Catherine the Great ratified mass plans of nearly 200 cities!) - which culminates in the late eighteenth century and early nineteenth century, accompanied by a regulation of the color in the city. In 1817, Emperor Alexander I issued a decree which requires painting buildings "in pale shades" with samples being provided on special boards. A range of pastel colors including yellow, green, blue, pink and gray becomes official this way, architects being expected to have a chromatic scale that allows them to create a stylistic unity in their constructions. The aesthetics of Russian Classicism and rationalist design accentuated preference for volumes in relation to form and not color. And the color was subordinate to the plastic joint and took a secondary place. The trend for the range of light colors, white and gray dominates: Isaac's Cathedral in St. Petersburg architect Auguste de Montferrand, 1818-1858. The Emperor Alexander I launched a competition for the construction of the Cathedral, which was won by the French architect Auguste Ricard de Montferrand, a student of Charles Percier.

The building was constructed between 1818 and 1858, with innovative engineering techniques. More than 100 kinds of shades of granite, marble, malachite and lapis lazuli were used for decoration.

Classicism, new aesthetic school, arrives from France, a country where almost all the buildings are made of stone. However, the Russian tradition is to build wooden, then apply a plaster or other mortar it is essential to paint. Dense and vivid hues that characterize the Russian culture of color - icons, costumes, objects of daily life, etc.. - then underwent Western influence and transform into soft pastel shades. These new colors will later be applied to the stone buildings of classicism, which put on their facades of a bluish color, greenish or pinkish, regardless of the natural color of the material. Over time in Petersburg rationalism asserts ever more energy in the structuring of urban areas. New Classicism: The Exchange and Rostral Columns, architect Jean-François Thomas de Thomon, 1805-1810, Notre-Dame-de-Kazan, Architect Andrey Voronikhin, 1801-1811.

Meanwhile, in St. Petersburg, the important work of architects such as Carlo Rossi Quarenghi and allow to merge separate groups of buildings into a harmonious whole, giving the city its artistic unity. In the years 1830-1840, it already has a confirmed stylistic identity. Alexander Pushkin, however, a great admirer of the city founded by Peter the Great, notes a certain monotony citing his "uniform prettiness."

The late nineteenth century saw a massive expansion of the city because of a relatively uncontrolled construction boom. Seized by business frenzy characteristic of world's major cities, St. Petersburg saw big messy brick buildings rising everywhere, which are gradually changing its scale and create a dissonance in the ambient color setting. The red brick now plays a significant role in the color palette of the city, soon to become the color that is favored and we even apply to historical monuments. For example, after 1880, the famous Winter Palace of Rastrelli was painted entirely in red brick - it is in this aspect that it will be assailed by revolutionary sailors in October 1917.

As for the eclecticism that triumphs at the same time in St. Petersburg, it manifests among others a virtually identical reproduction to existing models. Thus, the Church of the Holy Savior on the Spilled Blood (1883-1907), built on the spot where Emperor Alexander II was the victim of an attack, took the forms of the church Saint Moscow Basil the Blessed on Red Square Moscow (red, "Krasnyi" in Russian also means the color and expression of the "beautiful" or "good").

With the beginning of the twentieth century and the advent of Art Nouveau, we see a planner approach to color in the city revived and developed. The buildings are decorated with compositions and decorative panels, ceramic tiles in bright colors and facades are covered with glazed bricks. In response to the previous gray and pastel hues, new colors, such as purple, green and orange, which have brilliant bill glazed ceramics, restore some liveliness to the city: House Zinguer Company, Architect Pavel Suzor, 1902-1904, Elyseevsky store.

In Petersburg, the Art Nouveau inspired more by European influences, using more shapes than the fluid plastic color combinations and new techniques. The colors are retained and

the palette works by dark tones or pale: decor of Vitebsk Station in Saint Petersburg, architect Pavel Suzor, 1902-1904.

Architectural principles of Art Nouveau combine personal expression styles which inspired drawings and landscape forms blend with mosaic tiles in contrasting colors. These mosaics were also there to render walls impermeable. The color becomes at once protective for buildings. This period is characterized by a rich color. The modern era has greatly influenced the development of the colorful environment of the city and has produced a profusion of multicolored achievements in architecture, which was a real "explosion" in the previous two centuries. Color acquired a meaning of "composition medium of paramount importance" at that time and became an organization of urban space tool. With a program focused on completed assemblies, Art Nouveau architecture exploits certainly polychrome with happiness, but it is not big enough to make large urban alignments using pastel shades as you could do in the era of classicism. This style is indeed too attached to his voluntarily sensual plastic, which gives its construction a very assertive silhouette. It offers large areas of bright colors, preferring to create strong color accents on the scale of a large urban area. These interventions are likely to attract the attention and to shape the urban space. Color Art Nouveau announced already at that time what the "supergraphisme" modern will be: Magazin Alferova Street Sadovaya Architect: Wilhelm Schaub (Vassily Vassilyevich Russified by Schaub), 1903-1904 and Place Avstriiskaya and Kamennoostrovsky Avenue Saint Petersburg, "House" of Ulyanov, 1908-1909, Architect Serguei Guinguer "Conte House" Koltzov of 1905 to 1907, Architect: Alexander Bernardazzi.

The image of the city changed after the 1917 revolution. Strict regulations imposed by color constructivism in the 1920s and 1930s resulted in a complete "fading" of the new building in Petrograd (1914-1924) and then Leningrad (1924-1991). Constructivist projects presented in traditional shades of red, black, gray and white, give strength to the achievement of uniformly gray buildings. The economic difficulties of the 1920s sometimes make it impossible to complete renovation of the brick. Petrograd then saw a specific two-tone palette appear, made of red and gray: The Tower - monument to the Third International, Vladimir Tatlin Ievgrafovitch, 1917-1919.

The art and architecture of "Suprematism" initiated by Malevich considers the construction of buildings, airplanes, cars as a creative activity. These compositions are built from plans, beams, pins, that Malevich presents as "more alive than a drawn face." Suprematist forms want to create a new reality. They seek to express an infinite space, interdependence OF forms from each other allowing them to "float in space" as if they were not subject to the force of gravity. At the last exhibition Suprematist Malevich hangs the black square instead of the traditional icon of the home. The icon in Russia is usually placed in a corner, "Krasnyi ugol", in the room where it can best be seen. From then "Black Square" is considered an icon and takes its place in the exhibition space.

The image of the city changes during the holidays, the anniversary of the revolution. The carved red dominates. The overall balance and dynamic parts are a representation of an ideal space. Nathan Altman, architect designs the project of decorating the Winter Palace in 1918. Architect El Lissitzky and painter Ilya Tchachnik in 1920 create a project forum on Palace Square.

One of the greatest avant-garde Yakov Georgievich Tchernikhov puts knowledge, experience, ideas of compositions in service for development of a dynamic architecture design based on the movement of colors in space. It works by Style Constructivism (futurism) and create a series of "Architectural Fantasies", 1933. Formed by Ivan Fomin and Leontii Benois at the Imperial Academy of Fine Arts in Petrograd Tchernikhov has practiced as an architect in Leningrad. Although he continued his work as a teacher and lecturer in Petrograd, only a small share of its projects were built and even fewer seem to have been spared, as the factory *Krasnoe znamja* "Red Flag". Tchernikhov has produced many drawings of historical and fantastic architecture (cycles boards "architectural Tales" from 1929 to 1934, "Architectural Romance" 1930-1944 "Old Towns" 1933-1943, etc.), with subtle design that were never shown during his life. Author of about 17,000 drawings and projects he was given the nickname "Soviet Piranesi".

Russian avant-garde proposed new solutions to help the image of the city. Projects of polychrome facades in social housing have been developed (Architect Alexandre Nicolskiy, artists Maria and Boris Ender) for the city workers of the Red Triangle factory in Leningrad, 1927.

Totalitarian regimes of 30-40 years of the twentieth century have proceeded in a short time to serious cuts in the city and caused considerable damage. Dictatorships have led to the formation of a Stalinist official neo-classical style resulting in a pastiche of ancient Rome. And the "Nordic style" has simplified classical style variations. The main colors of the urban environment remained in overwhelming shyness and were barely noticeable. Polychrome should have been absent, as an expression and manifestation of democracy. Faced with Hitler's desire to raze the city, people did everything to save their city and its rich heritage. But despite many precautions taken in haste - statues buried, evacuated collections, buildings protected by sandbags from bombing - the destruction was terrible and left a scene of desolation.

After the war in Leningrad, in accordance with the general plan of rehabilitation and development of the city (1945-1948) architects NV Baranov, AI Naumov and VA Kamensky have created new architectural ensembles (Lenin Square, Revolution Square), rebuilt the Place des Arts, created the Marine Park and Victory Park and began the development of the city center along the Neva.

Functionalism and minimalism in architecture dominates in the 50s and 60s. Rationalism color matched to the function and construction was based on a correlation of shades and color tones, which however remained dominant achromatic colors. The use of color is needed to defeat the uniformity and help overcome the uncertainties in the search for solutions to the problem of functional construction as well as sometimes modify the properties of the shape of the building.

The Postmodernists works in 70s and 80s were marked by a "tendency to architecture space" and should be read as a rehabilitation of the topological space where the plastic unity of form opens and prompts a space-time journey. This trend has found applications in architectural projects where color gives individuality and own identity to architecture. It

helps to better understand the space by specifying the function of buildings. Style "Brutalism" in Contemporary Architecture, 1979-1989 also helps suggesting the functionality of the building by "signaling" components of its structure: LEN EXPO Centre, Vasilevsky Ostrov, 1979-1989, and Hotel Pribaltiickaia - Park-inn.

The trend in the choice of colors in the neo-rationalism and minimalism in architecture is related to the way of working on concrete, potentially giving it effects of matter. The architects have created their own image at service of a stereotypical architecture they have deployed in several major urban projects.

Along with the use of a palette of white and gray "metallic" and "futuristic", a tendency to dematerialize the building has emerged. This trend explores simple shapes such as cube, sphere, pyramid and cylinder. Special effects, "ghostly" are obtained by the use of glasses of transparent colors and reflective glass: The Baltic Pearl "Aeroplaza" mall contest Gazprom city.

Another trend is to use of saturated colors (red, yellow, blue, green) in contrast with neutral or gray background, this trend complements that of the "white concrete wave." Saturated colors are focused on as facade elements to compensate for the absence of color on the entire wall. This trend is like a tribute to the late research in architectural polychrome group "De Stijl", Theo van Doesburg, the Le Corbusier studio and "minimalism" group "Contemporary Architecture" "Primorsky" residential complex, "Na Optikov 34".

Today, at the beginning of XXI century, as never before, we see an interest in murals. They add organic shapes to regular surfaces in urban areas. The close collaboration between personalities with diverse skills: architects and designers, engineers, painters and landscapers, and quality of this collaboration should help create an optimal viewing: Murals modern neighborhoods, Espace «Fliguel" and "Third claster" rehabilitation of the 1867 architecture, architect André Stefieri.

Modeling the image of the city, urban design, the "light/color" relationship will enrich the palette of the environment and its semantic and visual varieties in the nocturnal urban space. Bright colors and shapes create a refined poetic harmony. Lifted bridges are powerful symbols in the image of the city of Saint Petersburg.

In St. Petersburg for the 300 years of the city anniversary an extensive work for the reconstruction of the historical heritage of the city center with the restoration of its colors begins. Multiple areas were defined meant to protect the legacy of urban heritage of baroque, classicism, eclecticism and modern art, including reconstituted colors, and they are to form the core of many colors in the capital. This program contains the conceptual design of a color application by streets or districts historically constituted or newly built.

Studies of local characteristics of the Saint Petersburg’s image, its colors and materials help distinguish in the different architectures its own pallet styles that reflect their originality. Among the determinants factors of the image of the City of St. Petersburg, located at the crossroads of European cultures, are European architectural and artistic traditions as well as

the local culture, their materials and colors, the phenomenon of the environment natural landscape.

Figure 1 The Palette of Saint Petersburg by Larissa Noury

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The Colors of Belém, Pará. A Quest for an Urban Chromatic Identity

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Abstract

This paper is a report on the findings of a research conducted by the Faculty of Architecture and Urbanism of the University of São Paulo focusing on the study of urban chromatic identity.

The objective is to present through the study conducted in one of the cities subjected to this research, which in this case is Belém, Pará, the methodology used to carry out studies and chromatic readings of large and medium-sized cities. The aim is to develop a chromatic palette, or charts of the data obtained, that are representative of those urban centers.

Chromatic Study Of Belém, Pará

Understanding the chromatic relations of a city is a fundamental step so as to be able to intervene either in the preparation and insertion of architectural designs or in the development of public policies. As Doherty (2010:2) states "Whether carefully coordinated, clashing or an expression of the materiality of the city color, it is a powerful social, economic and political force.

Colors are part of the process of architectural perception and urban conformation, reflecting not only the formal aspects, but also the cultural, social, and historical ones of the place and the population who live in it. It can be said that they are key elements in creating the sense of place, or belonging, among the dwellers of urban centers. Norberg- Schulz declares:

> Identification and orientation are primary aspects of man's being-in-the-world. Whereas identification is the basis for man's sense of *belonging*, orientation is the function which enables him to be the *homo viator*, which is part of his nature. (Norberg- Schulz, 1979 [80:22]).

Over time people develop a relationship of identification with local conditions, particularly with those they recognize as representative of certain areas, expanding, in many cases, to the whole city. Colors characterize this primordial image, like some other elements do, as Lynch asserts

> Structuring and identifying the environment are vital abilities among all moving animals. To achieve that, several types of signals are used: the visual sensations of color, shape, motion or light polarization, in addition to other senses such as smell,

> hearing, touch, kinesthesia, gravity and, perhaps, electrical and magnetic fields. (Lynch 1960 [2011:3])

Understanding urban areas from a chromatic perspective does not mean to only study the colors of each one of their buildings separately, but rather to study the assemblage, the way buildings relate and the context to which they belong.

According to Minah, three are the functions of colors in the urban context: dynamics, imagery, and tectonics. (MINAH 2008:2)

Dynamics can be basically understood as the relationship between figure and background, the relationships among the parts of the building and also the relationship between the building and its surroundings. This function determines juxtapositions, hierarchies, separations, transitions, and assimilations. Within dynamics it is included the mimetic function of architecture, that is, the integration of the building with its surroundings.

The tectonic relationship of color takes place in the clarification and definition of forms and building details, having the potential to enhance or "deconstruct" three-dimensional forms.

Imagery, on the other hand, is related to the perceptual experiences of color in architecture which convey materiality, cultural context, physical context, symbolism, and emotional response, as well as imagery related to conceptual goals and form definitions.

The perception of spatiality and volumetry by the observer may vary according to his or her movement around the architectural work, the observation angles, speed, and attention levels. Thus, it is possible to obtain different chromatic combinations, depending on the look under consideration, enhancing or subduing certain volumetric relationships in different forms.

> Cities are not only made up of their buildings, avenues, and viaducts, but also of the vegetation that at times is present around streets and boulevards, in gardens or concentrated in parks and squares. Their dwellers also constitute the city, clad in their outdoor garments, moving around and imprinting a chromatic dynamic second only to the one of vehicles which travel through it and which also participate in the way an urban area is perceived. On this regard, Lynch says: "the moving elements in a city, and in particular people and their activities, are as important as the stationery physical parts." ((Lynch 1960 [2011:3]). However, Lynch complements: "Like a piece of architecture, the city is a construction in space, but one of vast scale, a thing perceived only in the course of long spans of time." (Lynch 1960 [2011:1]).

