AIC 2019

Book of Abstracts

AIC 2019 Color and Landscape

Midterm Meeting of the International Color Association (AIC)

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AIC 2019 Color and Landscape
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International Color Association (AIC)

Buenos Aires, Argentina

14-17 October 2019

This publication includes abstracts of the plenary lectures, oral and poster papers submitted to the International Color Association (AIC) Midterm Meeting 2019 and accepted by the Scientific Committee. The theme of the conference was Color and Landscape. The conference, organized by the Grupo Argentino del Color (GAC), was held in Buenos Aires, Argentina on 14-17 October 2019, at the Universidad de Belgrano (UB), Zabala street Nr. 1837.
More information: http://aic2019.org

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AIC president's message: Tien-Rein Lee

Dear members of the AIC, dear color friends!

It´s time again to celebrate another wonderful event of our international color society:
The AIC 2019 Midterm Meeting is being held in Buenos Aires, Argentina, from 14-17 October, under the brilliant topic: "Colour and Landscape". So I´d like to send out a very warm welcome to all scientists, artists and friends of the worldwide color research and arts communities, and I sincerely hope that we will share this opportunity to meet on common ground for an intense exchange of many different views and perspectives!

It is to my great pleasure that we can announce this conference as a real high-profile expert gathering, offering a range of 21 topics in 10 fields of color research, plus forums led by AIC Colour Association's study groups. The Judd Award will be presented to Prof. Hirohisa Yaguchi, Chiba University / Japan; and the AIC CADE Award will be given to Prof. Roy Osborne, artist, educator and writer / UK. We are also looking forward to five plenary lectures and an exhibition. With such an attractive program and several highlights coming up, I have no doubts that we are going to enjoy a most exciting and interesting event!

So, let me express my deep gratefulness to the Organizing and Scientific Committees, and to everybody who has worked hard to realize this Midterm Meeting: I am sure that those great efforts will be honored as a substantial contribution to the world of color research and color arts, and that its conference findings is going to have a lasting impact on all fields of color expertise: Thank you very much!

In addition to the multifaceted professional program, the program also includes highly attractive cultural activities that shouldn't be missed - the excursion to the town of Tigre on the Parana river, and a banquet with Tango performance. Let´s all join in and take part in this special experience, providing us with a taste of original Argentinian culture!

I wish everybody a fantastic time in Buenos Aires!

Tien-Rein Lee
President
Association Internationale de la Couleur

AIC past president's message: Nick Harkness

Dear Friends

Colourful greetings and welcome to AIC 2019 Colour and Landscape. Firstly, a big thank you to Maria Paula Giglio and the team from Grupo Argentino del Color for organising this AIC event. The level of commitment required (all voluntary) to hold an AIC meeting is enormous.

It is nine years since we last met in Argentina at Mar del Plata June 2010. Welcome back this time to the colourful city of Buenos Aires. In 2016 we also met in South America in the vibrant city of Santiago with of course a side trip to colourful Valparaiso.

The topic for this meeting is very timely with so much environmental destruction. The rain forest of the Amazon, the lungs of the planet are being decimated by fires. They generate around 20% of the oxygen in the atmosphere and store greenhouse gases such as carbon monoxide. Adding to which the increasing loss of the polar ice caps and shrinking glaciers, have an exponential negative impact on global warming. I am sure there will be many presentations and conversations highlighting the critical state of our colourful and beautiful environment during AIC 2019.

The AIC clearly illustrates what can be achieved by mutual co-operation and understanding. The Society is in harmony in terms of geography, ethnicity, academic discipline and language. A truly global community.

This year draws to the end my formal commitment to the AIC and its Executive Committee. A journey which started in 2004 at the AIC Interim Meeting in Porto Alegre, Brazil when I presented the Colour Society of Australia's bid for the AIC 2009 Congress in Sydney to the AIC Executive Committee, at that time chaired by Paula Alessi then President of the AIC.

It has been a truly amazing experience resulting in so many friends in the colour community.

To you all, have a superb colour experience in Buenos Aires, seize the day, have fun and continue to grow your love for the wonderful world of colour.

Best regards

Nick Harkness

Immediate Past President AIC 2019

AIC 2019 chairman's introduction: José Luis Caivano

The Book of Abstracts of AIC 2019 "Color and Landscape" includes all the submitted abstracts that were accepted by the Scientific Committee of the conference. Each abstract was reviewed by at least two members of the Committee, many abstracts received three evaluations, and some, even four. The EasyChair system and platform was used for this process. The total number of submitted abstracts was 131, from which 129 were accepted. We are grateful to the members of the Scientific Committee who accomplished this task.

From the list of topics proposed, the most frequently chosen topics selected by the authors to frame their abstracts within the theme of the conference were as follows, in decreasing order:

topic	number of abstracts that selected the topic
Architecture	40
Identity & heritage	30
Urban landscapes	30
Psychology	28
Arts	25
Urban planning	25
Cultural landscapes	20
Natural landscapes	16
Digital color	14
Landscape design	14
Seasonal color changes	10
Landscape painting	10
Color descriptions in literature	10
Other topics: Physics, Geography, etc.	9 or less

With regard to the geographical distribution of the authors, 31 countries from the five continents are covered, with the panorama of the table below, where only 26% of authors are from the hosting country, while 74% come from overseas, which makes the conference truly international.

country	number of authors	local vs. foreign
Argentina	64	64 authors **(26%)**
Japan	28	
Brazil	24	
United Kingdom	19	
Portugal	11	
Taiwan	10	
China, Colombia	8, from each country	
Mexico, Turkey	7, from each country	181 authors **(74%)**
Belgium, Italy, Norway, Spain	6, from each country	
Chile, USA, Sweden	4, from each country	
France, South Korea, Switzerland	3, from each country	
Algeria, Iran, Uruguay	2, from each country	
Australia, Austria, Bulgaria, Canada, Germany, Hungary, Peru, Russia	1, from each country	
	total: 245 authors	

Thus, even when in AIC thematic conferences —i.e., Interim and Midterm Meetings— some of the papers do not address specifically the theme but are related to some other issues of color inquiry, and this is the case too, we hope to cover a good deal of the most recent research about color in relation to landscape from all over the world. The abstracts included here provide just a brief description of the works to be presented in the conference, either as plenary lectures, oral papers or posters. We look forward to see the presentations and have them developed in length in the Book of Proceedings, to be published shortly after the conference, including the full papers of the works actually presented during the AIC 2019 Midterm Meeting.

AIC 2019 organizing institutions & committees

The Grupo Argentino del Color (GAC) is responsible for the organization of the AIC 2019 Midterm Meeting, at the Universidad de Belgrano (UB).

Grupo Argentino del Color (GAC)

The GAC is a non-profit civil association created in Buenos Aires in 1980. Its aims are to encourage studies and research on color, and disseminate the results. Besides, the GAC promotes exchanges with other color associations, holds a specialized documentation center, and integrates various fields of color study in different areas: science, technology, art, design, industry, etc. The GAC is a regular member of the International Color Association, and is the organization that represents Argentina in the AIC.
Web: http://grupoargentinodelcolor.blogspot.com
Mail: gac@fadu.uba.ar

Universidad de Belgrano (UB)

Founded in 1964, the Universidad de Belgrano (UB), is a center of higher education located in Buenos Aires. The UB distributes its faculties in the headquarters of Zabala and Villanueva streets, and in Lacroze avenue. Studies comprise Architecture & Urbanism, Agricultural Sciences, Health, Economics, Exact & Natural Sciences, Law & Social Sciences, Humanities, Engineering & Information Technology, Languages & Foreign Studies. PhD, master, and specializations are offered in most of these fields, as well as in Business and Psychology. The university operates a radio station and features various sports activities, some with teams competing at inter-university level and in sports leagues.
Web: www.ub.edu.ar

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AIC Buenos Aires 2019 Midterm Meeting theme
Color and Landscape

The theme covers different aspects of the landscape, including its visions, constructions, and configurations.

The concept of landscape has a double existence: the observer and what is observed. It can be thought of as having natural and social configurations; a product of actions and interactions of nature and humans; a perception by a social group and individuals.

The landscape has an objective and subjective character; it is a social and cultural construction, a visual reality and a mental image, a transformation from the idea of terrestrial surface to that of identity in a society.

Color and landscape can be . . .
described, written, perceived, drawn, painted, lived, remembered, walked, traveled, thought of, colored, represented, prefigured, created, designed, inhabited, symbolized, transformed . . .
from literary, physical, pictorial, cultural, patrimonial, archaeological, anthropological, psychological, historical, philosophical, aesthetic, sociological, geographical, topographic, or epistemological points of view, among others.

The logo of the Meeting uses the colors of jacaranda flowers. The jacaranda is a typical tree of intertropical and subtropical America. It blooms in spring, and in this season makes part of the landscape of Buenos Aires city. Jacaranda flowers, arranged in clusters, have a purplish blue color that remains for a long time in the tree. When they fall, generate a purplish carpet.

María Paula Giglio
President, Grupo Argentino del Color

Oral papers and posters by topics

Plenary lectures

Plenary Lecture

Jean-Philippe Lenclos' methodology of the "Geography of Colour": Back to the origins and its international impact

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Abstract

In the Proceedings of the International Colour Association Conference 2018, nine papers referred to Jean-Philippe Lenclos' methodology for analyzing and synthesizing colours in the urban environment, a concept that he called the "Geography of Colour". The authors of these papers are coming not only from European countries, but also from Latin America and Australia. This fact tells us much about the international impact that the "Geography of Colour" has still today: United Kingdom (Mikellides), Portugal (Diz de Almeida and Caramelo Gomes), Poland (Kwiatkowska-Lubańska and Tarajko-Kowalska), France (Ollier), Finland (Pyykkö), Turkey (Küçükkılıç Özcan and Ünver), Peru (Arrarte-Grau), Brazil (Brasil and Guerreiro), and Australia (di Cara).