What basically distinguishes these elements is the dwell time, that is, while a building coated with granite or ceramic tiles has its colors unchanged for a long time, the chromaticities generated by people, vehicles in circulation and even the vegetation itself constantly change, i.e., are not permanent.

In the areas that acquire historical importance and, many times, also become tourist spots, their buildings usually keep their chromatic characteristics for longer periods of time, becoming references not only for dwellers, but also for visitors. Accordingly, aiming at obtaining an urban chromatic reference, buildings or group of buildings, especially those located in traditional or reference areas of cities, where the chromatic characteristics are preserved longer, were chosen to be studied.

To conduct this study on the chromatic identity of the city of Belém, the downtown area of the city was chosen as the focus (figure 1). Its historical center preserves some important architectural icons such as a fishermen's market (Ver-o-Peso –figure 2), several churches, and a commercial center with old buildings (figure 3), many of them coated with ceramics (figure 4) and with a chromatic composition characterized by high saturation colors and intense contrasts of light.

Figure 1

Belém is located in northern Brazil and is the capital of the state of Pará. The city, which is over 400 years old, has about 1.5 million inhabitants and had its heyday at the beginning of the twentieth century with the rubber boom in the Amazon. One of its features is to present an intense chromatic diversity in buildings that blend several historical periods.

Some buildings have small tiles coating them as a trait, but the vast majority of them have painted facades, having white as the characteristic of older buildings (colonial period) while the more recent ones present a strong chromaticity.

Traditionally, in most Brazilian cities, buildings located in commercial centers are characterized by their saturated colors and various hues. This aspect is also present in the area that was the object of this study since it is predominantly occupied by a popular marketplace.

Figure 2 Ver- o-Peso

One of the main methods for urban chromatic analyses was developed by Lenclos, (1999[2004]) one that he called The Geography of Color and is based on the relationships

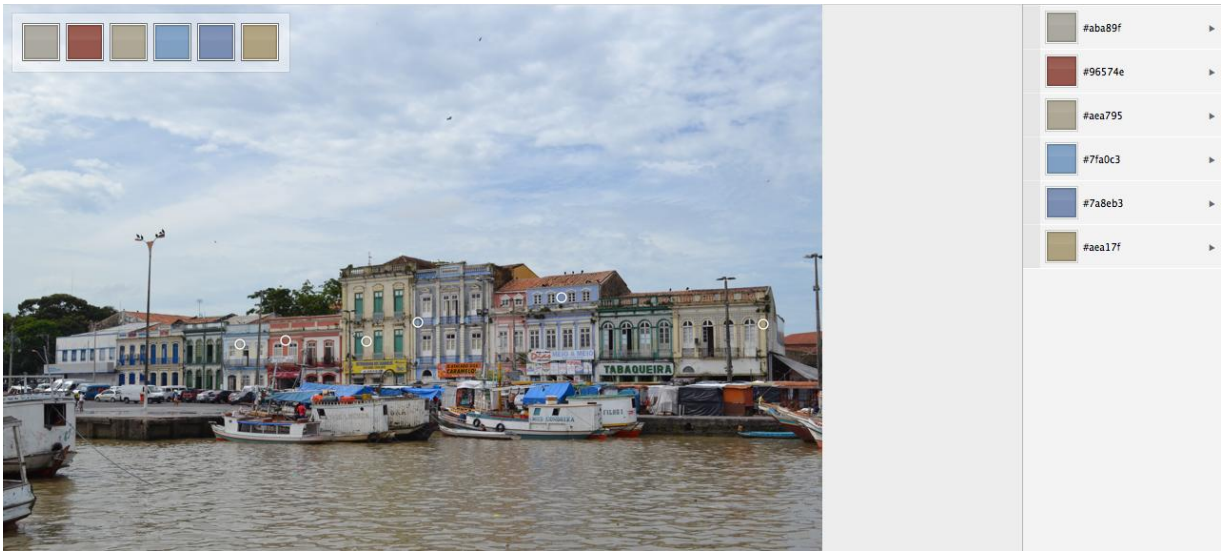

Figure 3

among regional colors, such as the ones of the earth, minerals, nature, as well as the ones of construction materials and their resulting colors in the cities. However, conducting a study of medium and large-sized cities entails a host of difficulties. First, because of the area to be studied, usually a large one, in order to be representative; Second, due to the difficult access to buildings, which many times are both isolated and tall, making it hard to measure them by scanners, something that would make the research more accurate. Another important aspect in this context is lighting, which derives from the weather relationships that are specific to each region, presenting variations during the day and in different periods of the year. The exterior surfaces of the buildings themselves are not uniform and, in many cases, present an intense variation of shades, albeit not always noticeable from a distance.

Figure 4

The methodology used is based on photographic records (Nikon DX 3100 with a Nikkor AF-S DX lens) and the development of chromatic palettes by means of the ColorSchemer2 software (and the web site http://www.perbang.dk) and, whenever possible, in loco readings using the NCS color scanner, aiming at comparing results.

The procedure adopted was expected to produce some degree of inaccuracy since neither image treatment processors nor even records of lighting were utilized.

Issues such as the variation of light and weather conditions, likely to be consequential because the photographic records were taken on different days and hours, were not taken into account either and, notwithstanding, the comparison between the result obtained by photographs and the data provided by the NCS color scanner, used when possible, was far more similar than expected and, in some cases, coincident. The same relationship between the records obtained by photographs and the measurements obtained by the color scanner occurred in the other cities where similar studies were carried out. It is worth noting that the results displayed by the charts reflect the "chromatic sensation" that the researcher had while visiting the city.

The records were scheduled to be done in a short period of time; in 2 days, in the case of Belém, which generated a snapshot of a moment of the city. The intention is to have this same study repeated within 3 years, employing the same methodology, in order to compare results.

The 411 colors identified were tabulated and generated the following charts: chart 1, shows colors in the NCS system; chart 2, colors in the Munsell system; chart 3, shows 'Lab' ; chart 4 in the 'hsb' system , shows the distribution of hues and chart 5, also in the 'hsb' system shows the relationship between brightness and saturation .

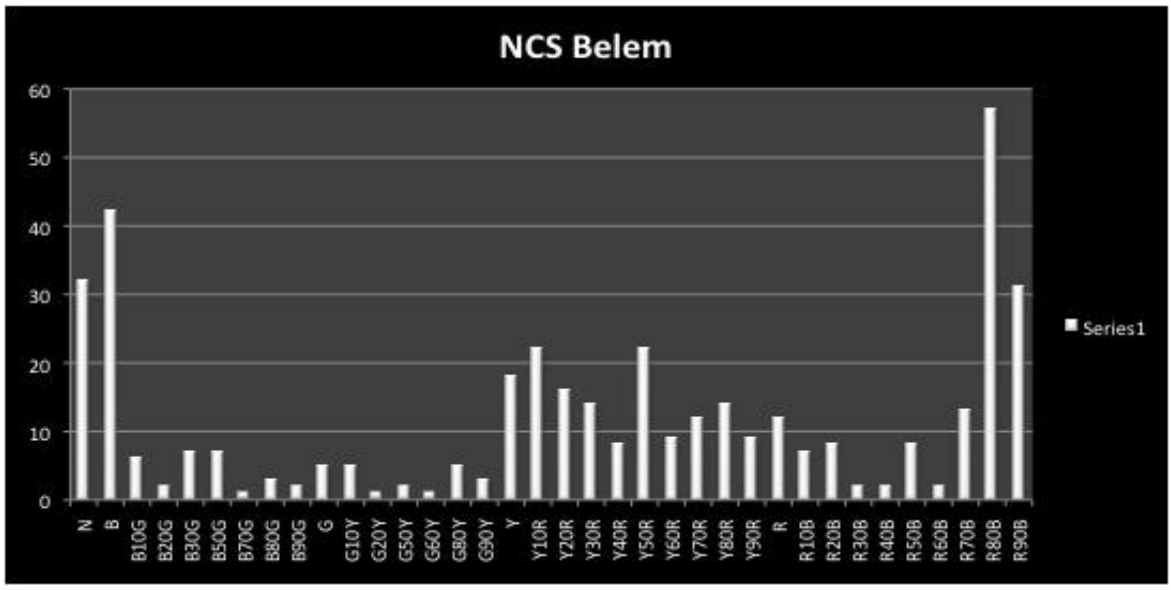

Chart 1

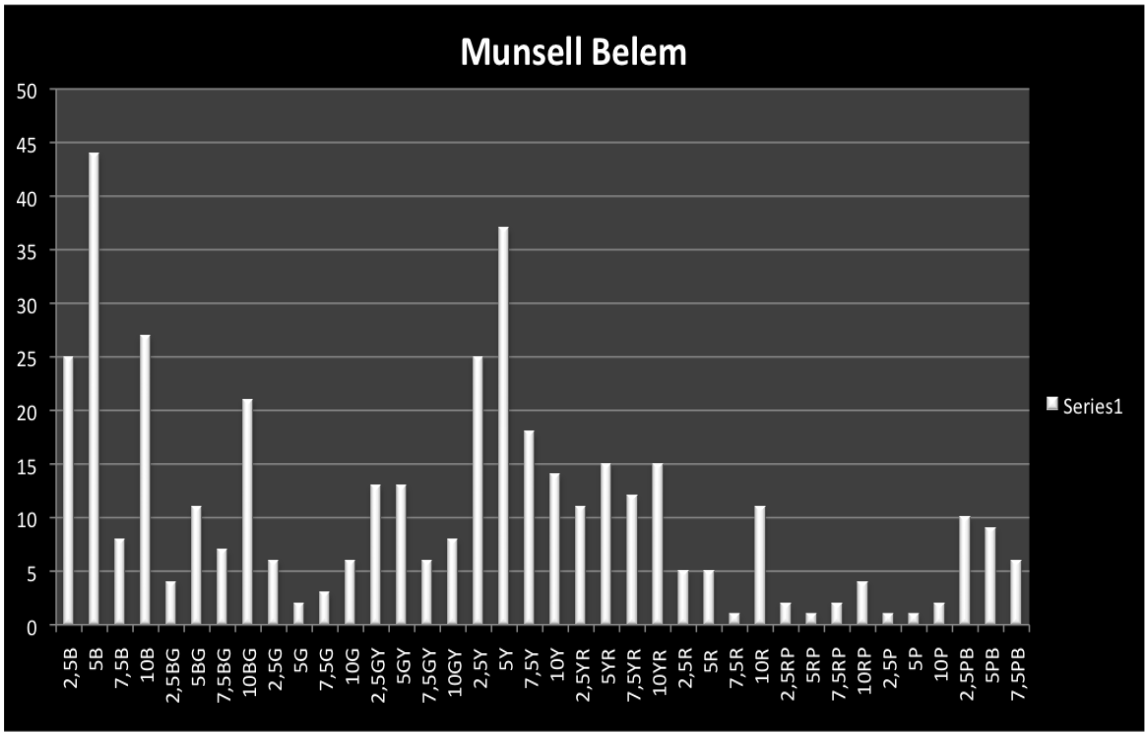

Chart 2

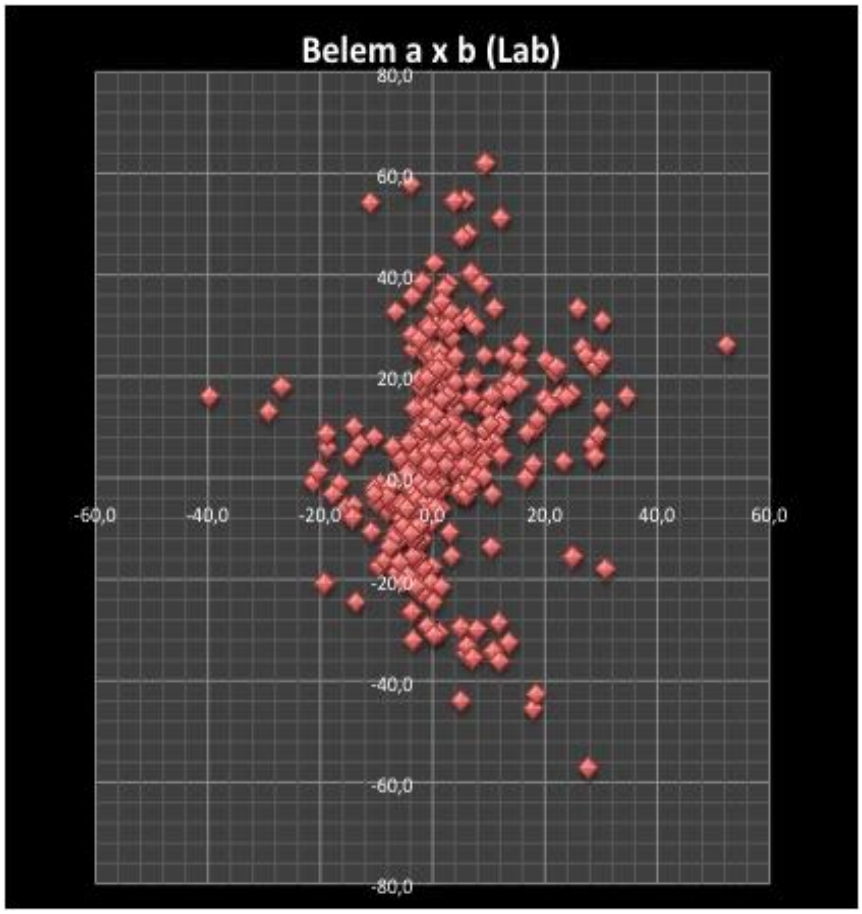

Chart 3

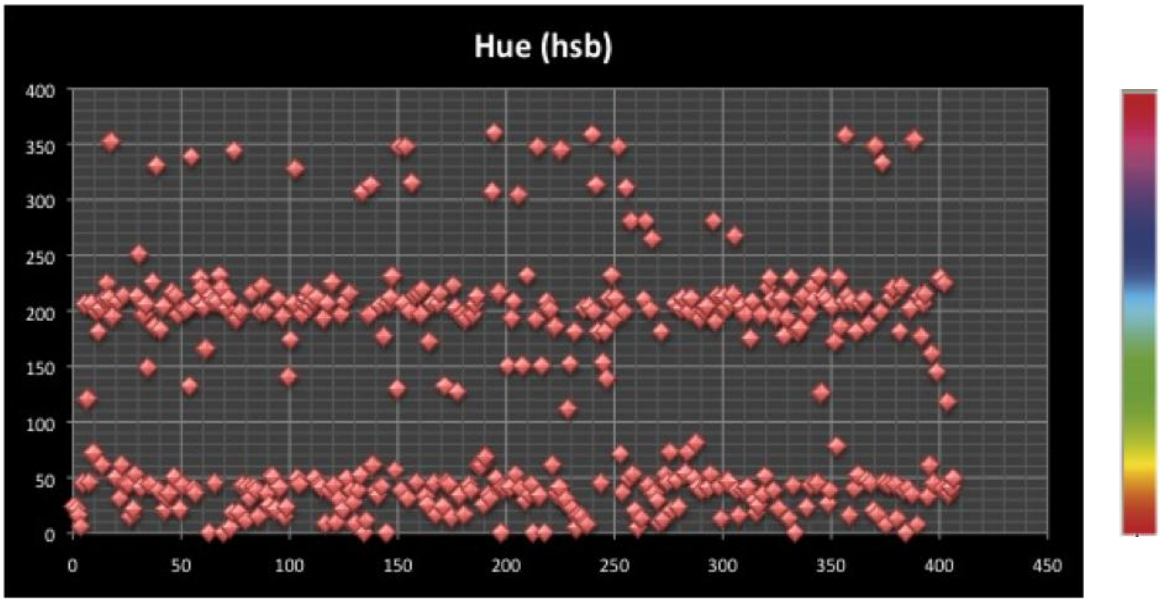

Chart 4

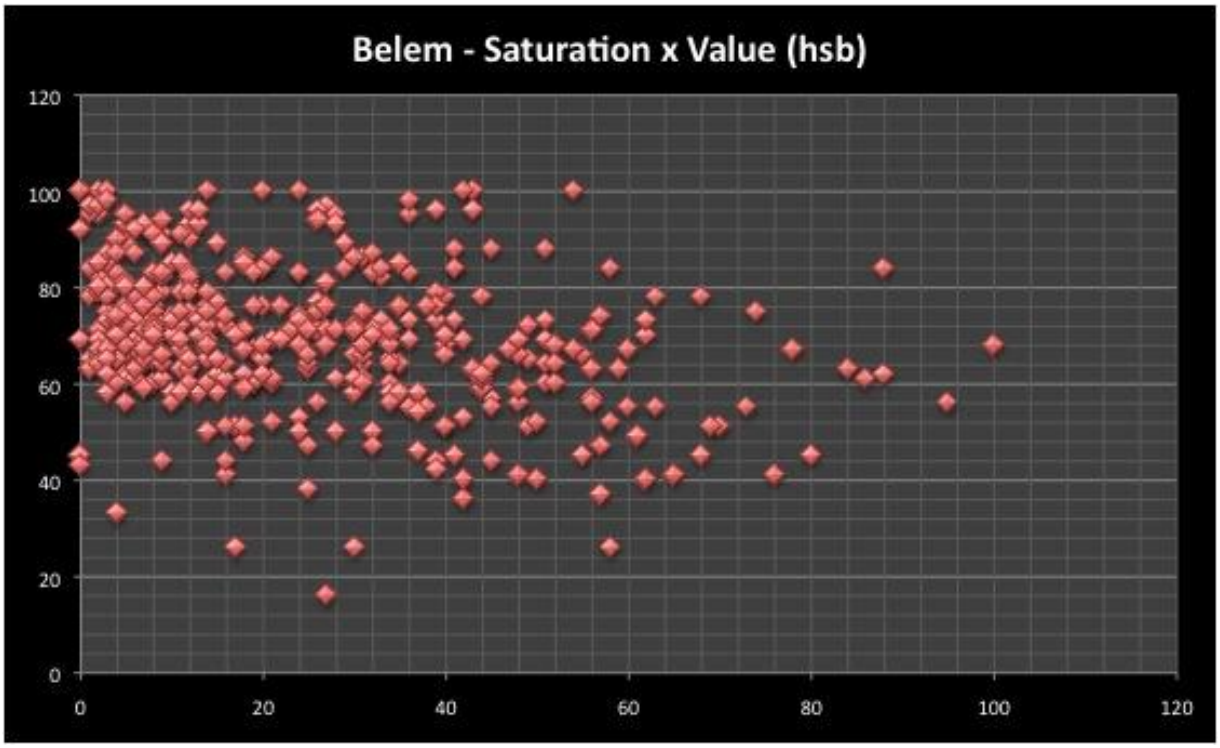

Chart 5

The vast majority of the colors identified are from buildings, due to their characteristics of greater endurance, but some urban facilities, which stand out in the landscape or indicate some historical importance or reference (with the same characteristics in terms of color longevity), were also taken into account.

CONCLUSIONS

In spite of a certain degree of imprecision in the methodology adopted, the charts generated by the study enable an understanding of the predominant chromatic attributes of the region surveyed.

When compared to data from other cities, by using the same methodology, some differences become evident, particularly in relation to those cities located further south of the country. As an example, a stronger presence of bluish hues can be noticed. In part, this presence can be explained by the intense brightness of the sky, which turns whites into slightly bluish whites, not only regarding images, but also in the way they are viewed.

It is noteworthy that one of the most representative buildings of the city, not only for tourists, the Ver-o-Peso market, has blue as its characteristic color (NCS: S30 40 R90B and S40 40 R90B).

The relationships among the characteristic colors of a region and its buildings professed by Lenclos, in what he calls The Geography of Color (Lenclos 2004), in the case of Belém, can perhaps be accentuated not only by the brightness of the sky, which is of a deep blue, but also by the handicrafts.

The region where Belém is located is rich in handmade pottery, which is developed according to the decorative styles of several local peoples, particularly the Marajoara, who apply various chromatic varieties to the clay, especially some of a yellowish-red kind.

The charts indicate that the predominant hues are yellows and reddish yellows and that the major difference in relation to the other cities that have been studied lies in the greater presence of shades of higher saturation and, in many cases, lower brightness, which generates a number of contrasts, not only of hues, but also of luminance.

The reading of colors through photographic records, in some images that present a strong contrast of luminance, gives colors a higher or lower brightness, depending on the way light falls upon them, in comparison to the reading done by the scanner or even by plain visual sensation.

Historical buildings, coated with small tiles (figure 4), reinforce this chromatic diversity, as if lending support to a tradition of the city in the use of color in architecture.

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Color and Place: New Ways of Expression in the Contemporary City

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Abstract

The clear trend towards the global city, a virtual city of flows, as the expression of the contemporary city makes us focus our attention on the Urban Place and its insertion in the present urban condition. The urban exteriors display new expressive and communicative functions of color that facilitate the promotion of pleasant experiences and contribute to the construction of urban places. Light, color and sound are sensory effects with the relevance of new ways of expressions established by present technologies (Bahamón 2010).

In the unique Latin-American context, and especially in the city of Córdoba, the intervention of color is essential. The iconic-linguistic potential of color, which has been enhanced by new production ways, boosts its capacity to communicate by creating atmospheres that go beyond materiality into new perceptive dimensions. This experience of the city and the resulting promotion of urban life are very important for the production of the urban place.

Introduction

The contemporary world witnesses essential changes in the production of urban environments which are shown in its architecture. Moreover, these changes take place in the new possibilities of expression of color and the different signs that go with its perception such as cesias, chromatic contrasts and textures that facilitate a bigger variety of environmental experiences and make us reflect on the Urban Place and the context that produces it.

The new interventions related to the structure, expression and meaning of the urban place, which in some cases involve the appearance of new architectural and urban components as well as a renewed value of spaces that already exist, have as a main objective to re-value the urban environments for the enjoyment of their inhabitants and to generate experiences in the social life context.

The combined impact of worldwide events such as globalization together with the local effects of the changing social-economic and cultural Latin-American context leads us to focus our attention on the interventions and transformations that have taken place in the urban public space in the last decades, especially in the city of Cordoba, Argentina.

Urban Place And Urban Context

The concept of urban place has changed throughout time together with the evolution of societies and the research contributions of many disciplines. Nevertheless, the close relation between the concepts of urban and existential space (Norberg Schulz 1975) proves that the perceptual expression of the city and its places matches the ideas of city throughout time.

This is shown in the leading roles of different components which, according to the perception of each historical time, are predominant. Consequently, every place or net of places in the city is the result of their previous history.

At present, the issue of public space and place is considered a priority. The present debate explains different perspectives. The urban condition is presented as an ideal kind of city connecting the physical-spatial with the mental-imaginative. On the other hand, the new technologies, communications and global deals place flows before places, dividing the city between hyper-mobility and stagnation. This meaning of urban city is expressed by the so-called global cities (Mongin 2006).

In this context where the traditional concept of place is under discussion, new urban interventions show a change of meaning of the concept of urban place. The expression of urban language takes advantage of new technologies but its inherent meaning, its essence, may not have changed completely. Urban places keep on being an environment of communication and socialization. The urban image does not belong to the city, but to its inhabitants since this image is born in the way it is represented in the minds of inhabitants. The city makes sense when it satisfies its inhabitants' needs (Pérgolis 2005).

In this context regarding the perception of Place, emerging urbanity elements rise with the purpose of regaining the traditional idea of urban place in the present socio-cultural contexts. Consequently, color and other components of language, renewed by their new ways of production, participate actively in the construction of the concept of Place.

As living meaningful environments, both individual and collective, the social production and construction of the urban public place must be understood as a dialectic relationship which changes along time, creating new ideas, social structures and meaningful places.

Figure 1. Different ways of production in urban places of the last decades in Córdoba city

The Chromatic Expression In The Contemporary City

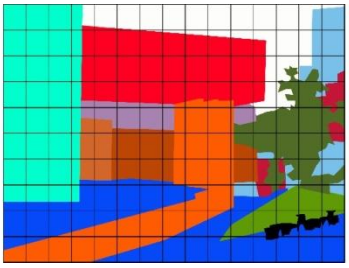
The urban color, as one of the structural components of the language of the city, contributes, as a quality, to fulfilling the needs of man; if these are fulfilled in city places, they become urban places. At present, other spatial configurations reveal that the expression of urban language has changed taking advantage of new materials and technologies developments. By means of new expressive forms of color, these urban places propose a different way of suggesting, informing and stimulating the sense of place in the city. This prompted a chromatic survey and the subsequent analysis of uses and behaviors in paradigmatic places of the city of Cordoba, Argentina in the last decades.

Method of the chromatic survey

Light, color, textures and cesias are main components of urban language, and as a consequence, of the created spatiality. These elements work on the whole configuration of limits having influence on the perception and communication of the urban environment.

By recognizing paradigmatic urban places in the city of Cordoba in the last decades, it is proved that color has accompanied the development of the concept of place in the city. The aim is to prove how the new materials and architectural trends have changed the chromatic expression creating changes for those who perceive and inhabit those environments.

The steps to conduct the chromatic survey are as follows:
- The paradigmatic environments are chosen according to their chromatic expression and temporal condition of urban place.
- The Natural Color System (NCS) is used to measure color since it is the most appropriate way to reveal the different chromatic modifications produced in urban spaces.
- Simultaneously, the performing cesia degree is measured and textures are surveyed to determine more accurately both the perceived color and the inherent one.
- A synthesis matrix is laid out to present the survey of different variables as well as the perceived color and the inherent one.
- The chromatic survey is conducted at different times of the day and in different seasons.



	SUPERFICIES	TINTE	NOTACION DE COLOR			SUP%
			(S)	(C)	(w)	
1	CIELO	B	10	10	80	11
2	SUP. VERDE	B80G	50	20	30	20
3	VOLUMEN RCIO	R	30	40	30	16
4	ARBOLES	G20Y	30	60	10	6
5	PRADO	G40Y	10	80	10	3
6	PISO	R70B	30	20	50	9
7	FONDO 1	Y80R	10	30	60	3
8	FONDO 2	Y60R	10	20	70	5
9	FONDO 3	R30B	5	15	80	3
10	FONDO 4	R20B	20	20	60	7
11	FONDO 5	R70B	20	10	70	2
12	EQUIPO	B	90	5	5	1
13	COLUMNAS	Y70R	20	30	50	14
					TOTAL SUP.	100

Figure 2. Urban color in urban places of the contemporary city – N.C.S.

Analysis of uses, appropriation and sense of place

The appropriation and use of urban environments are determined by the satisfaction of physical and psychological human needs. When these take place, the sense of place becomes real and is expressed by the emotional behavior and reactions of the inhabitants.

To confirm the new relations between space and sense an analysis of uses and behaviors is carried out to prove the meaning given by inhabitants to the urban experience.

The steps to analyze the uses and behaviors are as follows:
- An interpretative observation is carried out with the aim of determining the behavior and appropriations in the different selected testing environments. This observation takes place at different times of the day, on different week days and different seasons.
- with the aim of completing the analysis, questions are made to casual users to verify the association and the meaning the inhabitant relates to the perception of chromatic elements influencing public spaces.
- A synthesis matrix is laid out to present the analysis of recorded uses and behaviors.

Provisional Conclusions

In accordance with the above mentioned it is stated:

- According to the perception of each period of time, the notion of place proves the main function of color and different components of language and the different role they play.
- In the contemporary city the new urban architectural expressions affect not only the physical aspect of the city but they also condition the use and appropriation of the public urban space, changing the meaning of the concept of traditional place the inhabitants have.
- At present, the perceptual variation between the applied color and the inherent color is broadened as a consequence of the performance of perceptual signs as cesias, textures and the synesthetic process shown in the new expressive possibilities of innovative technologies and materials. Besides, an appearance variety is displayed, sometimes short-lived, supported by the new role of sensory effects such as light and sound.
- The chromatic survey and the survey on uses and behaviors show that the perception and meaning the inhabitants confer to color are associated to the different periods of time.
- The role of color in the contemporary city exhibits its potentiality to promote real experiences of city environments which have become Urban Places, both in new sites or in re-valued spaces. This highlights the need for chromatic design at different performance degrees in the city.

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Traditional Color of Cities in Central-Eastern China

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Abstract

The central-eastern region in China, as the pioneer of the implementation of the environmental color planning, has become an important reference to other areas in China.

The purposes of this research are to understand the general features of environmental colors of the traditional cities in central- eastern region, and the individual environmental color matching. In order to reflect the general features of the environmental color, three historical cities are chosen in this research: Zhouzhuang, Fenghuang and Chibi, which are in the east, middle and west of the central-eastern region respectively.

The general environmental color features of the central-eastern region come out according to literature research and color measuring in field research. The roofs are in color N, 10B~10PB and 5R~5YR. The colors of the exterior walls are generally in color N, associated with 2.5R~5Y which is also the similar color of the balconies, doors and windows. The street furniture are similarly in the colors of 5R~2.5Y, N and 5B~5P. The signs are using 5R~10YR and N on the background, and on text colors using N1, N9, 5GY~10G and high-value and high-chroma colors 5R-2.5Y. The similar colors are used in the central- eastern region, but the frequency of the color, using area of the color and the differences on the tones are used to show the individual characteristics of three different cities. At last, the authors come up with the color planning for the central-eastern region in China according to the results of the research.

1. Introduction

Chinese traditional architecture not only reflects Chinese traditional culture, but also has special features. However, with the process of urbanization, international architectural styles are blindly pursued, leading to the reconstruction and renovation of many cities. Lacking in particular city environmental planning and color planning, the cities have been destroyed in their original characteristics. In 1921, the research of environmental color have been started in China(Cui 2008: 5).

As the portal of China, the central and eastern region(fig.1) has characteristic culture, history, customs, etc(Guo 2008: 17). The environment color planning in this area is developing in a high speed(Wang 2009: 2-3)(Gou 2007: 84-88). Meanwhile, in this area, the implementation of the various city environmental planning and the attempt to carry out

the color planning are gathering experience for the development of city colors and environment. It also greatly inspires the process of the general environmental planning and color planning in China, not only in the central and eastern regions. Therefore, the central and eastern region is taken as the object of this research.

"Traditional Color" as an important issue is proposed in many researches(Yosida 2005: 3-42). The previous researches on environmental color are usually based on the history and color matching in each city. In this study, we did the research in three places in one region to show the regional traditional colors.

This research, for one thing, expects to understand the general features of the environmental colors of the traditional cities in central and eastern region. For another, to clarify the individual environmental color matching, and its method of different cities in this region, helping to develop characteristic Chinese cities with ethnic features.

According to the literature investigation and previous studies, determine the remains of Chinese historical cities, appoint a particular historical city and then conduct a field survey to its colors. Three representative cities in the central-eastern region have been chosen for field survey(fig.2). During the investigation, the research objects are divided into three parts: architecture, street furniture and sign.

2. Field Research And Analysis

In this study, the central-eastern region of China includes Jiangsu, Zhejiang, Anhui, Hubei, Hunan and Jiangxi six provinces. The central-eastern regions are amphibious staggered, and on the development of constructions, they protect the natural color of the cities(Jinnai 1993: 44), trying to achieve the harmonious beauty of nature and architecture(Yu 2010:20-21).