The aim of this paper is to go back to the sources and thoroughly study Jean-Philippe Lenclos' "Geography of Colour" as a concept that he developed in the 1960s. Important is also how the idea came into being. "While drawing in the tiny streets of Gion Machi and in gardens and temples, Ryoan-ji, Daizen-in, Ginkaku-ji, Koke-dera..., I was seeing space anew. In the silence, I learned the whole extent of matter and the beauty of rhythms. And the precious shadows of Tanizaki helped me, by pure contrast, to mesure the primacy of the light that gave life to every color. Then the idea came to me, as proof, that Japan's specific colors took part in its cultural identity. This revelation was born of the comparison with my own country of origin, the Pas-de-Calais, in the north of France where Matisse was born–a humid land where the habitat pays tribute to the bright tones of its orange tiles and brick-red façades, constrasting in a Fauvist manner with the intense green of the vegetation." (Jean-Philippe Lenclos, 1999).

Lenclos applied "The Geography of Colour" to a country, town, or village. He began with the systematic inventory of local colours and architectural traditions in various regions of France. Considering regional colours as belonging to the history, geography, and cultural identity of a place, the concept was extended beyond his native France to other European countries and beyond to other continents. These efforts resulted in a distinguished body of publications including: *Colours in France* (1982), *Colours in Europe* (1995), *Colours of the World* (1999), *Doors of the World* (2001), *Windows of the World* (2001), *Houses of the World* (2007), and *Colours of the Mediterranean* (2016). Some of the books co-authored with his wife Dominique Lenclos have been translated into English, Japanese, and Korean.

Furthermore, this paper analyzes the ways in which his ideas were applied in the nine papers mentioned above.

Keywords: local colour culture, colour methodology, urban environments, geography of colour, Lenclos

Plenary Lecture

Effective environmental visual literacy:
Pedestrian crossing design and the key roles of colour and contrast

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Abstract

Environmental visual literacy is the capacity to 'read' and understand passive design features embedded in the built environment. Effective environmental visual literacy occurs when human interactions with the built environment are safe and meaningful to users. That is, when design factors embedded in the built environment not only enhance aesthetic and encourage engagement, but support orientation and wayfinding, and the safe operation of daily activities. Colour and contrast can play an integral role in this process, simultaneously attracting attention to key design elements and enhancing safety.

Evidence-based colour and contrast strategies represent an approach to environmental design that acknowledges the range and extent of visual capacity and deficiency among users and aims to improve the interface between the built environment and users, irrespective of age and visual capacity. This paper reports on findings from a study which investigated the roles of colour and contrast in pedestrian crossing designs. The study's hypothesis focused on the effectiveness of colour and contrast in enhancing environmental visual literacy in pedestrian crossing design. The research primarily drew on theories and methodologies from environment-behaviour studies (EBS), research that focuses on human interactions in the built environment. In addition, this study was also informed by Gestalt principles of perceptual organisation; theories of colour and colour application; and visual literacy research.

Qualitative/quantitative research methods and specifically, nominal group consensus technique was employed to evaluate a set of intervention pedestrian crossing designs. Evaluations occurred at the annual conference of the Colour Society of Australia (Melbourne, 2018) and AIC-2018, AIC Interim Meeting (Lisbon, 2018). The nominal groups at these conferences were deemed to relevant knowledge and experience specific to the aims of the research study. The intervention designs featured a range of specific variations of colour and contrast elements. These specific variations were linked to the roles that colour and contrast play in human visual perception and in particular, perceiving and cognitively identifying environmental design factors.

The set of designs that were used in this research not only reflected current trends for colourful, abstract pedestrian crossing designs but more importantly, employed colour and contrast strategies that enhance environmental visual literacy. The set of designs included two variations of traditional pedestrian crossing designs as well as variations that featured combinations of high chroma, low chroma, contrasting and analogous colours.

Evaluations from two groups of colour experts were analyzed. The findings suggest that particular high chroma, contrasting colour variations in pedestrian crossing designs attract more attention and stand out more than traditional pedestrian crossing designs. These findings provide a basis to recommend changes to pedestrian crossing design to improve pedestrian safety. The next stage of this research involves implementing specific pedestrian crossing designs and conducting in-situ research to determine effectiveness in a real setting.

Plenary Lecture

Landscapes used in design and art:
The work of Fred Jordan, the Brazilian master of color

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Abstract

The aim of this paper is to present an academic research that was done at the Design Undergraduate Course at ESPM University, São Paulo, Brazil, about a designer and artist, Fred Jordan. Jordan's work is today part of the Brazilian cultural heritage and relevant for the comprehension of the visual history in Brazil (RUGAI, 2012). Particularly, the focus here is related to the use of landscape in his work. All of Jordan's work is extremely chromatic and much appreciated and used as reference by other Brazilian designers (Borelli, 2001). Fred Jordan was born in Berlin, Germany and came to Brazil in 1936, when he was nine years old. Jordan studied Fine Arts in São Paulo, Brazil and started to work for advertising companies in 1944. Great part of Jordan's work, in advertising, design or art, show a deep interconnection with the ideas of Goethe and other German artists and authors from the first half of the nineteenth century. The empirical part of this research covered a historical critical evaluation of Jordan's works, conducted at his former home place. This empirical research lasted for one year and also involved semi-structured interviews with members of the family. Results presented include an analysis of the way Jordan used chromatic landscape in his work. Jordan produced several works reflecting German naturalist thinkers' ideas on the meaning of life, time, art and artists. From studies of natural phenomena referenced in his calendars, for example, Jordan exploited, through his illustrations the meaning of relationships amongst people in society. For him, nature's balance depended on the connections observed in many aspects in the world, on the evolution of the Universe, on the History of Humankind. Jordan worked with a lot of lyrism and he revealed his poetic subjectivity in his work. He presented an immersion in his own world, full of emotion and subjective feelings. To him, time was a crucial element which transformed his calendars – seemingly useful artifacts – into insights about the world and the permanence of mankind. It is intended here to make known the work of Fred Jordan, who has greatly influenced the cultural chromatic heritage of Design in Brazil.

Keywords: design, art, landscape, German thinkers, nineteenth century

Plenary Lecture

Colour theory and neo-impressionist landscapes

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Abstract

Neo-Impressionism, pointillism and divisionism are terms often used interchangeably, but they have completely different meanings. *Neo-Impressionism* is an art movement which appeared in 1886 and was popular first among French, but soon thereafter also among other, mainly, Belgian, Dutch and Italian painters. *Pointillism* is the technique of placing small dots of paint close to each other on the canvas, wanting to create (but, as we shall see, not necessarily succeeding in) the optical mixing of different colours. *Divisionism* is the technique of placing dots, dashes or patches of different (often complementary) colours next to each other, and it may or may not use pointillism as the basic technique.

The theoretical foundation of neo-impressionist painters goes back to the works of Chevreul and Ogden Rood, both well known and, according to contemporary sources, well studied by Seurat, Signac & Co. The scientific novelty in end of 19th century France was the application of *complementary colours* next to each other, which - at least according to Seurat's views - should have given a more luminous aspect to these paintings. The somewhat erroneous expectation that the "additive mixing" of tiny dots of primary colours (and here they already knew that in this situation those were red, green and blue) would result in white, or at least in brighter colours than the primaries themselves, caused disappointment.

In this paper we shall discuss the difference between *additive mixing of lights* (as happens in projecting overlapping lights of different colours or in spatial fusion of RGB dots on a monitor) and *partitive* (averaging) *mixing* of the reflectance of tiny paint dots (as in a pointillist painting) or that of differently coloured sections of a spinning disk. We shall see the reason for the fascinating impression created by these neo-impressionist painting being the result of the simultaneous contrast effect of neighbouring colours when watched from close and the optical mixing of the same when watched from a distance. According to recent research the dichotomy is also caused by the characteristic of human vision: the colour resolution of the human eye is much lower than the form resolution, and the unique scintillation of these painting seen at a certain distance is the result of our eyes already mixing colours but still distinguishing forms (those of the dots or dashes).

The pointillist/divisionist technique lends itself particularly well to landscape painting as a genre, and in its variegated forms including townscapes and seascapes, sometimes populated, sometimes not, it was by far the most popular among neo-impressionist painters. It is telling that at the first modern exhibition of Neo-Impressionism (Guggenheim Museum, 1968) out of a total of 175 paintings there were only six still lives and fifteen figure paintings shown, the vast majority were landscapes, views of country and city. We shall have a close look at the colour science applied to some of the landscapes of the neo-impressionist masters, with special reference to Matisse's majestic pastoral landscape *Luxe, calme et volupté.*

Plenary Lecture

A summary of the parametric studies on colour difference evaluation

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Abstract

Colour difference research has been extensively investigated over the years. CIEDE2000 was proposed in year 2001 and has been tested from various new data. However, these formulae can only be applied under a set of reference viewing conditions as defined by CIE, i.e. a pair of samples should be object colours, large sample size with edge contact, small to medium magnitudes, and be observed under a D65 simulator, and should be observed under high luminance level, against a mid-grey background. In reality, this set of reference conditions is difficult to achieve. Various studies have been carried out to study the impact of different viewing parameters with intention to develop a parametric colour difference equation to consider different viewing conditions.

This paper will review the research works conducted to study different viewing parameters including mode (aperture vs surface), assessment method (perceptibility vs acceptability), materials (textile, coating), media (surface vs display), contents (patches vs images), physical size, separation, colour difference magnitude, background colour, illuminant.

For each parameter, the visual phenomena will be shown and the colour difference equation will be proposed to model the effect. Finally, conclusion will be drawn on what important parameters had a significant impact on colour difference evaluation and a generic equation will be proposed to consider these parameters.

Keywords: parametric effect, colour difference formula, parametric colour difference formula

AIC Judd Award Lecture

Individual color vision

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Abstract

The most widely used CIE color system is based on a single observer, called the CIE 1931 standard colorimetric observer. However, color vision is more or less different in individuals. Such an individual difference sometimes becomes a problem to make a quantitative model. Therefore, a set of visual functions from a single observer is useful to make a color vision model. I have employed myself as a subject and measured various visual functions with psychophysical methods. These are the color matching functions, the spectral luminous efficiency functions by heterochromatic flicker photometry, and the opponent-color response functions by hue cancellation method. From the analysis of the relation among various visual functions obtained from a single observer, it is suggested that the L-cone and the M-cone signals are linearly transformed to the achromatic channel, the r/g opponent color channel is linearly processed by the transformation of cone signals, and the y/b opponent color channel is non-linearly processed by the cone signals of the L-cones and S-cones.

As for individual differences in color vision, color vision deficiencies and aging effects could be considered to be the major factors. In 2006, CIE defined the cone fundamentals as the relative spectral sensitivity of cone receptors as measured in the corneal plane. We have developed a color appearance model for anomalous trichromats using the CIE 2006 cone fundamentals. Even if the colorimetric values of two stimuli with different spectral powers such as an object color and a display color are equal, different colors may be seen. It is considered to be a problem of observer metamerism, which is caused by the fact that the color matching function of a real observer is different from that of a standard colorimetric observer. It was suggested that the problem of observer metamerism could be analyzed with a color appearance model for anomalous trichromats and also aging effects.

Thanks for the long-standing research and activities in CIE and AIC, the cone fundamentals for a standard observer and further the CIE2015 XYZ colorimetric system based on the standard cone fundamentals have been established. In the near future, it would be desirable to establish a colorimetric system for individual color vision.

Renaissance colour symbolism

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Abstract

Between 1495 and 1595, a unique series of texts were published in Paris and Northern Italy on the subject of colour symbolism. The first was written by the Sicily Herald (Jehan Courtoys) about 1420, and the last by Antonio Calli. They all relate to the choice of colour in dress, and extend and promote ancient and medieval beliefs that colour was a divine manifestation that could possess profound meaning and supernatural power. This talk will summarise the content of these publications, the two most influential of which were Gilles Corrozet's *Le Blason des couleurs en armes, livrées et devises* (Paris, 1527), translated into Italian in 1565, and Fulvio Pellegrino Morato's *Del significato de' colori* (Venice, 1535). After the appearance of Andrea Alciato's 'Emblem book' (Augsburg, 1531) and Clément Marot's 'anatomical blazons' (Lyons, 1536), there was a mid-century craze for moralistic poetry, out of which came Morato's colour sonnet, offering meanings for a series of 14 colours extracted from some 60 ancient and medieval sources, principally Virgil, Horace, Ovid, Pliny the Elder and Petrarch. Corrozet's sources are more obscure, and the 'second tract' of his book on blazons appears to offer the most extensive record of contemporary European colour symbolism. Together, the two authors were influential particularly on subsequent colour publications by Coronato Occolti (Parma, 1568), Giovanni de' Rinaldi (Ferrara, 1584) and Giovanni Paolo Lomazzo (Milan, 1584). Remarkably, after Calli's *Discorso de' colori* (Padua, 1595), no original books wholly on colour symbolism were published for almost 250 years, until Frédéric de Portal's *Des Couleurs symboliques, dans l'antiquité, le moyen âge, et les temps modernes* (Paris, 1837). This would seem to suggest that, after about 1600, previous, subjective notions about the magical powers of colour were largely discarded during the Baroque era, most probably owing to the rise of empirical science, and a novel belief that light and colour were physical phenomena to be examined objectively, with optical instruments and mathematical calculations. Though Goethe revived an interest in colour associations in his *Farbenlehre* (Tübingen, 1810), it is not until the rise of literary and artistic Symbolist movements in Europe, and such Theosophical publications as Annie Besant's *Thought-Forms* (London, 1901), that the practice of attributing specific meanings to colours is again popularly embraced. Thereafter, and throughout the twentieth century, considerations of the indicative meanings of colours were integrated into the visual arts and various aspects of colour psychology and therapy.

Keywords: Renaissance, colour symbolism, dress, blazons, colour meanings

Environmental color design

Architecture and landscape
Urban landscape

C>0 – Traditional façade neutrals are not achromatic

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Abstract

In this article, we examine the "neutral" façade colours of traditional Norwegian architecture, building on previous research on establishing a colour guide for the city of Trondheim. Like most Norwegian towns and cities, Trondheim is foremost associated with painted façades in traditional hues and nuances of reds, yellows and greens, in combination with façades in nuances of light to medium dark neutral colours of whites and greys. The last decades has seen Norwegian architecture pointing towards a dramatic change in the traditional colour palette towards a perceived uniform, achromatic palette, often accentuated with chromatic, highly saturated colours, in stark contrast with the overall gestalt of the traditional colour identity.

The project is supported by the Trondheim Municipality, and the analysis is based on the approximately two thousand (2000) registrations of façade colours in the city of Trondheim, using NCS (Natural Color System) as a colour reference. Previous articles of this work includes analysis and discussions of nominal and perceived colour, identification of the drivers behind the current achromatic tendency, identification of the typical hues and nuances of the city, and with a closer look at the relationship between the blackness (B), whiteness (W) and chromaticness (C) of the nuances of the colour palette:

Meeting New Challenges in Colour Tendencies in Norway. Angelo and Booker, AIC 2015.
Colour Perception and Perceived Colour. Angelo and Booker, AIC 2016.
Architectural colour; a discourse in the popular Norwegian press and social media 2014 to 2016. The greying of Norway. Booker and Angelo, AIC 2016.
S>C – Proposing a formula for Harmonic Urban Colour Composition. Angelo and Booker, AIC 2018.
Architectural Colour Design in Defense of Identity and Place; the Challenges and Potential Strategies for the Future in Urban Development. Booker and Angelo, AIC 2018.

In this project, analysis show clear tendencies for a coherent use of specific hues and nuances. In general, the chromatic façade colours has been identified to hues between NCS G30Y – R, in nuances with - more or less - equal likeness to whiteness, blackness and chromaticness, and with important, but rarely used, blue hues between R80B – B, in typical nuances between 10 – 40 % in blackness and 02 – 10 % chromaticness. The more muted chromatic and neutral façades colours are in nuances with 10 – 50 % blackness and 2 – 10 % chromaticness. In a broad sense, the most important rule of thumbs for a coherent colour design in Trondheim would be to avoid achromatic colours and colours with more chromaticness than 50%, and to use nuances with a higher percentage of blackness than chromaticness (S>C).

The article takes a closer look at the "neutral" colours in the palette. We have previously stated that they are "but very rarely achromatic". However, further analysis of the colour registrations suggests that this statement is faulty, and that traditional neutral colours never were achromatic. This is discussed by examining the possibilities and limitations of the tools used in the colour registrations, and of the pigment composition used in traditional paints. As a conclusion, we have found that traditional façade neutrals are not achromatic, and that the chromaticness is more likely to be 1% or more (C>0).

Keywords: colour in architecture, chromatic composition, neutral colours, pigments, NCS

Clorindia domestica. Studies of architectural chromatic organization in relation to landscape

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Abstract

This work is framed in the research project "Clorindia domestica" directed by Roberto Lombardi in the context of the Morphology Course and the Color Research Program at the School of Architecture, Buenos Aires University. At this stage, the research is focused on a first selection of cases taken from a larger set of single-family houses that we are now investigating, made by architect Clorindo Testa in cooperation with Juan Fontana, Eduardo Bompadre, Elena Acquarone, Juan Genoud and Ezequiel Rivarola. These cases stand out due to their condition of free perimeter houses, built in suburban areas or immersed in natural landscapes.

In this research, we can plot differences between inherent and perceived color. By unfolding the exterior building envelope we can recognize the relation between color, external configuration and morphology. Chromatic diversities are produced due to the incidence of light and the own shadows, even when we are dealing with painted houses with a dominant inherent color (reason why, in the publications, the houses are called "Green house", "White house", etc.)

The analysis makes special emphasis on the landscape and it reflects how color works as an organizer, not only of the elements in the house but also of the architecture and its context. Functions of color can be defined as abstract-generic and perceptual-contingent. It can be perceived how the colors of the houses and landscapes constitute integral palettes which selectively manage contrasts and mergers.

The research is based on architectural drawings and photographs selected from a period of Testa's work dominated by the use of outside and inside painted surfaces. Therefore, we have developed a system which builds a global synchronic perception of chromatic relations, in order to simultaneously show what would otherwise require a tour of the architecture work in a temporo-spatial sequence.

The method of representation consists in:
● Unfolding the exterior surface (and some interior ones) to study a topological behavior of the color, that deals with superficial continuities and discontinuities between different elements and relative positions in the space.
● Applying the inherent color on the surface under full light, according to the photograph chosen as reference.
● Defining the surfaces by their perceived colors, without drawing separation lines. The edges between surfaces are generated by the color change, as it is natural in visual perception.
● Applying the perceived color depending on the light received by each surface, according to its orientation, for the chosen illumination.
● Representing the own shadows, not the cast shadows.