Three historical cities(fig.1), are selected in this research: Zhouzhuang, Fenghuang and Chibi. Three cities are located at the east, middle and west of the central-eastern region respectively.

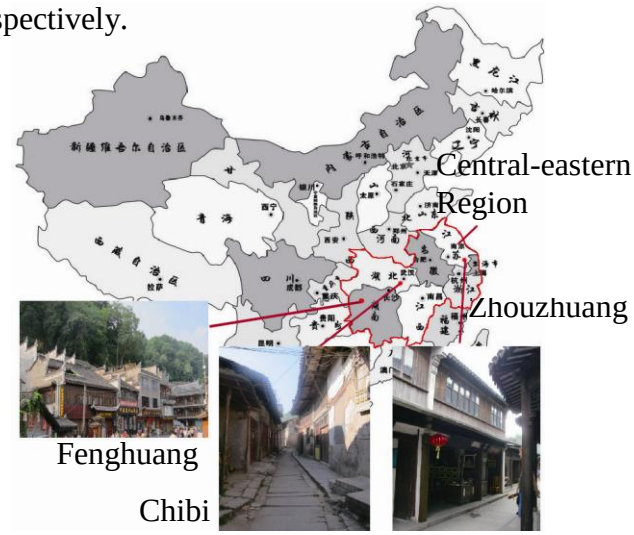

Fig.1 Object Region in China

Fig.2 Field Research

2.1 Zhouzhuang

Zhouzhuang was founded in 1086(An 2010: 1), and located on the east of China(fig.3), now has become a popular tourist destination as a typical historical city in eastern China. Because of the economic development, the increasing population and many other reasons, the environment in Zhouzhuang is facing serious problems.

The research(fig.4) is carried on in September 2012. The range is 800 meters long and 600 meters wide of Zhouzhuang the ancient town. The survey time is controlled between 9 a.m. to 4 p.m. in order to obtain accurate color data. In Zhouzhuang, the pathways are divided into the waterways and the land ways and the data collected in this research are mainly composed of the color on the land ways.

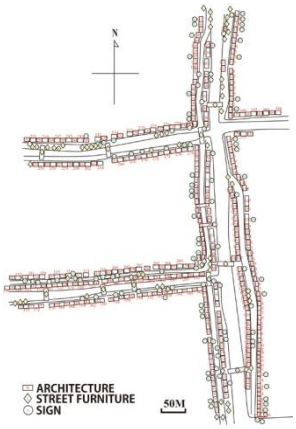

Fig.3 Location of Zhouzhuang Fig.4 Research Map Fig.5 Architecture in Zhouzhuang

2.1.1 Analysis on Architecture

Firstly, we analyzed the color of roofs. From the graph in fig.6, we may see that the colors of the roof are mostly in the range of achromatic color and then PB. According to the filed survey, roofs of architectures in Zhouzhuang are made of the same material, which are gray tiles(Zhong 2005: 1-8). In addition, since many roofs are relatively unified, they are basically similar in colors.

In respect of value, achromatic color roofs are mainly in the range of N3. A small part of roofs also apply value in the range of N1-N2. The value of chromatic roofs is basically in the range of 2-4. In respect of chroma in hue-chroma graph, mostly are in the range of 1-2.

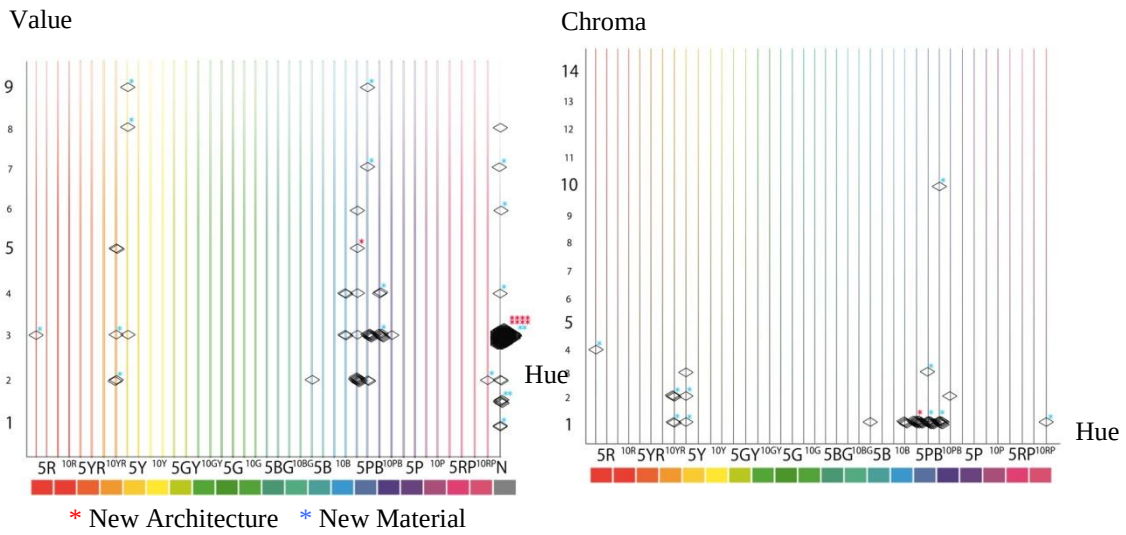

Fig.6 Color Data of Roof in Zhouzhuang(N=386)

It then comes to the analysis of the exterior wall, which is the most important part of architectural colors. From the perspective of hues (fig.7), most are achromatic colors and others lie in the range of color YR-Y. We analyzed the colors of exterior wall by dividing them into two parts according to the used materials. The first group uses bricks, which are painted into different colors. The painted colors are most in the range of achromatic color and Y. The other group uses wood with primary color, some of which is painted with the similar color ranging between R-YR.

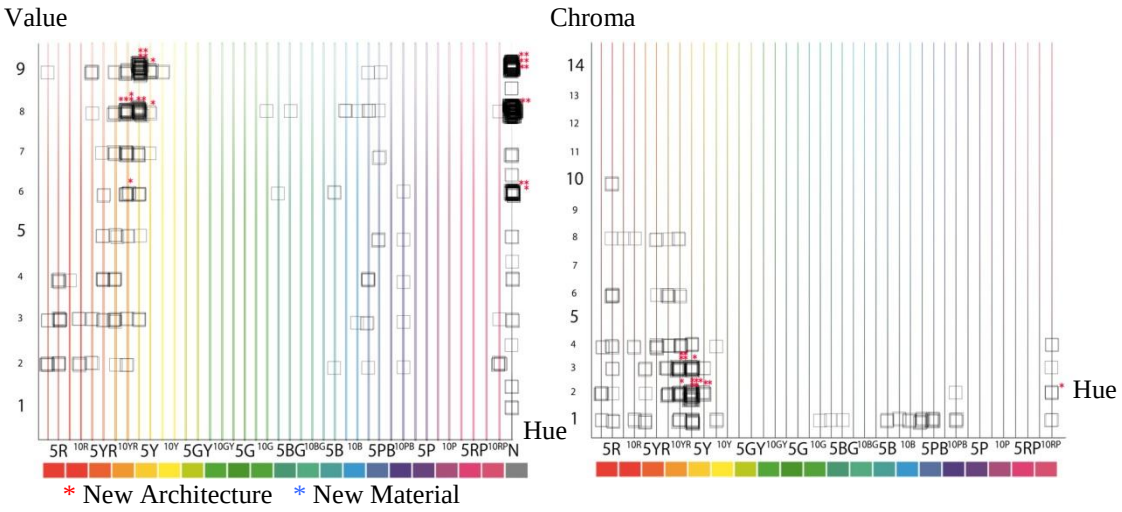

Fig.7 Color Data of Exterior Wall in Zhouzhuang(N=386)

In respect of value, most achromatic color parts are mainly in the range of 8-9, and the value of part Y is mostly in the high-value scope of 8-9. The value of wood materials is in the range of 2-7. In respect of chroma, they are mainly in the low-chroma range of 1-4.

In the following, we will analyze the colors of balconies. In the present research, architectures in Zhouzhuang are basically one-tier or two-tier. Since they are built many years ago, few of them have balconies.

From the research data in fig.8, we may see that the colors of balconies are mostly ranging between RP-Y. In order to match with the exterior walls, windows and doors of the

architecture, balconies are basically made in wood. Most balconies are in the low value range of 2-4 and low chroma range of 1-4.

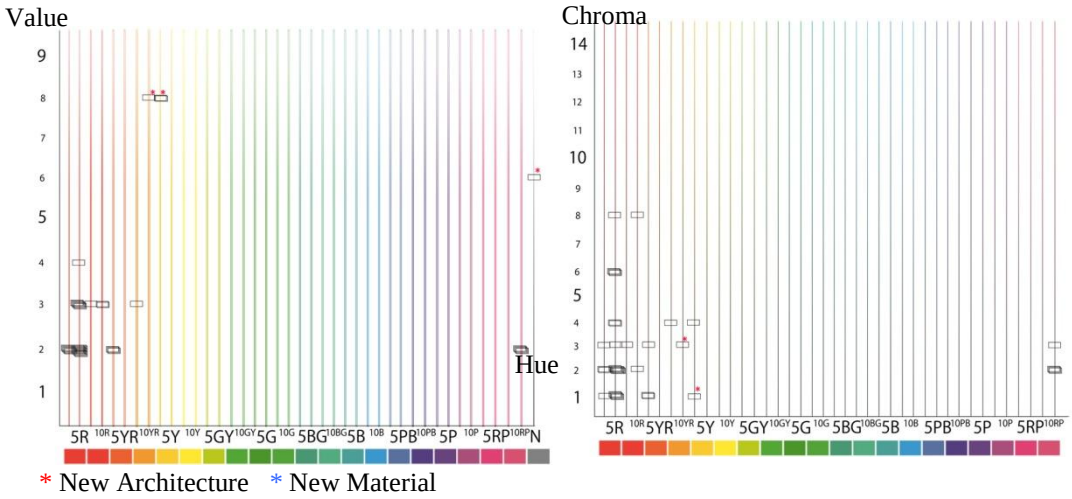

Fig.8 Color Data of Balcony in Zhouzhuang(N=37)

At last, we carried out analysis on the color of doors and windows of architectures. The field research shows that the colors of doors and windows mostly match with each other. So we will integrate the analysis on them in the research.

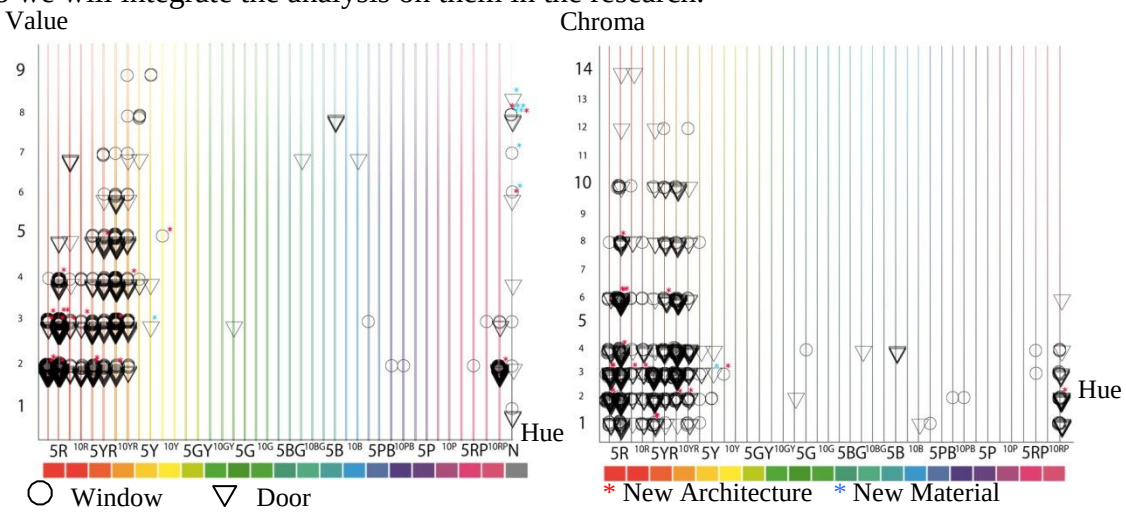

Fig.9 Color Data of Window and Door in Zhouzhuang(N=386)

In respect of hue, the range of doors and windows is the similar, mostly between R-YR (fig.9). Field research shows that doors and windows are made of wood, so they are in the primary color of wood or painted with similar color. But also a small part of them are in the range of achromatic color. These doors and windows are basically in the medium-low value range of 2-5 and medium-low chroma range of 1-6

2.1.2 Analysis on Street Furniture

Then we will focus the analysis on street furniture in Zhouzhuang, including landscape arrangement, benches, trashcans, street lamps and other outdoor facilities. In the research

on the colors of street furniture, we carried out measurement by classifying them into dominant color, assistance color.

First of all, we analyzed the dominant color of street furniture. The general distribution of the dominant color lies in R, Y and N (fig.10). The field survey shows that street furniture are mostly made of wood, stone and metals. In this case, the dominant color is consistent with that of their materials.

Analysis on value is carried out from the chromatic colors and achromatic color. First, the value of chromatic colors ranges from 7-9 in most cases and a few parts lie in the range of 2-6. Achromatic color has a value range around 1.5, black in other words. In respect of chroma value, it covers a relatively wide range, with range 1-4 and range 10-14.

We can see that the assistance colors are in range of R-YR, PB, G and N. As to the value of assistance colors, it shows a feature of disorder. The value of chromatic colors is between 1-4 and that of achromatic color is in the section between 1.5 and 9, black and white in other words. In respect of chroma color, assistance colors are mainly in the range of 1-4 and 8-12.

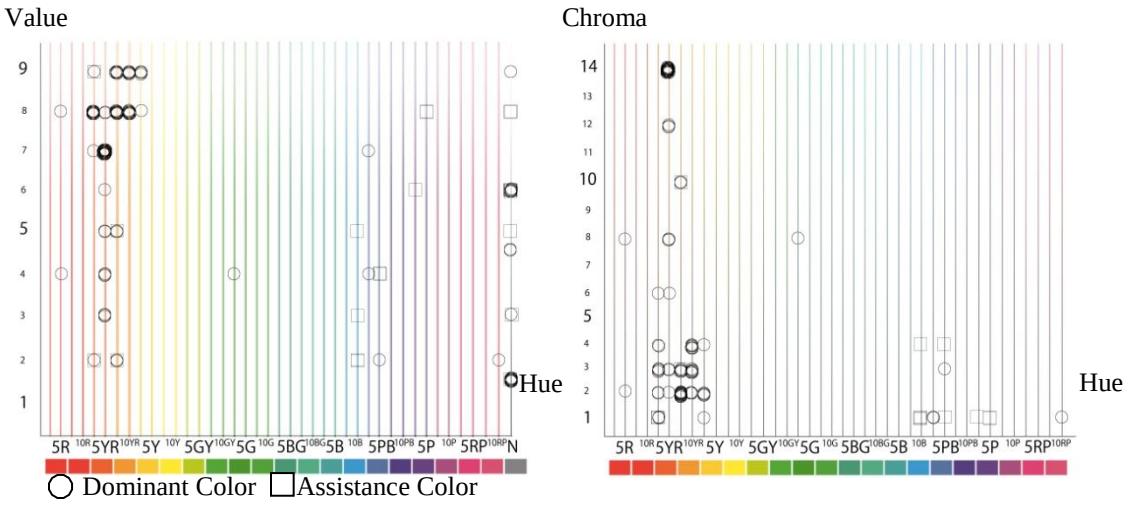

Fig.10 Color Data of Street Furniture in Zhouzhuang(N=69)

2.1.3 Analysis on Sign

Sign include indicator, shop signs and advertising boards etc. In the research, we classified their colors into background colors, text colors and pattern colors.