Summing up, the developed method gives the possibility to compare the study cases and to identify systematic operations of color in relation to the morphology, allowing us to recognize some operative consistencies in the study works. We propose to value not only their macroscopic and generic behaviors, but also their multiple local intelligences which are capable of generating singular relationships that do not weaken, but expand and multiply the consistency of the project procedures.

Keywords: architecture, chromatic organization, inherent & perceived color, representation system, landscape

Colour in relation – Relations between the perception and design of architectural surface and its context

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Abstract

The following considerations explore design relevant questions about the colour quality of architectural surfaces in complex interaction with their correlating context. Based on our applied research project "EVDH" we draw a comparison with a field chapel built between 2005 and 2007 in Wachendorf Germany by the architect Peter Zumthor to expose from a design-driven perspective relations of colour and its context.

Colour is considered in its material qualities and therefore as interacting with and being influenced by the material world. Different colour appearances are elaborated as variables in the application processes, in the life process and in the perception of the building and its environment. In these temporal sequences, which we all define as parts of the context, colour is shaped by various changes and transformations, which are to be reflected and discussed in this paper. The aim is to understand the qualitative aspects of coloured surfaces in order to cultivate diversity in the built environment.

I. Research project 'EVDH'

Relations between colour and context on facades was first examined in the applied research project "EVDH - Extended processes for plaster surfaces: synergies between digitality & craft" of the theme platform 'Materialität@hslu' at Lucerne University of Applied Sciences and Arts. Based on these insights, the connections between colour and context were described and woven into a relational whole and it is shown that this weave can develop distinctive design qualities. Material samples resulting from series of experiments flanked the observations on material qualities in different light situations and different viewpoints, changes caused by environmental influences and by different application processes. The research showed how the single aspects light, material, application method and perception can be modulated and cultivated in a complex way forming a complete spectrum.

II.Bruder Klaus Field Chapel, Peter Zumthor

The insights pertaining to design and the relations between colour and context are discussed and elaborated by means of a case study on the *Bruder Klaus field chapel* by Peter Zumthor, paying special attention to colour material and context. The building serves as a best case as it demonstrates how design solutions are able to embrace and incorporate traces from the building process and the material surroundings of a building. The example underlines the fact that colour isn't merely the superficial and final application of a coat of paint on an architectural surface, but the result of a complex and continuing design process. Instead of discussing colour qualities in isolation, the paper attempts to show that the whole is more than the sum of its parts. Thus, a small cosmos of fascinating complexity opens, which modulates our world in many ways.

Keywords: design, architectural surface, context, relations, process

Good or bad, nice or ugly? – Some exterior colour design by private houseowners in the northern part of Sweden

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Abstract

Exterior colour design will always be public and accessible for people in the area of the object. It will create feelings and sensations. It can be considered as good or bad colour design. It can be described as nice or ugly. All depending on the context like the surroundings, the light, the season how all these factors will be discerned by the observer.

By tradition private houses in Sweden has been painted mainly in red but also in whiteish and yellowish tones. Due to technical limitations, historical background and from a practical point of view, these colour areas were accessible for the private house owners and from an aesthetic aspect, also suitable in the Swedish landscape with lushly green summers, brownish autumns, snowy white winters and pristine yellow-green springs.

As a result of the development in tinting of paint, where the modern tinting technology now can almost produce any colour shade, the range of colours has extended to other areas. New areas of off-whites, pastels and more chromatic colours have become more used by Swedish private houseowners and as a result, the selected exterior colours now are challenging the observer in a different way that we are used to.

What does it take to consider the choice of the exterior colour of a private house such as good or bad, nice or ugly? Are there principles that can be applied to the use of exterior colours that makes it good and nice instead of bad and ugly? How does the private owners relate to the wide range of colours the producers are offering and marketing for exterior purpose?

This paper will present some selected private houseowners choice of colours for their exteriors and put this into the context of earlier studies of traditional colour scales for exteriors and the colours of the Swedish nature. A number of objects will be presented with an analysis, based on both visual assessment and readings, based on the NCS colour system, of the used colours.

Urban attractors: Color and sustainability

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Abstract

Urban attractors are referential objects that dynamize the public space by creating intervention polarities. Stands for pauses, various types of activities and events that refer to Shakespeare's quote: "the world is a stage and we are the actors".

The goal is to reflect on color regarding the stages of life through impacting objects for the enjoyment and experience of places that support by activities, functions and events. For this, the importance of color and the design conjugated with vegetal elements is valued.

The colors of the flowers or the colored arrangements, the color of the supports and the contrast, the design of the additional elements of cover and the day and night information systems, create visual qualities referenced to color and to sustainability.

Thus, the aesthetic, economic and ecological message is articulated taking advantage of its location, shape and dimension complemented by its color, design, information, colorful elements and flowering plants. These attractors create cozy environments for their shade, odor and colors, humanizing less friendly areas of the city.

As an analogy, the red "follies" of Bernard Tschumi in the Park of La Villette in Paris (1987), create polarities in the nodes of a reticulated matrix. Also cultural references to the traditional pergolas or to the trees that need structures made by man to support canopy size are references to be recovered.

These intervention units not only restore old concepts of enjoyment and of being, but also respond to a complexity of urban situations that are revitalized through the scale of intervention. In this area, one should mention the concept introduced by the bird' cage in the London Zoo (1960-1963) by Lord Snowdon, Frank Newby and Cedric Price, that equates a new relation between the observer and the object of observation.

The observer enters the cage and the birds have space to fly creating an integrated intervention, masterful by concept and scale and design. Also the greenhouses create a space container for trees and plants, being able to refer the *Orchidearum* at the Medellin Botanical Garden, Colombia designed by Plan B Architects and JPRCR Architects.

It is a matter of scale that is introduced. A multifunctional urban attractor of significant dimensions exists in the *Plaza of La Encarnación* in Seville, whose scope involves sustainability and color. It is an analogy that can be made in the context of this reflection, which objective is to deepen these strands together with Nature in a sustainable, poetic and critical way.

The "architectural guerrilla" strategy of the 60's is also revived, combining design and color with fragments of burned trees. The restoration of the memories of our childhood's gardens with the fragrances and colors of spring mark the seasons. The pergolas on the viewpoints, the ephemeral interventions in the traditional festivals, bring a message of sustainability and color.

They are festive entities subject to variations according to multiple factors that introduce versatile elements and visual dynamics. Through the dynamics of form and activities, through criticism of visual pollution and the destruction of nature, its presence interacts with the public and creates a critical dimension in the city life. The color message and plant elements that are combined with support structures maximize their urgent color communication. As a case study we present the Metallic Trees at The Museum of The Presidency of the Republic, Portugal.

Keywords: color, sustainability, urban attractors, symbiosis, environment

The color of roofs and sustainability

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Abstract

Whatever the color or material of the project, its design should reconcile the idea with aesthetics and technical requirements. Building roofs are determinants in the urban image, especially in cities of multilevel appreciation, and have an essential role in sustainability.

Ceramic tile (brick color) was one of the first man-made building materials. In addition to the vibration of the possible shades, one can take advantage of the tinting and paint to obtain a colored pattern or use glazed ceramic with plastically controlled color variations such as the "Casa Batlló" in Barcelona, Spain.

The ceramic roofing is still one of the most efficient solutions in the passive sustainability for coverings, with great durability and high resistance.

White roofs have been used over the centuries in Mediterranean countries. They are suitable for hot climates saving energy in cooling systems. Roofs painted in white absorb less heat than a common roof because of the greater reflection of sunlight. This feature allows reducing the heat transferred to the interior of the building, thus improving the comfort of the occupants. Its white color can also be obtained by painting with very reflective paint and therefore with high solar reflectivity and high emissivity of infrared. In this case they are called Cold coverings.

Another kind of colored roofs are the living roofs, covered with vegetation. They are called green roofs, but in fact they can have several colors, depending on the plants chosen for their coating. Furthermore they can accentuate the Season of the Year or the respective change, allowing a metamorphosis of its image throughout the time. Moreover the aesthetic and aromatic qualities of the flowering areas, the green roofs also allow to reduce the presence of the construction. It is important to use sustainable native plants that are resistant to drought and do not require excessive watering.

The glass coverings can have various colors, allowing combining several levels of transparency with electric power generation and water sealing.

All kind of roofs can be coated with modules and photovoltaic elements, allying technology with the design.

Several countries have created regulations and legislations to ensure the construction of green roofs and/or white roofs primarily for ecological and heat-absorbing reasons.

Keywords: tile roof, white roof, green roof, glass roof, sustainability

Chromatic design in the natural landscape.
University student residence in the Campo Escuela FCA-UNC, Córdoba, Argentina

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Abstract

Color, as one of the essential components of architectural design, participates in the design process fulfilling different roles according to the specific design intentions of each case. In this way, color acts in new projects, in renovations or in interventions where it assumes the leading role of the engine of change or transformations. In turn, all these participations are given at different architectural and urban scales. In the case of the Faculty of Agricultural Sciences – University Residence, color assumes a vital key part in design due to its role as a transformer of an existing school building in housing.

Within the framework of the Specific Collaboration Agreement between the Faculty of Architecture, Town Planning and Design (FAUD) and the Faculty of Agricultural Sciences (FCA), both of the National University of Córdoba (UNC), it is entrusted to the Color Institute (FAUD-UNC) the chromatic design of the first Student Residence of the UNC, belonging to the FCA. The tasks developed included the specific chromatic design by defining the color palette to be used; the advice in making decisions regarding the general arrangement of the common public spaces of the Residence and technical assistance of the work.

The purpose of the proposal was to respond to two contextual situations of the project. On the one hand, the architectural typology relationship in a natural landscape, and on the other, the retrofitting of an existing school building that would become housing for students. Given this situation and considering that color should be an element of significance, it was decided to work with a chromatic contrast proposal for both the exterior and the interior of the building.

The design intentions to define the chromatic chart, considering the mentioned conditions, was to work with saturated colors in chromatic contrast over the neutral chromatic dominated field. As a result, bluish gray colors were applied to the exterior surfaces of the building and a reddish orange color was used in the main entrance marquee and in smaller outgoing volumes that complete the definition of the façade. In this way it was possible to establish an immediate building-environment contrast.

In the interior of the building, following the same project thougts, saturated colors, both warm and cold, were applied to smaller surfaces, generating in turn a chromatic contrast over a neutral dominant field. This one conformed by white and gray colors applied in the structure and limits of greater surface. This decision had the sense of generating a lively and cheerful atmosphere, associated with the university student activity.

Considering that color is a material with its own qualities, with the capacity to transform spaces and intervening in perceptual and significant spatial experience, the proposal expresses the protagonist sought for an existing building of large dimensions and whose function has been transformed.

Keywords: architectural color, natural landscape, design

Luis Barragán among colors and forms:
A case-study on project strategies in three of the architect's works

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Abstract

This work tries to observe the chromatic phenomenon, allied to the understanding of color as a formal element, analyzing three buildings by Luis Barragán, namely Casa González Luna (Guadalajara, 1928), Luis Barragan House and Studio (Mexico City, 1947) and Casa Gilardi (Mexico City, 1976). In these works, the architect used forms, colors, light and shadow as instruments that stimulate effects and sensations to the observer. The objective is, then, to unveil the formal and coloristic composition, and to draw the relations and influences adopted as projective strategies. In the present study the concepts are discussed, such as, by color, the principles of the combination by analogy of Efimov, of chromatic harmony and their relations, of light and shadow and the form according to Wucius Wong. It was also identified the speech of Luis Barragán and in him the concern with the know how to see the architecture. The method used was the case study, from the selection and analysis of two representative images of each project and the technical procedure of redesign, explaining the primary elements of the form. Another procedure used was the identification of the corresponding harmonic relations in the chromatic circle, the palette of the predominant hues in the images, under the interference of light and shadow, elaborating a general palette of the predominant colors in the projects. In the color composition the following relations of harmony were found: analogous colors; monochromatic; hot colors; and triadic. It was also identified the hues that permeate the colors yellow, blue, red, green, brown, gray and black. As for the formal aspects employed by Barragán, primary elements such as lines, straight and planes were found in volumetric compositions with the mastery of the visual elements of shape, size, color and texture. The execution of rectilinear elements defining planes or openings in planes is also part of the formal vocabulary of the architect. However, it was verified that the strategies of application of the color are subordinated to the built form and the conditions of luminosity of the place, resulting in the use of the combination by analogy, that allows the union between color and form, highlighting them and making them inseparable. Future research may encompass a broader cut of works and formal vocabulary in order to advance the study of the architect's design strategies with respect to form and color.

Keywords: Luis Barragán, color, light, shadow, form

Impact of concrete in the built landscape

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Abstract

The concrete is a construction material that evolves according to the political, social, economic and technological needs of each region. It integrates a large part of the constructions by their structural and/or aesthetic functions. In addition, its social impact due to the various functionalities can acquire an artistic or historical character through the monuments, sculptures or urban furniture integrating the built landscape. In occasions, it is used massively, but often other predominating materials can conceal it. The cementitious mixture consists of cement, stone, sand, water, and often mineral admixtures are used to modify specific characteristics in the fresh or hardened mixture.

For many years, humanity has striven to make constructions with relevant beauty. Natural stones were the most used building materials since antiquity, and the concrete appeared latter as an interesting alternative because its use provides not only advantages related to mechanical and durable properties but also its "rough" appearance assimilates it to natural stone. With it, structural elements can be manufactured in shape of columns, beams, arches, or else parts in place ("in-situ") or in factories (pre-molded) with different textures and colors.

Rationalism and expressiveness were the reasons that in architecture guided the facades structure. The concrete is an alternative that allows to materialize thoughts by involving it as a modeling paste, that is, a material without its own shape that takes the shape of the mold that contains it and whose final appearance is conditioned by the formwork type. This concrete, which was appropriately called "béton brut", started the trend of "brutalism".

On the other hand, the Art Deco and modern buildings highlight a concrete facet with greater aesthetic acceptance.

This work presents three cases, antagonistic to each other, demonstrating the versatility of mixtures made with cement. First case: New Argentine Theater, located in La Plata city- Buenos Aires Province, built after the destruction of the original one; second, the Woman Bridge (Arch. Eng. Calatrava) and, finally, the urbanization plan thought by the Arch. Eng. Salamone.

Keywords: impact of concrete, buildings

Colour harmony: landscape and city

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Abstract

The harmony of color is a universal, transcultural phenomenon. Applied either to the creation of natural landscape, of a city's visual image or the construction of new urban spaces, it represents a system of coded messages of the visual world that helps us understand, evaluate our surroundings and act in different contexts. The purpose of color design activity always has been the creation of "Man-Colour-Architecture" equilibrium, which is based on the correlation between material and cultural particularities.

As of today, the harmonies of color of landscape and city, their nuanced and complex combinations, form a synthesis of knowledge and understanding of the environment. Created or appropriated by local people and full of subtleties, they have affected all human activities for centuries, even millenniums ... Their impact is considerable, and by creating a pleasant and original setting they affect people's minds, change their mood and influence their behavior.

In today's urban planning, architecture, visual art and communication, all aspects of creation are concerned. That is why our working method is at the crossroads of historical and scientific reasoning with an artistic touch: it embarks on an imaginary trip through time and space to explore the infinite universe of color harmonies in order to enhance the image of different cultures (Bulgarian and Italian) and the representing cities (Plovdiv and Matera) around the world.

Our project method, based on a multidisciplinary approach, will be a possibility to involve all groups of professional architects and designers as well as concerned local citizens aiming to create an easily perceived and highly rich visual environment of the city including immaterial and ephemeral architecture and urban design.

In the proposed project for the transformation of the urban environment, landscape and city, concerning the "Image and identity of the city. Urban color study for cultural capitals of Europe 2019: Plovdiv (Bulgaria) and Matera (Italy)" we offer a mobilization of different cultural codes as a presentation and branding of Plovdiv and Matera specific images to internal and external audience: local public, visitors of the cities, national and international tourism organizations etc. Chromatic study of natural landscape, of the inhabited spaces as well as knowledge of the local historical heritage are fundamental to developing a strategy in reconstruction, restoration or rehabilitation. Our method and the results of investigations devoted to the color image of the city will be an indispensable part for strategic plan of urban environment of the cities and will be an important information for architects, urban and landscape designers and artists.

Keywords: colour harmony, landscape, city, environment, architecture

Color in residences for the elderly: ideas competition for scholars

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Abstract

Color is a good starting point to reflect about the architectural possibilities for an interior design project. Course after course, scholars enrolled in the subject "Graphic and Chromatic Design" of the Master in Architecture, accept the challenge of updating an existing inner space by using simple architectural actions: redistribution of rooms, refurbishment, graphic design and color. The places to work in are existing buildings where users find problems or the owners consider that need a renewal. An external company to the university is involved in the activity and awards the best project in an architectural ideas competition. In previous editions, students worked in the offices of an international enterprise, the rooms of a research center, or the waiting rooms of a hospital and some of the projects were finally built. In the course 2018-2019, scholars have been working in the common rooms of three houses for the elderly near Valencia managed by Gesmed, to increase the comfort of residents and to help in their orientation improving the graphic design of signals. The projects are framed within the activities of the research project "Modifications of the Visual Comfort in Residential Centers to improve the Quality of Life for the Elderly" founded by the Spanish Research Agency.

To develop the color project for each one of the three residences selected, scholars and professors visited the places and recorded all the information needed, not only about the forms and colors of the existing buildings, but also about the problems that users and staff perceive in day to day. Some of the most common needs detected were difficulties related with glare, disorientation in big size rooms and a particularly concerning general lack of cosines. Definitively, users would like to feel like at home.

Together with the information collected on site, every color project started from the cast of the chromatic resources assimilated in a previous work of analysis of existing noteworthy architectures. Color is an effective vehicle to achieve architectural intentions connected with the ideation. Color may interfere in the functional organization of the architectural spaces, in the orientation of the users and their circulations, or in the characterization of the functional destiny, after the critical reading of some buildings by Norman Foster, Richard Rogers or Renzo Piano. Sometimes color and the general design tries to link with nature displaying greenery or evoking the sense of a landscape, after the critical reading of projects with roots in the ecological utopians from the sixties. Other times, colors are subtle and display a neutral environment for living, after the understanding of specific architectures by RCR architects, Selgas Cano, or Peter Zumthor. The possibilities of dynamism, kinetics in spaces, anamorphisms and other optical effects were left aside because of their disturbing effect for elder people; despite they have interesting results in other contexts after some artists like Felice Varini, Olafur Eliasson, Carlos Cruz Díez or Boa Mistura. Some of the proposals tried to connect with the visual universe, the color codes and other cultural conventions that are usual for people in the range between 70 to 90 years old. Some different design strategies like the reuse of existing objects, vintage furniture or graphics from ancient advertisements, are some of the resources to help elder people to maintain their roots and not to lose their memory.