First, we discussed about background colors of sign. The hue of background colors is in the range of R-YR and N (fig.11). Field survey shows that sign in Zhouzhuang are basically made of wood so they are with the primary color of wood or are painted with similar color.

Data on value is featured by disorder. The value of chromatic colors covers a range of 2-5. A small part of shop signs use high-value colors as their background colors. The value of achromatic color is in the range of 1-2, black and white in other words. In respect of chroma data, since those sign are mostly used for shops, they are distinguished in order to match the architectures and styles of goods they sell.

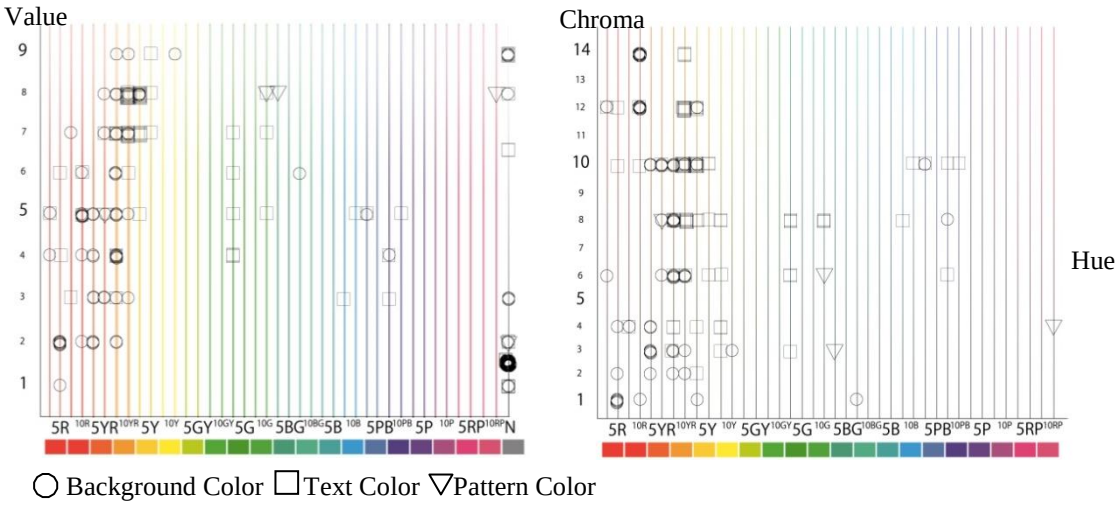

Fig.11 Color Data of Sign in Zhouzhuang(N=114)

In the following, we summarized and analyzed text colors and pattern colors of sign. Analysis on pattern colors is incorporated into that on text colors due to its simplicity. The hue data of them covers the range of YR-Y in most cases, and then scatter in the range of R, G, BP and N. In respect of value, chromatic colors are mostly in the range of 7-9 while parts with achromatic color are in the range of 1-2 and 8-9, black and white in other words. In respect of chroma, data shows the largest coverage in a high-chroma range of 8-14.

2.2 Chibi

The city of Chibi(fig.12), once called Puqi, was built in AD 223(Chen 2005: 8). We did the research in Yangloudong which built in 1626. There exists an ancient street that is mainly composed of constructions in Ming and Qing Dynasties. The main street is 5 meters wide and 1000 meters long with several T-alleys. The construction area of the street is about 0.7 square kilometers, all paved by bluestone.

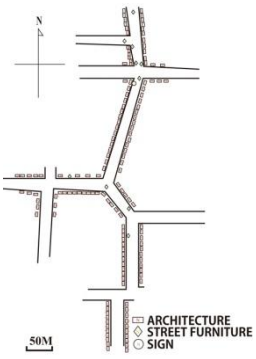

Fig.12 Location of Chibi *Fig.13 Research Map* *Fig.14 Architecture in Chibi*

The research is conducted in August 2013 and the range of the research is the Ming-Qing Ancient Street in Yangloudong(fig.13), which is 1000 meters long. The time is controlled between 9 a.m. to 4 p.m., in order to obtain the accurate color data. The data

acquisition is mainly the collection of the colors of the architectures on the both sides of the street.

2.2.1 Analysis on Architecture

Firstly, the color of the roof is analyzed. As can be seen in the fig.15, the colors of the roof are mainly in the range of achromatic color, and a small part of the colors are chromatic colors in R-RY range. According to the survey in the field, the roof in Yangloudong is relatively unified, using grey tile, continuing the simple atmosphere from Ming and Qing Dynasties. Some houses choose to add wood as support and some use tiles that are in high chroma in YR series when under reconstruction.

From the value aspect, the value of the grey tiles is mainly in the range of N3, and the other parts are in low value of N1 and high value of N8-N9. On the other hand, the range of chromatic colors is mainly in mid-low value. The chroma distribution of the roof in chromatic colors is relatively messy. In the range of mid-low chroma is the color of supporting wood, while the colors of high chroma are those of new tiles.

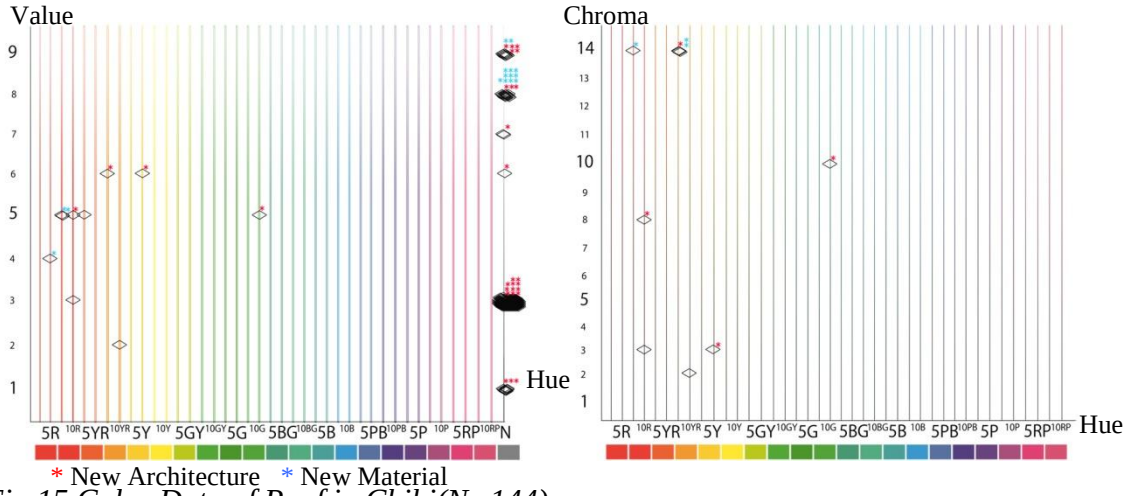

Fig.15 Color Data of Roof in Chibi(N=144)

It then comes to the analysis of the exterior walls of the architectures. According to the collected data in fig.16, the hue of the exterior walls is generally in the range of R-Y and achromatic color N. From the aspect of material, most parts of the achromatic ones are color coating, grey bricks, stone and cement etc. The coating part generally chooses the color of white, and in order to connect with the grey tiles and black bricks, much architecture also uses grey coating. Most cement, on the other hand, is used to repair. The material of the chromatic part is generally coating and wood. The coatings are in YR-Y range, and wood in the range of R.

From the aspect of value, the value of achromatic colors is mainly in the range of mid-high value of 6-9, and some in low value of 3-5. The former is basically white of the coatings and cement, and the latter is generally dark grey, which is painted to connect with the color of black bricks. As for the chromatic part, most of the data is in high value of 7-9, and a fraction in mid-low value of 2-6. Most of the data, on the chroma side, are in mid-low chroma of 1-6, and some are in high chroma of 8-14.

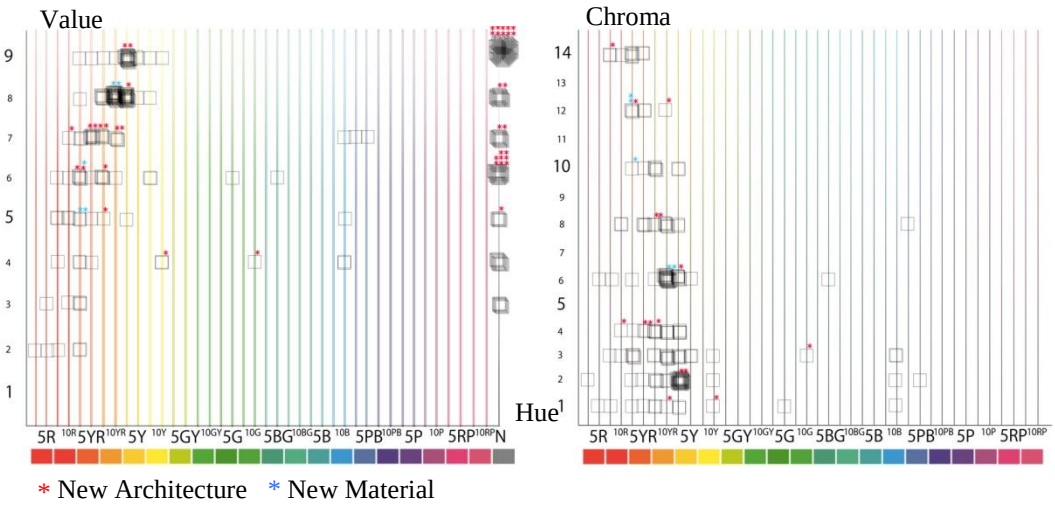

Fig.16 Color Data of Exterior Wall in Chibi(N=144)

The third thing to be analyzed is the colors of the balconies. Because they are historic buildings, and most of them are traditional residential architecture, there are only a few architectures that have balconies.

According to the data graph in fig.17, the colors of the balconies are mainly in the scope of the achromatic color N. The hue range of the chromatic colors is in R~Y. From the aspect of value, achromatic colors are mainly in mid-high value on 6-8, and chromatic colors on 2,3,4,8. The chroma of chromatic colors is in low and middle chroma of 1,2,3,6. Moreover, from the data, we can see that the balconies that use achromatic colors are generally newly constructed and use coatings or metal colors, while the chromatic balconies are in the color of wood.

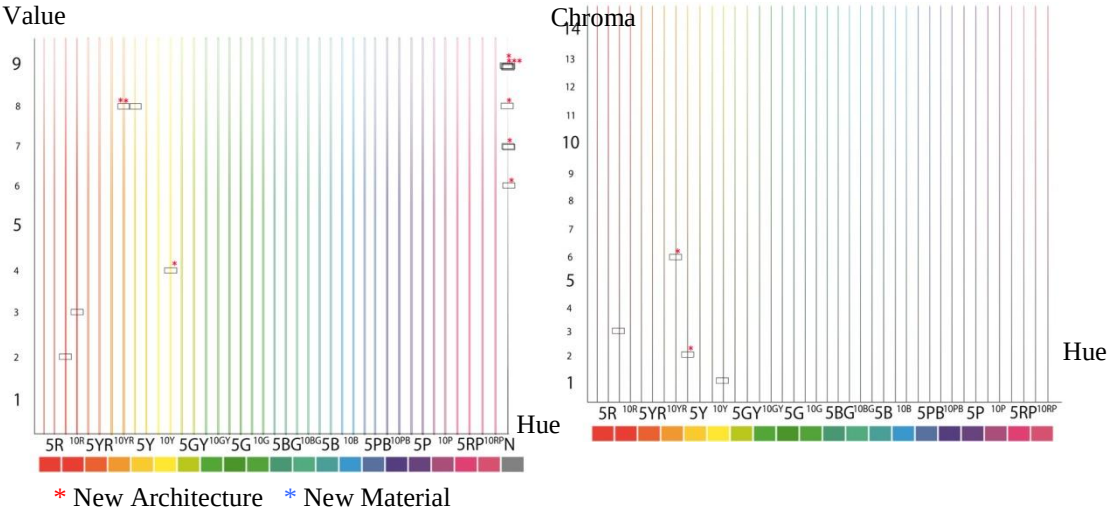

Fig.17 Color Data of Balcony in Chibi(N=12)

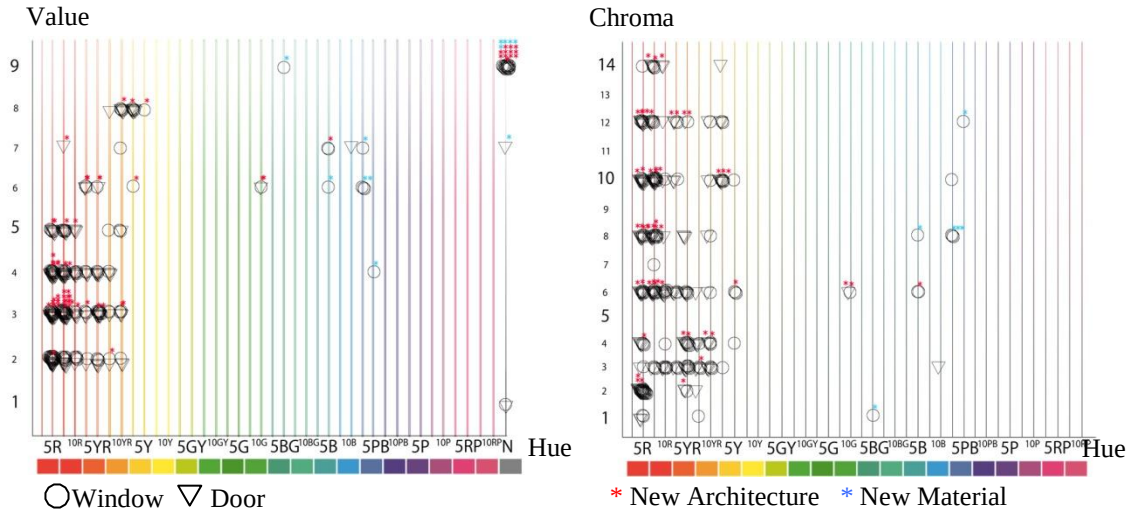

Fig.18 Color Data of Window and Door in Chibi(N=144)

Lastly, it comes to the discussion of the colors of the doors and windows. On hue as shown in fig.18, the colors of the doors and windows range mostly in R-YR, and a small part concentrates in N and G-B range. From the perspective of material, the doors and windows are basically wooden, and the colors are generally the original colors of wood or similar color coating. In addition, a small number of architectures use metal on the window, or choose a blue with very strong contrast in the process of renovation.

On the view of value, the achromatic colors focus on the range of high value in 9, and chromatic colors in low and middle value in the range of 2-5. On chroma, they are mostly in the range of low chroma in 2-6, with some doors and windows choosing high chroma in 8-14.

2.2.2 Analysis on Street Furniture

Then we will discuss and analyze the street furniture in Yangloudong. In fact, there is not a large amount of street furniture since Yangloudong is a residential area. Street furniture is roughly landscape decoration, stone benches, trashcans, etc.

First, we will analyze the dominant colors of the street furniture. The main street furniture in Yangloudong are stone chairs, and the color range is basically on YR~Y range (fig.19), and part of the chairs use bluestone to connect with the architectures and ground, in the range of B tone. Besides, there are trash cans as the decoration. Because there are no written construction regulations in Yangloudong, the trash cans are green, which is a common color just like those in any other places, without any connection with the architectural color or other public facilities.