Keywords: color, architecture, interior design, elderly

Chromatic applications in interior spaces for the elderly in the P. Borja Geriatric Center of the Fontilles Foundation

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Abstract

The space in architecture is one of the most important concepts throughout the history of architecture. There are many characteristics that define the three-dimensional aspects of architectural space in search of a harmony that provides a more livable place.

This communication deals with a particular chromatic study, that is carried out in three interior spaces of the P. Borja Geriatric Center of Fontilles Foundation, in Alicante. This geriatric is specialized in the care of elderly people with different degrees of physical or psychic dependence. The study is based on the research project carried out by the Research Color Group of the UPV, that is funded by the Ministry of Industry and Competitiveness of the Government of Spain. The aim of the study is to establish parameters and chromatic modifications of interior spaces of the public centers of the Valencian Community, where dependent elderly people live and stay.

The facilities of the P. Borja Geriatric Center present certain architectural features that is subject to be studied because it is a building located in a particular natural setting and, therefore, its architectural features are different from the centers that are locatedt in an urban area. This foundation was created at the beginning of the 20th century in order to help the most vulnerable people, as well as offer and carry out various research projects. That is why this center is a benchmark of social imprinting where various studies on health and wellbeing are carried out.

In this context, firstly, the study focuses on the color analysis of the rooms of this center that was applied in its beginnings. Secondly, the study offers the development of new chromatic proposals that aims to improve the built environment of the center. The several spaces that are analyzed in this study are, nowadays, the most used by residents in their daily lives: a multipurpose room where daily activities are carried out in groups, a corridor and its routs to the different rooms, and a standard bedroom. The chromatic proposals offered in this studio for these spaces have been made by RV, offering the resident the possibility to visualize and select different chromatic compositions by using suggestive and harmonic color combinations. These color combinations proposed were studied as a result of a previous survey. The survey provide objective answers according to the visual stimuli of the residents. Finally, the chromatic combinations that were chosen by the residents were taken into account, becoming the most suitable proposals to be included in each room of the center. The natural lighting, the orientation of the rooms and their dimensions, were among other spatial features, the basic factors to define the set of chromatic interventions.

For this, the methodology and resources that have been applied for this study will be shown: that is, the surveys, the results, and a screening of the process carried out in the research project where the response of the visual stimuli of the residents will be observed. As a consequence, the chromatic proposals presented for these spaces have been combined in such a way that they can offer a more harmonic and appropriate perception according to the place where they live and coexist.

Keywords: color, space, architecture, elderly

Color and space in interior design

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Abstract

How are designers using color in built environments? Color is nowadays present in Interior Design. The presence of colour in the built spaces began with the discovery of the colour itself, and its perceptive effects started to be discovered.

Today, various studies of colour exist to the most different disciplines, different colour theories were created, although the theme is not yet exhausted.

The coulour has unique perceptive properties, needed to the space understanding. It is the generator of space. This essay pretends to bring a reflection on how the application of colour in various spaces can modify its perception, explain it, reinforce it, define it.

The usage of colour in Interior Design is not something from the past, it is still present in this century. Various designers, knowing their own abilities, took advantage of that.

The colour is an important characterizing element of space and it is important to understand that, and not an element of aesthetic facing and merely decorative.

It is observed, at present, that the production of the designers has been concerned, as much with the formal composition, as the fundamental paper of the color in the space.

The interior design production has been more concerned with its formal composition, but as it has been seen, the colour has an important role in the space.

The colour has yet a psychological influence in the human beings. The colours transmit feelings, well used these can reinforce the ideas that we pretend to transmit. Studies indicate that colours have influence in people´s behavior, and this fact can be used in good favor of Interior Design.

The human being is emotive and sensitive, and the colour is a huge stimuli that holds and stimulates.

It seems wise to say that Interior Design is beneficing with the presence of colour.

After the approach of these questions, the elaboration of a sort of colour application advices on various types of spaces is being required.

Keywords: colour, space, perception, sensation, form, interior design

Deriving colour palettes from images of natural landscapes

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Abstract

The colours of natural landscapes represent important information about the character of the region in which the landscape is based. The colours extracted from the natural landscapes are considered as the harmonious colour arrangements that could provide a pleasing visual experience to human. The particular colour combinations from the natural landscape can be built into a colour palette for designers to indicate their design themes. These colours can be used in different design areas including architecture, landscape architecture and urban design, for example, to deliver characteristics to buildings or other infrastructures that enable these structures to blend with their natural surroundings. In this study, methods to develop colour palettes based on analyses of digital images of natural landscapes are explored. A psychophysical experiment in which participants select five colours that are representative of digital images of landscapes is first described; this generates data that can be used as ground-truth data against which other (more automatic) methods could be evaluated. Automatic methods for generating colour palettes from images include cluster analysis in various colour spaces.

In this pilot study, 30 participants with different design backgrounds were presented with digital images displayed on a computer in a darkened room. The images were displayed one at a time and there were 10 digital images in total (each of which represented a natural landscape). For each image, each participant was requested to select five colours and obtain a colour palette that represents the image. This was done by the participant clicking on an area of the image using a mouse and a GUI that was written using the MATLAB programming environment.

An automatic method for generating colour palettes from each image was developed using cluster analysis. The cluster analysis was performed in several different colour spaces including RGB and CIELAB. The colour palettes generated by the automatic clustering method were compared with the colour palettes that were derived from the psychophysical data using a quantitative method that has previously been published. Some alternative methods for automatic palette generation will be discussed including eye tracking.

Keywords: colour, landscape, natural landscape

The French period in the history of environmental colour design

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Abstract

The term 'environmental colour design' came into being relatively late in the 1940s. It was invented in response to a new reality, which gave increasing attention to how the processes of human activities interact with colour and associated natural factors, e.g., geographical, solar, climatic. Two tendencies were crucial to the development of the term. On the one hand, around 1900, as part of the Art Deco movement materials and colours had been combined in meeting new technological and social demands, while under Expressionism, De Stijl, Bauhaus, and Modernism light, openness, and simplicity were introduced into architecture as fundamental qualities. In all these various trends colour was considered to play a significant role in the architectural and urban environment. On the other hand, starting in late 19th century Europe, cognitive and experimental psychology induced a wave of interest in the visual language and psychological meaning of colour and colour associations. Experimental psychology became a scientific field of research and colour was part of it. The arts contributed substantially to the search for the meaning of colour. In the early 20th century, Bruno Taut and Le Corbusier – two prominent architects, who also were dedicated to painting – developed a conscious and thorough application of colour in architecture considering colour as a powerful means to modify interior and exterior environments.

In the 1960s, colour designers in France began to develop colour concepts not only for one single building or an interior space, but also for residential developments, new towns, city districts, and also for industrial buildings, public spaces, and infrastructure. Colour was applied at a monumental scale, with supergraphics visually widening, distorting, or enhancing spaces and volumes. Colour provided a new dynamic and movement to the environments. Developing further, this understanding has shaped the Postmodern city and has also had a significant impact on the development of environmental colour design in the sense that it sparked the birth of a new profession: the colour consultant. In collaboration with architects, engineers, town planners, industrialists, or hired for specific projects by public or private companies or governmental agencies, the colour consultant has become part of a multidisciplinary team (see e.g., Prieto, 1995; Caivano, 2006; Schindler, 2012; Song, Ed., 2017).

Various renowned colour consultants working in France have left an indelible mark on the history of environmental colour design: Jacques Fillacier, Georges Patrix, Fabio Rieti, Bernard Lassus, André Lemonnier, Jean-Philippe Lenclos, Michel Cler and France Cler, and Victor Grillo among others. Their influential colour projects and research have addressed colour for new buildings, historical city centres, and local or regional urban landscapes. Works of these colour experts are included in the Centre Pompidou's collection and have been exhibited in Paris (2011–2013) and Roubaix (catalogue, 2017). As well, their theoretical insights and practical approach to colour, often published in books, professional magazines, and newspapers, have been crucial to environmental colour design, colour research, and colour education in the arts and architecture.

In the vast and diverse literature on environmental colour design there is, however, no research devoted to this important 'French period' as a holistic artistic phenomenon. Moreover, there is no study of the influence of the ideas of the French colour consultants and designers-colourists on the traditions of environmental colour design. The present paper will address this gap.

Keywords: environmental colour design, colour consultant, designer-colourist, colour methodology, French context

Color and heritage: Analysis of the evolution of the methodology used in Italian color plans

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Abstract

The colors of the buildings express the chromatic tradition of the place and contribute to identify it. Therefore, the interventions in the buildings in historic areas should consider both formal aspects and colors, to improve perception of the urban landscape and preserve the chromatic identity of the place.

Understanding that cities are in constant renewal and historic areas are also subject to processes of transformation, it is possible to observe that the use of inappropriate colors for painting the facades of buildings of historic and cultural interest contributes to the disruption of the identity of these areas. To prevent this, a color control is required, which can be performed through Color Planes. This article aims to analyze the evolution of the methodology used in the elaboration of the Italian Color Planes, which are a reference when it comes to color planning, and applicability of this methodology to the historical areas of Brazilian cities.

The Color Planes are frequently used in European countries for preservation and enhancement of the urban landscape, especially in its historic areas. Important characteristics of the color planning is the understanding of color as an important element for the set of buildings, creating ambiences and considering the perception of streets, squares, neighborhoods and in some cases cities in their totality. The Color Plane should understand the coexistence of the polychromy of different periods and architectural styles with the purpose of valuing the urban landscape.

In this study, the understanding and reflection with regard to color planning are achieved through bibliographical research. A comparative analysis of the first Color Planes of Turin, Italy - *Piano Regolatore del Colore* by Giovanni Brino (1978) and the *Progetto-Colore* by Germano Tagliasachi (1985) - and more recent Color Plans of the Italian cities of the Province of Latina (2006) is performed. It focuses on the following aspects: (i) color plan objectives, (ii) methodology, (iii) results and (iv) criticism. The selection the Italian Color Planes for analysis is induced by the fact that they are pioneers in developing a methodology, which influenced both practical experiences in other countries and developing of further research in this field.

The discussion of the methodology employed in these chromatic plans is relevant, because it makes possible to find out the general principles that should be considered when developing an adequate methodology for the use of colors in Brazilian historic areas. Through the analysis of the methodology used in the chromatic plans, it is possible to observe historical-critical and technical-methodological evolution in the elaboration of the Color Planes, and the necessity of inclusion of the formal and morphological aspects of the city in the Color Planes. Unfortunately, in Brazil, we are still at the beginning of process of understanding the need for normatization of the interventions of the surface layers of historical buildings, for their preservation and conservation, both in aesthetic and technological aspects. This research tries partially to remedy this situation.

Keywords: color plans, chromatic methodology, historical colors, urban polychromy

Chromatic identity of urban historical settings: chromatic typology analysis

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Abstract

Among the aesthetic potentials of the historical settings, the color is one of the attractive resources, that transforms its image. The improvement of the visual image, with the purpose of restoration and conservation of identity, requires, among other tasks, the elaboration of specific strategies of coloring. The presence of buildings with different formal languages makes an appropriate choice of overall coloring of a setting quite problematic. Different historical levels suggest that the coloring should be based on the patterns of painting used in the past, with the possibility of some variations established by the historical styles.

This work proposes a methodology of analysis of urban polychromy based on the concept of chromatic typology, which is considered as an active, participative element in formation of the site identity. This allows us to choose more objective criterions for definition of the painting schemes and to decrease a degree of subjectivity in determination of the colors of historical buildings. In this study, the chromatic typology is defined as a result of interaction between morphological characteristics of historical constructions and their colors, as well as a union of formal and chromatic aspects, which are considered to be typical for each analyzed historical period. This concept was applied to both historical and perceptual aspects.

The research was performed in two stages: 1) the study of historical buildings and definition of stylistic chromatic models and 2) the evaluation of the perception of these models by current residents of the cities, taking into account a level of familiarity of inhabitants regarding the selected architectural styles.

Historical data of each architectural style were obtained by different techniques, each complementing another, such as, prospections (stratigraphic prospects) of buildings, survey of historical records and descriptions, analysis of images and study of projects with colored façades kept in historical archives. Perception data of residents were collected by applying questionnaires with visual images. The study was performed in four Brazilian cities of the Rio Grande do Sul state - Pelotas, Piratini, Jaguarão and Bagé.

The obtained results of the definition of coloring for the three partially overlapped historical periods - colonial, eclectic and pre-modern - have confirmed a feasibility and validity of the proposed methodology. Besides of revealing the general coloring of the past and the polychromy of the stylistic edifications in the sequence of historical changes, the study makes possible to identify the chromatic preferences of inhabitants of historical areas. In this way, the research unveils constant and innovative chromatic components and, therefore, creates some references to guide possible interventions in historical areas of urban scale.

Keywords: color scheme, urban polychromy, historical heritage, environmental perception

From the color of mountain landscape to the color of the heritage city of Guanajuato, Gto.

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Abstract

Santa Rosa de Lima (Santa Rosa) and Puerto de Santa Rosa are located in the Municipality of Guanajuato (in the State of Guanajuato, Mexico). With a population of 1085 inhabitants and 2573 meters of altitude above sea level. This locality is located to little 15 kilometers of the city of Guanajuato, inscribed in the list of World Heritage cities, and is acceded by the highway to Dolores Hidalgo. These settlements date from the seventeenth century, its main activity was mining industry mainly in the process of mineral extraction. The Real de Santa Rosa reported about twenty-eight mines in its jurisdiction three centuries ago.

The area, nestled in a rich and immense oak forest has suffered from its first settlements, product of mining, serious ecological damage considering that environmental problems of the sierra is related to the change of land use, deforestation and erosion, the decrease in the permanence of water bodies; which directly affects the loss and fragmentation of habitat for flora and fauna.

Guanajuato being a mining municipality demanded the exploitation of its wood resources for the opening of more mining gaps, in some areas the forest was negatively impacted. The national reforestation day promoted in 2008 helped the Mesa Cuata ejido of the Sierra de Santa Rosa reforest its environment and begin with the recovery of its forest lands.

The objective of this investigation deals with the relationship between the color of the Sierra de Santa Rosa and the patrimonial architecture of the city of Guanajuato, from an aspect of identity, of landscape transformation; to make known the impact that the natural landscape has suffered through a photographic record of deforestation, being in its initial state an oak forest and being affected by the religious impact and mining production. The study of the Sierra de Santa Rosa seeks to identify the characteristics of the natural phenomenon - rainfall - and the historical human transformations of the territory, as well as the interaction of all those elements, to understand the dynamic landscape: how to design adaptable landscapes and Proposals for increasing urbanization and climate change?

The city of Guanajuato has been an outstanding pole of economic, political, cultural and social development in Mexico during the colonial era. The discovery of an important silver vein in 1548 gave rise to an intense mining activity that still lasts. The historical uses and the transformation of the Guanajuato River that crosses the city reflect this essential aspect of the local economy, as well as the mines, the benefit haciendas and the tailings, or reservoirs of mining waste, that shaped the city's landscape and of its surroundings. At the beginning of the 17th century, Guanajuato was the main mining center of New Spain; at the end of the century, it had 47 haciendas benefiting from minerals located on the banks of the river, leaving an important amount of silt in its channel.

Keywords: mountain landscape, human settlements, transformation, identity and patrimonial color

Color territories: The colors of Boyaca, a palette for its identity

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Abstract

The following presentation shows the progress in the research project "Color territories: The colors of Boyaca, a palette for its identity" carried by the Gama research group of the Faculty of Architecture, Design and Urbanism of the University of Boyacá, Colombia.

This formative research idea has brought together students from the Architecture and Graphic Design faculties for a study of color of the urban landscape, this analyses color as a way of expressing the identity of a region. As a cooperative project it has been developed by the two departments above using their distinct perspectives, so, it promotes a collaborative and interdisciplinary approach.

The project is led by Elisa Violante and Carlos Mario Rodriguez, lecturers in Architecture and Graphic Design respectively, who are responsible for supervising the joint development of the project, including fieldwork, collection of information, and ongoing sessions with the Gama group students.

The methodology consists of analyzing the color of the environment of each city or town from the physical and perceived perspectives. Accordingly, the chromatic study of a selected municipality is realized in research by two students, one focusing on the physical dimensions, such as urban landscape and housing, and the other, surveying the attitudes of the residents relating to their perception of color. Therefore, it is a collaborative and comparative process, in which the community is also invited to participate.

In respect of the research techniques and instruments used, in the case of the physical context, it includes an observational process with photographs and drawings synthetized in a color palette using the NCS system. The other part of the study is developed with the citizens in activities using workshops and surveys that allow them to express color as a metaphor for the reality of the city.

At the moment the project has studied the results of five different municipalities in Boyaca and continues to add new places as the research group grows, eventually the study will involve at least two or three towns from each region of Boyaca, a total of around 15 municipalities. With the results a chromatic map of Boyaca is starting to emerge, this information has given us interesting new perspectives. Through color we can better understand how people relate to their environment in an urban setting, and also the chance for citizens to think about how color can be used to define the identity of a city.

Keywords: urban color, landscape color, identity, environment

Postcards from chromatic places
(from Golden, Colorado, to White Settlement, Texas)

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Abstract

The proposed paper features a design project I created titled *Postcards From Chromatic Places*. The project, in the form of postcards featuring color fields —à la Joseph Albers, Spencer Fitch, and Ellsworth Kelly— is inspired by actual towns on the United States map (from Flint, Michigan to King Salmon, Arkansas to Little Silver, New Jersey to Ruby, South Carolina). These works playfully voyage through the residues of color in the American cultural landscape and explore color's impact on our society at large.

The design methodology included (1) combing the atlas to identify every town in the United States named with a word associated with a color, (2) choosing two color-named towns per state, (3) pairing each color-named town with a specific Pantone Matching System hue, (4) designing 50 postcards using the colors of the chosen towns, and (5) researching and analyzing the history behind the name of each town. A variety of factors such as the hues of the physical landscape (the river color in Coffee Creek, Montana and the soil color of Blue Earth, Minnesota), elements of the geologic landscape (the minerals that inspired the famed Gold Rush in Golden, Colorado and the deposits of coral in the limestone banks of the river near Coralville, Iowa), structures in the human-built landscape (the color of the railroad depot in Ecru, MS), the ancestry of the region (the honor to the Dutch Royal House of Orange in Orange, Iowa), and, controversially, the people in the landscape at the time of the town's inception (the ethnicities of people in White Settlement, Texas) inspire the color names of American towns. The paper presents the design work, *Postcards From Chromatic Places*, coupled with research and analysis of the social, cultural, and spatial significance of names of color towns in the American landscape.