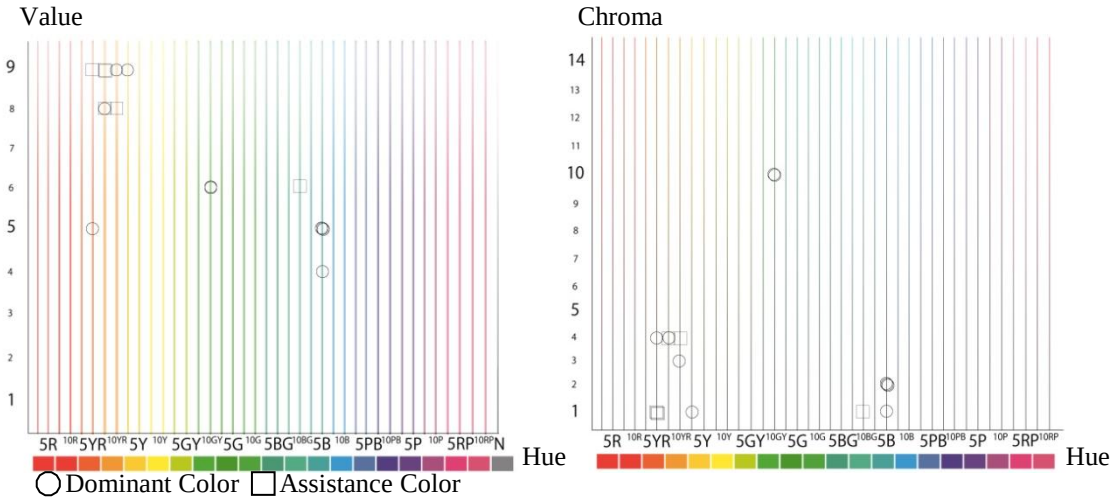

Fig.19 Color Data of Street Furniture in Chibi(N=144)

In the range of value, it largely concentrates in the range of 4 to 9, and the chroma in low chroma of 1-4 with part of the facilities using high chroma of 10. From the perspective of the field survey, YR stones mostly concentrate on the range of mid-value and low chroma, while the grey stones use a low value and low chroma.

Next, we analyze the assistance color. What can be seen from the graph is that, assistance colors basically focus on YR, BG and N interval range, and then in the scope of the achromatic color N. From the point of the field survey, assistance colors are basically the same kind of material with different colors and the text color on the trash can are in achromatic color N.

In terms of tone, the assistance colors are in mid-high value of 6-9 and low chroma of 2-4, which are relatively bright colors. While the colors of text are basically within the scope of N9, namely white.

2.2.3 Analysis on Sign

In this chapter the sign data in Yangloudong is to be analyzed. Theoretically, signs include indicator, sign of shop, billboards, etc. Yangloudong is a residential area, and has not been over developed, so there are only one or two shops. During the research, we find only one sign and one store sign. Because of the relatively small quantity, and the signs are man-made and set in recent years, we decide not to analyze the sign in Yangloudong.

2.3 Fenghuang

Located in Xiangxi of Hunan province (fig.20), Fenghuang was first founded in Kangxi 43 of Qing Dynasty. It has gone through 300 years-long vicissitudes(Liu 2005: 3). The ancient city got its name becasue there was a phenix-like mountain in the southwestern part of Fenghuang. Since ancient times, it has been the gathering place of Miao and Tujia.

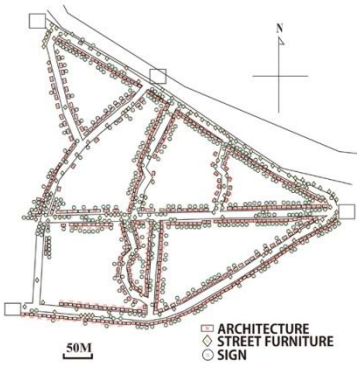

Fig.20 Location of Fenghuang Fig.21 Research Map Fig.22 Architecture in Fenghuang

Carried out in September 2013, the research covers the Fenghuang city that is surrounded by ancient city gates as shown in fig.21. Fenghuang town was built by the river and parts surrounded by walls are basically roads. The present research chose the ancient city as the target and investigated the colors of architectures along the road.

2.3.1 Analysis on Architecture

To begin with, we analyzed the color of roofs. From the graph in fig.23, we may see that the colors of the roof are mostly in the range of achromatic color and then R-Y, a small part of data is in the range of BG and PB. According to the present research, roofs in Fenghuang can be classified into three types in general: one is fully built by gray tiles, one is mainly built by gray tiles and complemented by wood materials, and the last one is built with the mix of black bricks and gray tiles and painted in white.

In respect of value, achromatic color roofs are mostly in the low-value range 1-3 and high-value range 9. A small part of data is in the range of medium value 6-8. The value of chromatic roofs is basically in the range of low-value 2-3. In respect of chroma, mostly are in the range of low-chroma 1-4.

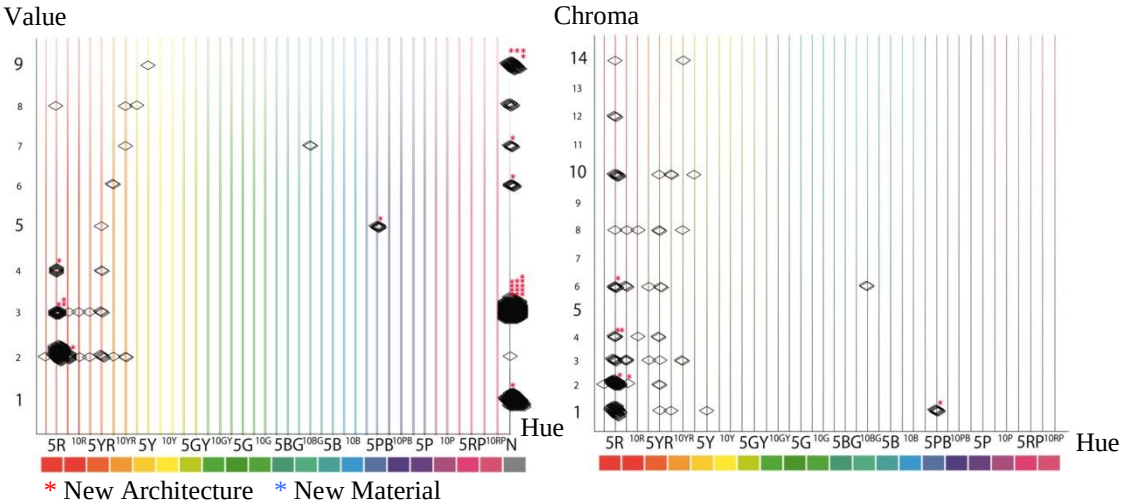

Fig.23 Color Data of Roof in Fenghuang(N=471)

Another focus of the present research lies in the color of exterior walls, which is the largest part in architectural colors. The fig.24 shows that the color of exterior walls is in the section

of achromatic color N and chromatic color R-Y. We carried out analysis on the materials of exterior walls due to its major influence on colors. The color of black bricks lies in the range of N and PB, stone in YR-Y, PB, N, wood in R-YR and coating in achromatic color.

In respect of value, parts of achromatic color are in the medium-value range of 4-7, then in the high-value range of 8-9. Chromatic parts are relatively widespread. Medium-high value 6-9 is most widely used, followed by medium-low value of 2-5. The chroma is in the range of 1-4 in most cases, followed by the range of 10-12.

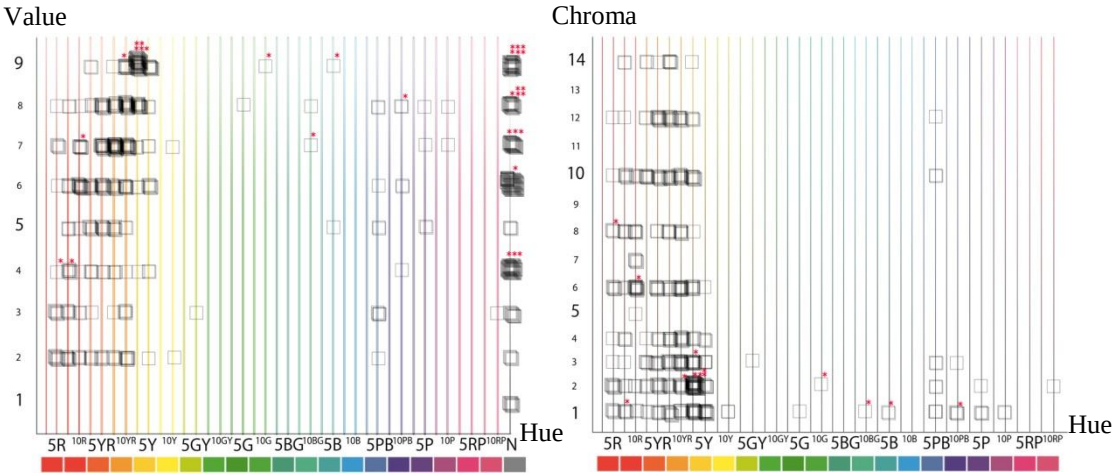

Fig.24 Color Data of Exterior Wall in Fenghuang(N=471)

In the following, we will analyze the colors of balconies of architecture. Research shows that the color of balconies is in the range of R-YR (fig.25) so as to match the exterior walls, doors and windows. A small part of balconies are in the color range of N, B and G. Due to renovations, metals and coating are used for balconies, which makes them diversified in colors.

As to value, achromatic color is in the range of 1, 6 and 9. However, chromatic ones are widespread in the range of 2-4 or 5-9. In respect of chroma, they are in the range of 1-4 in most cases while some other architecture have balconies of medium-high chroma. Colors are diverse due to the lack of prescription on their usage.

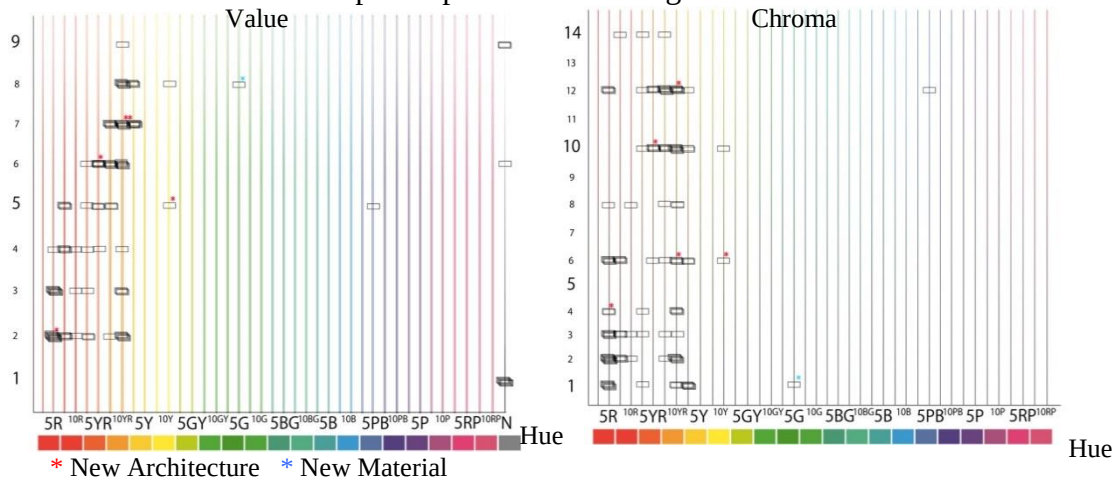

Fig.25 Color Data of Balcony in Fenghuang(N=120)

At last, we carried out analysis on the color of doors and windows of architecture. In respect of hue (fig.26), the range of doors and windows is the same, mostly between R-YR. Field research shows that doors and windows are basically made of wood. A small part of them are in the range of achromatic color.

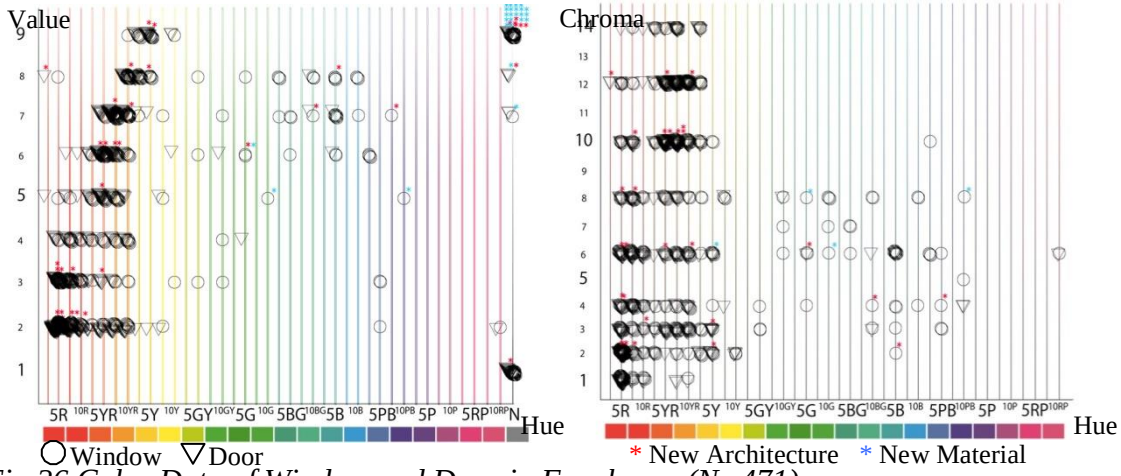

Fig.26 Color Data of Window and Door in Fenghuang(N=471)

In respect of value, achromatic color is in the range of 9, metal white in other words. The value of chromatic ones is widely used. Data shows that most of them are in the range of 1-6 while a small part are in the range of 7-9. As to the chroma, most of them are in the range of 1-4 and 10-14.

2.3.2 Analysis on Street Furniture

Then we will focus the analysis on colors of street furniture in Fenghuang, including landscape arrangement, benches, trash cans, street lamps, telephone booths and other outdoor facilities.

First of all, we analyzed the dominant color of street furniture. The general distribution of the dominant color lies in R-YR, then in the range of achromatic color N as shown in fig.27. The field research shows that street furniture are mostly made of wood, and a small part of them are made of stone. Colors of wood are in the range of R-YR while stones are in the color range of N and PB.

The value of achromatic color covers a large range since black, white and gray are equally used. Data distribution is also disordered in respect of chroma, with 1-4 and 10-14 being the most widely used. Due to the large number of street furniture and diverseness of their types, tones used in them are wide in range.

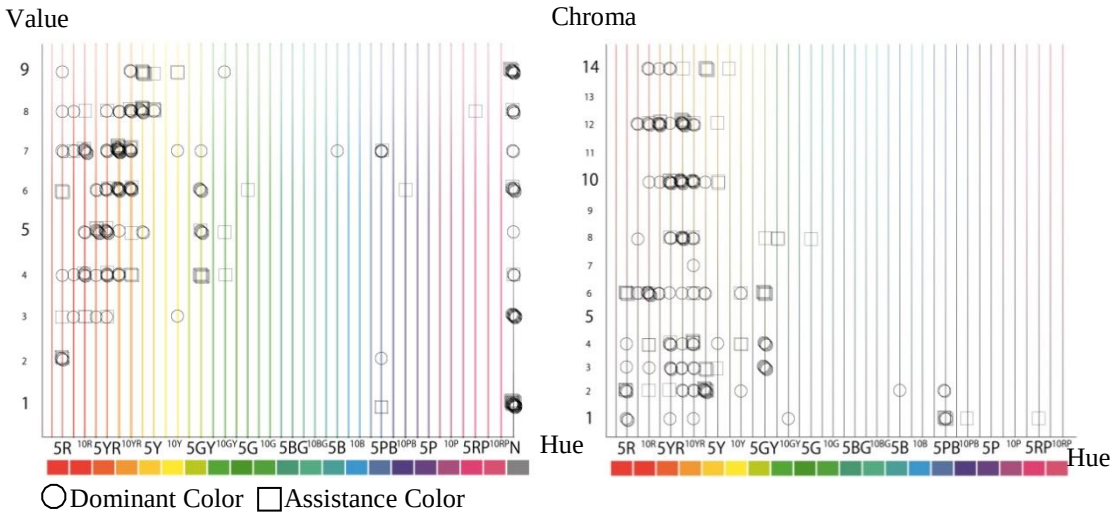

Fig.27 Color Data of Street Furniture in Fenghuang(N=120)

In the following, we will analyze assistance colors. Displaying assistance colors in the fig.27, we may see in graph that assistance colors gather in the range of R-G, PB and N. Field research shows that the text colors cluster in the range of YR-G and N.

In respect of value, assistance colors have diverse distribution. Achromatic color gathers in 4, 6, 7, 8, 9 while chromatic colors gather in the range of 7-9, followed by 1-6. Likewise, the usage of colors is not unified in chroma.

2.3.3 Analysis on Sign

Sign include direction signs, signages and advertising boards. In the research on the colors of sign, we classified their colors into background colors, text colors and pattern colors and then carried out measurement and analysis on them respectively.

First, we discussed about background colors. The hue of background colors is in the range of Y-R and achromatic color as shown in fig.28. Sign in Fenghuang are basically made of wood and stone, which are building materials matching its classic features. The color range of wood is between R-YR while that of stone is in Y, PB and N.

In respect of value, achromatic colors basically gather in the range of low-value 1 and high-value 9, black and white in other words. The value of colors scatter in a wide range and the chroma is not unified too.

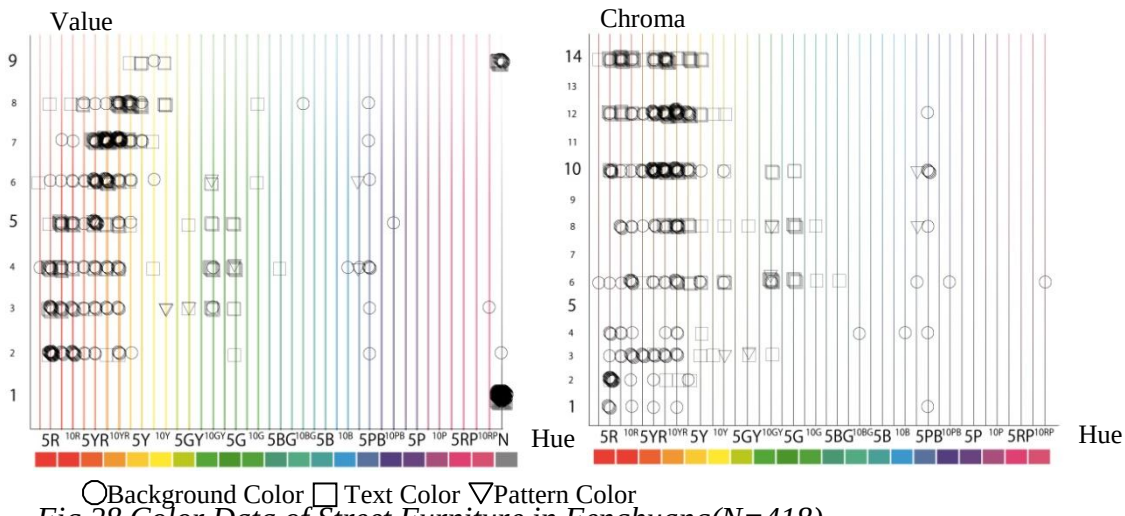

Fig.28 Color Data of Street Furniture in Fenghuang(N=418)

The following will focus the analysis on text colors and patter colors of sign. Analysis on pattern colors is incorporated into that on text colors since they are few in types and they are complementary with the latter. In respect of hue, text colors gather in the range of N and R-YR, then GY-BG. Only 4 patter colors are detected, ranging between GY-PB.

The value of texts with achromatic color is in the range of 1-9, black and white in other words, and then 5-9. Its chroma is in the range of 6-14. As to patten colors, their value is in the range of 3, 4 and 6 while their chroma is in the range of 3, 8 and 10.

Field research shows that text colors and background colors contrast in harmony. Backgrounds with low value and low chroma are often decorated with text colors of high value and high chroma. In addition, contrastive colors are also used, for example, red backgrounds often select green texts. As to pattern colors, they are used to match up text colors, which is the reason why they are consistent or similar.

3. Traditional Color

It firstly comes to the summary of the historicity in the central and eastern regions. These regions are geographically located in the central and eastern parts of China, with a long history and a large population. In the process of the development of history, the regions have experienced the division of land scope, the changes of the owners and other administrative, and each change has a significant impact to the culture, environment, customs, etc. Also, these changes also exert a subtle influence on the city colors. According to the research, the existing historical cities are affected most by the Ming and Qing Dynasties era(1368-1912), and the characteristics of the era are well remained. Therefore, the historical cities in this research all meet the basic characteristics of Ming and Qing Dynasties.

3.1 General Features

It is concluded in this research that the color of cities in certain area has some commonality, namely regionalism. According to the general characteristics in central and eastern regions of China, widespread color range in this area has been proposed on the basis of the unity in the region.

Firstly, the colors of the architecture are to be discussed. The colors of the roof, in the first place, are mostly consistent, namely grey with red wood as subsidiary, and a small amount of roof use white and grey bricks as material. Therefore, the colors of roof are in the range of achromatic colors, similar colors PB and red. As for the exterior walls, the whole materials are coating, yellow stone, grey stone, grey brick and wood, so the colors of exterior walls are achromatic colors R-Y. Besides, the material of the balconies, windows and doors is basically wood, the color of which is consistent with that of the exterior walls. As a result, in the large-scope color planning in this study, we choose a relatively wide-range data as the standard as shown in table 1.

Table 1 Regionalism Color of Architecture

Architecture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Roof	N	1-3,9		10B-10PB	2-5	1-2	5R-5YR	2-4	1-3
Exterior Wall	N	3-9		2.5R-5Y	2-9	1-12			
Balcony				2.5R-5Y	2-9	1-12			
Window and Door				10RP-5Y	2-9	1-12			

Secondly, the color statement of the street furniture is to be introduced. According to the similarity that is concluded from the data, the dominant color of the street furniture is mainly in the range of achromatic colors of coating, grey of stone, yellow of stone and wooden color. It is therefore determined the color of the street furniture as achromatic colors, B and YR-Y(table2). As for the assistance colors, they are similar to the dominant color with some difference, so the range of the assistance colors is relatively wide.

Table 2 Regionalism Color of Street Furniture

Street Furniture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Dominant Color	N	1-9		5B	4-5	1-2	5R-2.5Y	2-9	1-12
Assistance Color	N	1-9		10B-5P	3-6	1-4	5R-2.5Y	2-9	1-12

Last but not least, the colors of the signs are to be analyzed. Seen from the general material of the signs, they are mostly wood to support the architectural materials, and some are coatings as well. Therefore, the colors of the signs are in the range of achromatic colors and R-YR. In addition, the colors of the texts and patterns are almost the same, and according to the research, there is only a small amount of patterns, which is therefore not analyzed alone. The general range of the colors of the texts and patterns is in achromatic colors, R-Y and GY-G

Table 3 Regionalism Colors of Sign

Sign	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Background Color	N	1-1.5		5R-10YR	2-8	1-12			
Text and Pattern Color	N	1-2, 9		5R-2.5Y	4-8	6-12	5GY-10G	3-6	4-10

3.2 Color Planning

Individual color planning has been come up for each city on the basis of the characteristic of each city. Through the survey, we found that the individual features are observed by the color used in the exterior wall.

Varieties of colors are used in exterior walls. The most frequent color of architecture in Zhouzhuang is achromatic colors, at 71.76%, which is associated with 36.28% in range of RP-YR. For the base color, 60.88% architectures used the achromatic color as its main color. So, we suggest use more achromatic color in exterior walls. We proposed the individual color planning in table 4 and fig.29 for Zhouzhuang based on these features.

Table 4 Color Planning for Zhouzhuang

Architecture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Roof	N	3		10B-10PB	2-5	1-2	5R-5YR	2-4	1-3
Exterior Wall	N	8-9		10YR-2.5Y	7-9	1-4	2.5R-10YR	2-4	1-4
Balcony				2.5R-10YR	2-4	1-4			
Window and Door				10RP-10YR	2-5	1-8			

Street Furniture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Dominant Color	N	1-1.5		2.5YR-2.5Y	2-9	1-4	5B	4-5	1-2
Assistance Color	N	6		2.5YR-10YR	2-9	1-4	10B-5P	3-6	1-4

Sign	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Background Color	N	1-1.5		5R-10YR	2-8	1-8			
Text and Pattern Color	N	1-2; 9		7.5YR-2.5Y	7-8	8-12	5G-10G	4-5	4-6

Fig.29 Color Planning for Zhouzhuang

In chibi, varieties of colors are also used in exterior walls. The frequently color is N, at 83.33%, then in the range of R-YR, at 62.5%. For the base color, 67.36% architectures used the achromatic color as its main color. We proposed the individual color planning for Chibi on table 5 and fig.30. For the base color of exterior wall, we recommend the usage of achromatic color at 70%.

Table 5 Color Planning for Chibi

Architecture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Roof	N	3		10B-10PB	2-5	1-2	5R-5YR	2-4	1-3
Exterior Wall	N	3-9		10YR-2.5Y	7-9	6-8	7.5R-2.5Y	2-5	1-6
Balcony				7.5R-2.5Y	2-5	1-6			
Window and Door				5R-10YR	2-6	2-12			

Street Furniture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Dominant Color	5R-10YR	2-6	2-12	5YR-2.5Y	8-9	3-4	5B	4-5	1-2
Assistance Color	N	9		5YR-10YR	6-9	1-4	10B-5P	3-6	1-4

Sign	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Background Color	N	1-1.5		5R-10YR	2-6	2-12			
Text and Pattern Color	N	1-2		5R-2.5Y	4-8	6-14			

Fig.30 Color Planning for Chibi

While in Fenghuang, achromatic colors and R-YR are observed in similar amounts, representing 67.3% and 61.14% of total color respectively. For the base color, 57.32% architectures used the achromatic color as its main color. We proposed the individual color planning for Fenghuang on table 6 and fig.31. For the base color of exterior wall, we recommend the usage of achromatic color at 60%, and the 33% of R-YR.

Table 6 Color Planning for Fenghuang

Architecture	Hue	Value	Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Roof	N	1-3,9		10B-10PB	2-5	1-2	5R-5YR	2-4	1-3
Exterior Wall	N	4-9		5R-5Y	2-9	1-12			
Balcony				5R-5Y	2-9	1-12			
Window and Door				5R-5Y	2-9	1-12			

Street Furniture	Hue	Value Chroma	Hue	Value Chroma	Hue	Value	Chroma
Dominant Color	N	1-9	5R-2.5Y	2-8 1-12	5B	4-5	1-2
Assistance Color	N	1-9	5R-2.5Y	2-9 1-12	10B-5P	3-6	1-4

Sign	Hue	Value Chroma	Hue	Value	Chroma	Hue	Value	Chroma
Background Color	N	1-1.5	5R-10YR	2-7	1-12			
Text and Pattern Color	N	1, 9	5R-2.5Y	4-8	6-14	5GY-5G	3-6	6-10

Fig.31 Color Planning for Fenghuang

4. Conclusions And Discussion

According to the research and investigation in the three ancient cities in the central and eastern regions, the characteristics of the environmental color and the method of using colors in city environmental color are concluded. We know that the color range of these three cities is basically the same. However, frequency of color, area of color application, and the difference of tones are major elements to show individual characteristics of the three different cities. Therefore, environmental color planning should be focus on elements about frequency of color and area of color application.

In the conclusions, we found that not only the range of color, some other elements also have an important influence on environmental color. In this study, we proposed the color planning based on the current situation. The next step, we will consider the application of frequency and area of color on environmental color planning.

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Adaptive Urban Chromatic Control Method. Case Study In Bucharest, Romania

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Abstract

After the communist era, in the early '90s, the Romanian urban landscape gradually began to change, as new materials and colours became available. These, together with the desire to be detached from the former forced uniformity of communism, on the one hand, and the significant gaps in the urban Romanian legislation, on the other hand, have nowadays led to a chaotic landscape and a chromatic "dizziness" affecting the global image of the Romanian cities, an urbanscape torn between excessive polychromy and colour chaos.
In this context and given the obvious change in the colour quality of the Romanian built environment, this article proposes a method of adaptive urban chromatic control based on the analysis and synthesis of chromatic informations that exist in-situ aiming to generate urban chromatic regulations.
Within the synthesis of the field data it was aimed to objectify the results by using a mathematical formula that generates the colour profile of the streets expressed in percentages. The adaptive character of the resulted chromatic schemes derives from the consideration of the urban development strategies of municipalities, of the colour preferences of residents and also of the dynamic nature of the chromatics of an area. This method is tested in a case study on a street in Bucharest.
The study has generated a number of colour schemes that can provide to the local authorities a basis for the achievement of colour regulation of the area. Due to the ease of implementation and to its objectivity, this method can be used in the planning process of the chromatic urbanscape.

Introduction

After 1990, when the communist regime colapsed, the Romanian chromatic urbanscape began to be assaulted by the rehabilitation of the individual housing and / or public buildings but also by new constructions, culminating with the chromatic rehabilitation, as part of the thermic rehabilitation, of the communist blocks of flats. The lack of coordination at the city level led to chaos both from the urban and architectural point of view and also in terms of colour.

Colours like purple, orange, red, blue or deep green heaved gradually in sight in the urban landscape (dominated by gray) representing evidences of the 'taste' of the owners of the buildings and the lack of interest shown by the authorities and professionals with reference to the colour.

The colours, the textures and the materials were mostly used to emphasize the financial power of the owners of the buildings and, in a way, those were a sign of freedom.

In this context and given the obvious change in the colour quality of the Romanian built environment, this article proposes a method of adaptive urban chromatic control for the purpose of generating urban chromatic regulations. The method aims to establish and coordinate at the City level a general chromatic table based on the analysis and synthesis of chromatic informations that exist in-situ.

The Method

The method of colecting and synthesis of the chromatic informations is based on a mathematical formula aiming to objectify the process.

This method is applied beginning with the sub-zone level and requires accurate mapping of the existing colours, textures and materials and the integration in successive steps of the informations at the zone level and finally at the city level (Figure 1).

Mapping of the existent chromatic pallette takes into account all the informations that contribute to the chromatic environment, except the daily layer, the most variable one, represented by people, vehicles, traffic signs etc.

In other words the collected chromatic informations are taken from the geographic and climatic layer (climatic characteristics, sunlight, soil, water, vegetation etc), the built layer (streets and buildings) and the layer of the natural landscaped (planted vegetation, lakes etc).

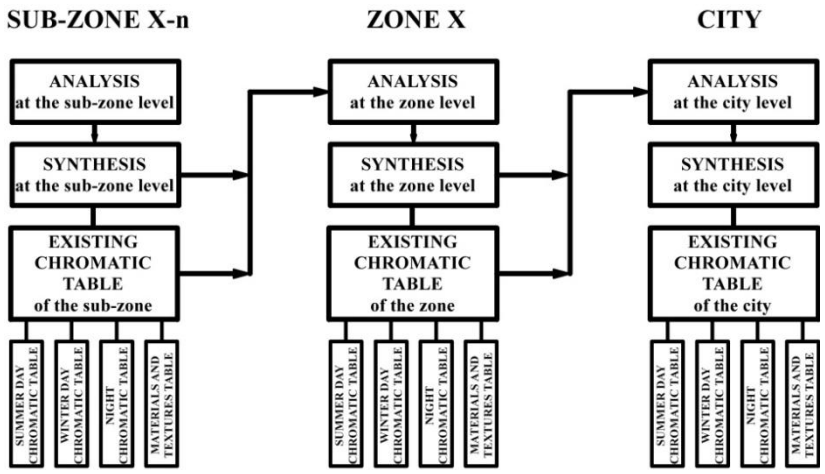

Figure 1. Proposed method - Strategy of mapping of the existent chromatic situation

Once the informations are synthesized at the macro level of the city it can be developped a chromatic strategy and a colour plan for the entire city given both the urban development strategies and the feedback received from the public (Figure 2).

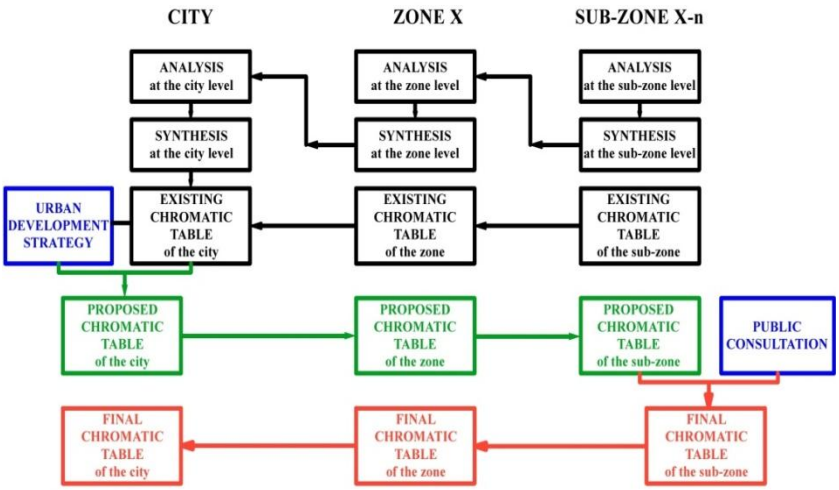

Figure 2. The proposed method - Strategy of establishing a coordinated and unitary chromatic table

Mapping of the existent chromatic informations

This method is based on the analysis of the information collected from the field using the global perception (Lenclos 1999 [2004: 60]), the elemental perception (Lenclos 1999 [2004: 60]) and, where appropriate, the informations from historical studies.

The determination of the proportions is made on the photographies using a grid (O'Connor 2006 [2006: 23]).

The steps of the analysis are as follows:

1. The summing of all the surfaces of each street front by linking cadastral plans and photos. The amount so obtained will be 100%.

2. For every surface it will be assigned coefficients as follows:

Changing probability coefficient (P_s):

Surfaces which have a high probability of change (obsolete, very degraded façades and fences) $P_s = 0.6$

Surfaces which have a medium probability of change (façades and fences in average condition, showing no significant degradation) $P_s = 0.8$

Surfaces which have a low probability of change (façades and fences recently completed or rehabilitated) $P_s = 1.0$

$$= \sum (C_{1\dots n} x H_{1\dots n} x P_s + G_{1\dots n} x h_{1\dots n} x P_s)$$

where:

F_a = 1 or 2 front surface of the street

$C_{1\dots n}$ = the length of the building façade *1* ... *n* located in the front *a* of the street

$G_{1\dots n}$ = the length of the fence of the building field *1* ... *n* located in the front *a* of the street

$H_{1 \dots n}$ = the height of the building *1* ... *n* located in front *a* of the street

$h_{1 \dots n}$ = the height of the fence of the building *1* ... *n* building located in front *a* of the street

P_s = probability of change coefficient

3. In a similar way there will be revealed the colours, materials and textures associated with the street (S) and also the front ends of the street (the background on which it is projected).

$$+ T + V + M$$

where:

A = the area of the roadway

T = the area of the pavement

V = the area of the existing vegetation on the street expressed as a percentage, may be greater than 100% of the road surface and the pavement ("floor" itself) according to its share in the overall picture;

M = the area of the existing urban street furniture expressed as a percentage of the road surface and the pavement (of the "floor" itself) by its share in the overall picture.

4. The tables will be built on the current chromatic situation illustrating the existing sub-sample area and the materials and textures, and share their physical and sentiment, as follows:

- Table of colours - summer day;
- Table of colours - winter day;
- Table of colours - night (will signal the presence of materials with certain characteristics that contribute to a significant change in perception)
- Table of materials and textures

In developing these tables it has to be taken into account the perceived colour changes depending on the degree of sunlight available at the time of data collection.

5. These tables will be summarized and will constitute the existing colour range of the sub-zone. (Figure 2)

The existing chromatic informations of the sub-zones will be integrated in the chromatic analysis of the zones and, respectively, in the chromatic analysis of the city. Together with the urban development strategy and the public consultations it will result in a general chromatic pallette that will represent the guiding lines or boundaries of the colours, materials and textures of the city as a whole, zones and sub-zones of the city.

Case study: Bucharest, Romania, Bahluiului street, 1st district

In order to validate the proposed method of collecting chromatic informations a case study was built.

Materials: The chromatic informations were collected using colour palletes and photographies: the colours were compared to the colour pallettes and the materials and textures were photographed. There was no in-situ prelevation of materials.

Limitations: The accuracy and the validity of the entire strategy cannot be actually evaluated because Romania still has several legislative gaps.

A brief view shows that residential buildings were chromatic rehabilitated (inevitable in case of the thermic rehabilitation) without a specific rule. Each contractor / architect has imposed both colours and colouring scheme (Figure 3).

Figure 3. The thermic and chromatic rehabilitation of the blocks of flats, Bucharest

Bahluiului street, part of the 1st district of Bucharest, is located in the area bounded by Calea Griviței street, Nicolae Titulescu boulevard, Turda Street and Ion Mihalache boulevard (Figure 4). The tall blocks of flats (up to 11 stories height) guard an area dominated by individual houses with no more than 3 stories height.

Most of the blocks of flats in this area were thermic and chromatic~~al~~ rehabilitated using arbitrary colours and colour schemes.

Trying to avoid the propagation of this situation also to the individual housing, to raise the awareness of local (general) authorities on the impact of colour on the urban environment, this study is focused on a street where individual houses built before 1989 are mostly dominating (Figure 5).

Figure 4. The area bounded by Calea Griviţei street, Nicolae Titulescu boulevard, Turda street and Ion Mihalache boulevard

Figure 5. Bahluiului street

Mapping of the existent chromatic situation

The *global perspective* (Lenclos 1999 [2004: 60]) aims to highlight both the dominating colours and materials and also the existing parasite colours and materials in the study area.

These images (Figure 5) illustrate the background colour on which the street is projected: blocks on Titulescu boulevard (recently renovated) and individual houses on the Costache Marinescu street (some renovated, some not).

Figure 5. The global perspective - eye level - Bahluiului street

The global perspective of the street reveals that the dominant colours for buildings are white and yellow earth. It also can be seen in the background a blue coloured façade and also a vivid green façade of the blocks of flats on Titulescu boulevard, recently rehabilitated, colours that appear to be parasitic.

The *elemental perception* involves revealing the existing colours in situ for each field using standard pallettes. The survey highlights the colours and proportions between the front present for each field separately (Figures 6 and 7).

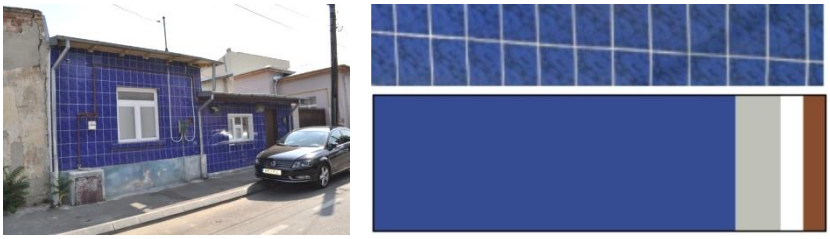

Figure 6. Photographic survey of the colours and textures and of their proportions 36 Bahluiului street

Figure 7. Photographic survey of the colours and textures and of their proportions 22 Bahluiului street

Similarly, for each field were revealed the colours and the textures as well as their proportions; the pallettes were summarized and a cumulative pallette of colours and textures was created for the entire street as wall as for the immediate vicinities (Figures 8 and 9).

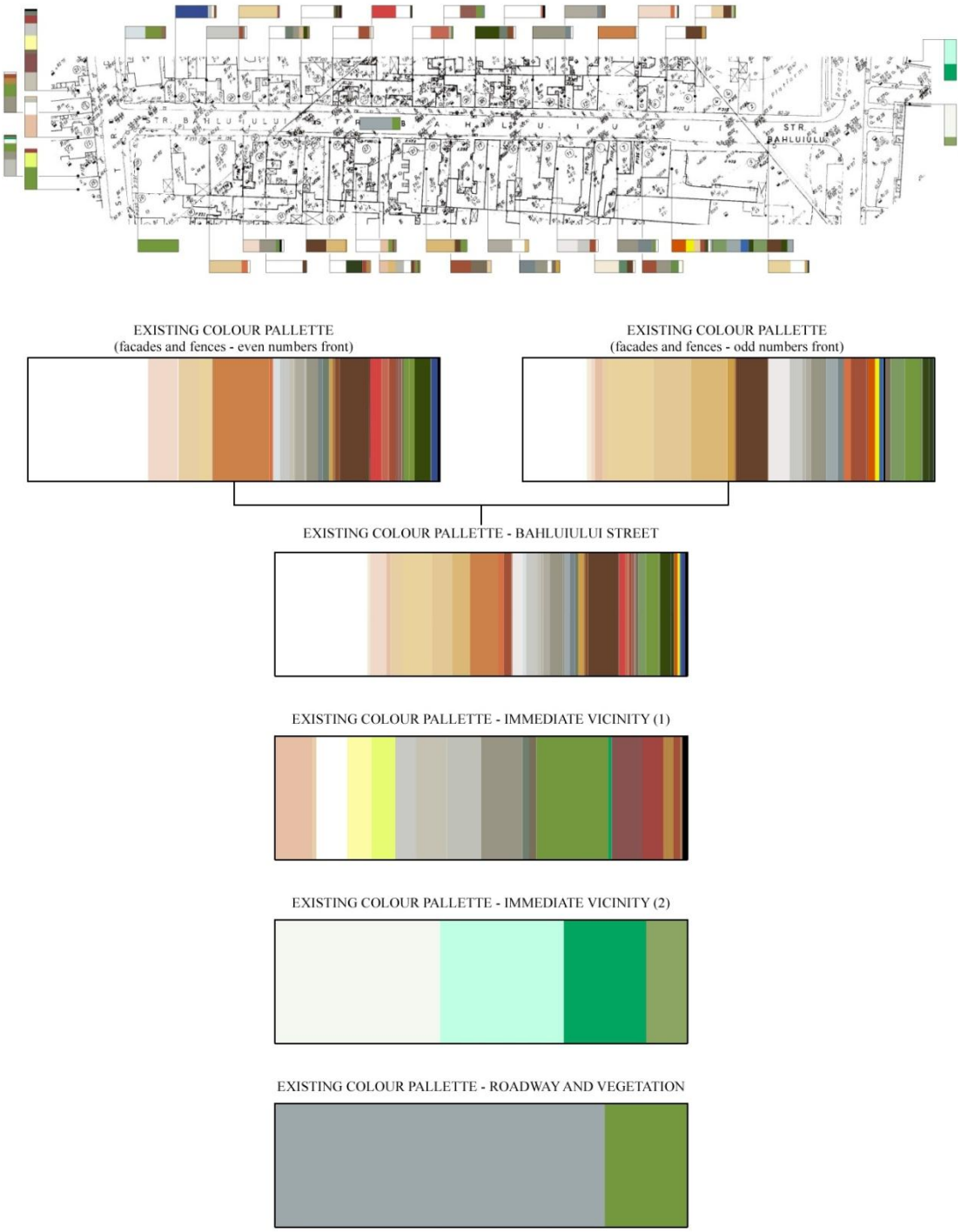

Figure 8. The existing colour pallette of the Bahluiului Street and of the immediate vicinities

Figure 9. The synthesis of the dominant existing materials and textures

The colour and textures palettes present the existing situation in the area. Depending on them, there could be made proposals concerning the chromatics (only after a coordination at the entire city level).

The proposals presented below (Figure 10) start from the existing situation by removing the parasitic colour and / or texture and generating more colouring options focused on a harmonious modeling of the existent chromatic situation.

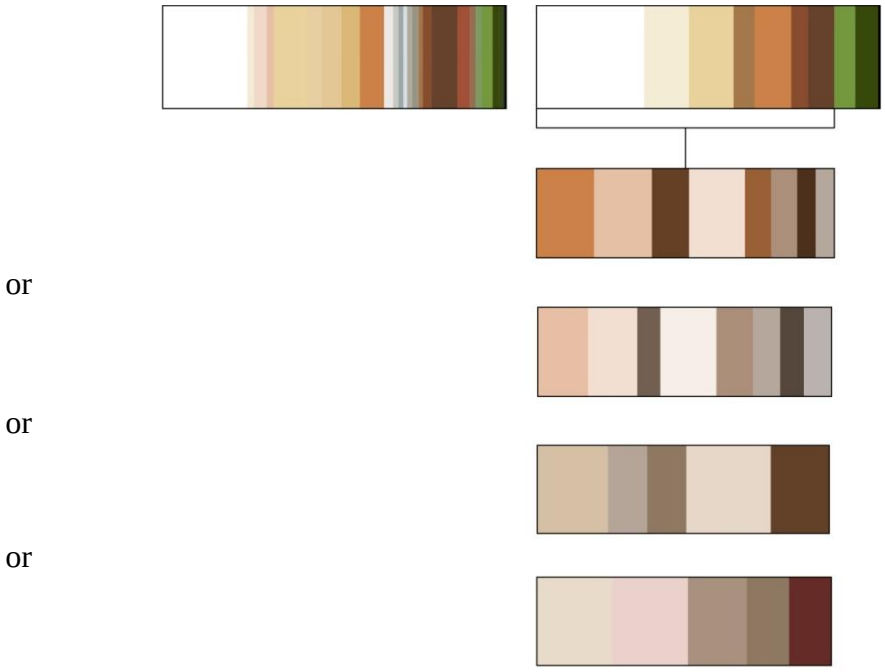

Figure 10. Proposed colour palette for the studied street

The analysis of chromatics and textures revealed in situ emphasized the presence of some materials used improperly (tiles applied externally) as well as some colours that at street level can be considered parasitic (blue, red, deep yellow). Regarding the used textures (different variants of outside plasters from the traditional, very fine grained, to the present ones, with a more pronounced granulation) except the texture generated by plating an entire exterior wall with tiles, they are similar in appearance, at the level of perception.

The application of the method generated pallets of colours and textures available on the analysed street, pallets that, as confirmed by the photographic survey comply with the reality existing in situ.

At the time of the synthesis there are thus approached and analysed all the present colours and textures so that the decision to remove or add a colour / texture to be expressed taking into account the whole picture of the street.

Conclusions

The proposed method objectifies to a large extent the selection of colours and textures by using mathematical formulas easy to apply.

The proposed method for mapping the existing chromatic situation is not difficult to be used by anyone, even a non-specialist.

The synthesis phase has to be performed only by architects and urban planners.

Through this method it is created a potential strategy for controlling and adjusting the urban chromatics.

The adaptive character of the resulted chromatic schemes derives from the consideration of the urban development strategies of municipalities, of the colour preferences of residents and also of the dynamic nature of the chromatics of an area.

Creating a harmonious and unified image of the city depends on the colour planning and a rigorous control of it.

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