Illustration: Towns in the United States named with color words and their corresponding Pantone Matching System colors.

Keywords: *color naming, geography, color in design, color fields, North America*

Color and housing: A study of the chromatic aspects of the social mass housing complexes

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Abstract

This study explores the chromatic aspects of the social mass housing complexes by employing the use of the aesthetic approach adopted in the Environmental Perception field of research. The main purpose is to investigate the chromatic characteristics of facades, which affect the aesthetic quality of the residential buildings and, in consequence, the entire urban environment. The practical interest in this issue is caused by the increase of this type of constructions in urban environment and necessity to involve chromatic resources in planning these complexes due to their poor aesthetic composition in many projects.

The case study was perform in the city of Pelotas, Rio Grande do Sul state, Brazil, which has an expressive number of this kind of constructions. The research consisted of two stages: first, an analysis of principal physical and chromatic characteristics of the social housing complexes was carried out and identification of chromatic and structure typologies of existent facades was performed; second, resident preferences and satisfactions with respect to formal and symbolic attributes of the chromatic typologies used in the complexes were evaluated.

At each stage, specific methods and techniques were applied to achieve the proposed goals. The information on 95 housing complexes existing in the city and built from 1956 to 2008 was collected from different sources such as photo, drawing projects and records. Then the used facade colors were identified and classified in accordance with the Natural Color System (NCS) codes. As for resident preferences, specific questionnaires were prepared and used to interview 150 residents of these complexes. The data results were processed using non-parametric statistical tests for data analysis included in Statistical Package for Social Science (SPSS).

The research made possible to visualize the current situation of the housing complexes and understand how residents perceive the buildings, especially relationship between their formal and chromatic components. This was achieved be creating a large data base containing formal and chromatic characteristics of each of studied building complexes. In particular, it was shown that residents prefer cool range of colors, emphasizing the green tons, as opposed to what currently prevails in the housing complexes. In the terms of the chromatic distribution, a prominence of relief elements achieved by contrasting colors was preferred painting scheme. This work provides a comprehensive database, a theoretical framework and qualitative methodology for studies focusing in the area of Environment Perception, and it also allows us to prepare guidelines for chromatic studies of this kind of buildings.

Inherent and perceived colour: Bolivia-La Paz-Copacabana

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Abstract

This work develops the didactic experience as well as the conclusions accomplished after the student trip carried out within the framework of an academic reciprocity agreement between the School of Architecture, Arts, Design and Urbanism of the Mayor University of San Andrés, from La Paz, Bolivia and the School of Architecture, Urbanism and Design of the National University from Córdoba, Argentina.

The program exchange that involved teachers and students made it possible to share and implement different joint participation actions that promoted academic development aimed at strengthening the comprehensive training of each one of the participants.

As teachers of urban morphology of the School of Architecture, Urbanism and Design, of the National University of Córdoba, we considered many alternatives to work in the "ability of the human being to face the adversities in life, overcome them and even be positively transformed by them."

During the trip, several experiments in both urban and natural spaces were carried out, trying to understand both of them from the perception as well as from the inherent color.

The study and survey of the inherent color was performed by using a device called NCS Colour Pin (Natural Colour System). This device works by reading the color in different objects or materials and sending that exact information to a mobile device via bluetooth. That information is then exported as a spreadsheet summary of the entire measurements done in the previously assigned site.

On the other hand, the identification and determination of the perceived color, also given in NCS notation, came from the visual comparison with the NCS Atlas or NCS samples provided in the system.

Observation is performed by comparing the observed color in a given parameter with the color in the NCS Atlas, using the chromatic circle and triangles according to each chrome, allowing to determine specific NCS notations. In this method, it is usually assumed that observers are familiar with the NCS Atlas management and understand its variables, what make them capable of recognizing which of the NCS samples is the most similar to the perceived color.

The numerical values of the perceived colors provided by the NCS allow then to compute the different attributes of each of the colors.

After completing the "fieldwork", all participants came back to the classrooms and worked with different pigments to generate each one of the observed colors, focused on understanding their composition from the color theory and finally measured their inherent color values.

As a result of this process, the students were able to experiment the handling and creation of the color, as well as to understand the environmental or texture variables that affect and transform it.

It is from this starting point that they were able to propose urban landscapes interventions and modifications, within a learning process that challenged them to have a more inquisitive and creative attitude by applying knowledge acquired in the subject and by encouraging to continued training in the topic.

Keywords: colour, inherent, perception, teaching

Color in graffiti as a modifier of urban space

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Abstract

This research work focuses on the study of the perceptual and experiential phenomenon in the urban environment (urban structures), through the language of color present in graffiti.

The La Candelaria neighborhood of the city of Bogotá, capital of Colombia, has been taken as a case study. A place of great contrasts, combining modern buildings with colonial buildings, cobblestones, cobbled streets and paved roads, among other urban structures, whose own history make up the neighborhood history. All together causes an explosion of colors in balconies, baseboards and walls painted with graffiti, to achieve a magical confluence of color where are evident and important features that grants a particular identity to the most important downtown and tourist area of the city.

New perceptions and experiences are recreated in the passer-by, who is involved in different imaginaries, which allow us to construct different narratives of the place. And, it is under this premise that the following questions arise as a starting point for the investigation: How does the interaction of colonial urban structures influence the expression of their original color and the language of graffiti in the transformation of place? And, how does all this create positive emotional bonds and recognition of space?

The human being constantly modifies the environment and one of the ways he achieves it is through color, which designates a significant sense of order in everyday life in regard to landscape, architecture and urban environments. By means of methodological tools from the discipline of design, research begins, understanding the relationship and connection between what is painted, the architecture, the nearby community, the surrounding Bogota society and the visitors.

This is how the chromatic palette proposed from the art of graffiti, the construction materials, the particular colors of the houses and the urban landscape contribute in an essential way to reinterpret and resignify existing spaces such as squares, streets, buildings, chapels and houses among others. That is, color is then used as a language and produces a number of meanings in the individual that from his intuition, evocation and historical knowledge of the place; gives conscious or unconscious emotional responses, forming an identity of this. "Images capture attention and shape reactions so that they believe that the physical properties of images are as important as their social function" (Moxey, 2017).

The analysis of these visual and material productions is made from an interpretative vision of Visual Studies understood as methodologies that investigate the discursivities of power implicit in the images of any type and how they generate an aesthetic experience. Through this documentary and artistic archive we investigate the technical processes, the aesthetic characteristics, their influences, their ideology and their relationship with the architectural space; In this way, with the results of the work, we can identify the different narratives that are constructed through the atmosphere of the color that is lived in the La Candelaria neighborhood and the meaning in our cultural and visual history (Moxey, 2017).

Lisbon: The colour of change

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Abstract

Lisbon urban design is changing driven by smart solutions which aim to humanise built environment offering equipment and services, enhancing people appropriation of the urban space.

While Lisbon is growing as a smart place, people realise that the smart concept is more than environmental and economic oriented solutions revealing a strong social impact, in changing the way people live and interact with public places. However, does this contemporaneous urban space offer a humanised solution? Does it stimulate human senses towards the nurture of the emotion? At the end, are we still in an industrial image, with a technical focus or, are we producing humanised environments where human senses are stimulated and colour, in their dissimilar dimensions, assumes a leading role?

Such solutions contribute to a positive user experience; however, the human sense of comfort and wellbeing in the use of urban environment goes beyond technical solutions. Users demand more than an environment responsive to functional needs, users demand emotional stimulus.

Colour in built environment emerge as a tool of language, expression, communication and assembly encouraging users' stimulus, emotions and behaviour.

More than desirable, urban spaces approach colour in its aesthetical dimension plus its influence on urban area identity mainly by the reproduction of patterns sustained by traditional materials, construction process and colour, disregarding the functional and emotional power of colours and how these attributes can contribute to model human behaviour.

In a moment where the concept of smart cities invades important metropolitan areas, providing technical solutions that benefit built environment with new equipment and services, where the exterior space emerges as a scenario to improve human interactions how should colour be approaching to humanise built environment? How can colour be part of urban design smart solutions to enhance the social impact of smart concept?

To explore this subject, we will consider the city of Lisbon. Lisbon city centre becomes a preferential scenario to implement smart solutions. Yet, the available solutions illustrate their environmental and economic benefits neglecting their power to promote new ways of living and interacting with urban design. Considering the different levels to understand colour in built environment - the neighbourhood, the street, the building and the detail – and the functions that colour can assume in it, it is urgent to rethink the planning of urban chromatic palettes.

The aim of this paper is to understand how colour can be an indisputable component of smart solutions within the development of urban design in Lisbon.

Keywords: colour, urban design, smart solutions, user experience, user centred design

Colour functions in urban design: communication, identity and user behavior

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Abstract

"Color is much more than an aesthetic statement: it is part of a life-giving and life-preserving process. It is part of the terms and conditions under which humans live and experience. Besides other sensory perceptions, humans orient themselves according to optic signals, and learn through visual messages. This makes color vitally important to the meaning of the environment as well as to human interaction with it." (Meerwein et. al, 2007:16)

When correctly used, colour influences humans behavior and improve the urban experience. Despite this, rarely colour has been considered as a primary instrument of urban design. The complexity of colour subject, the absence of rules and the lack of operational concepts led urban chromatic choices voted to the free will.

However that colour choices to the public place can follow some guidelines in order to improve both, the urban environment and the user experience. But these guidelines need to be visual and conceptual systematized to become more operational to professionals, municipalities and individuals. Namely:

- Colour is important to <u>communication</u>. As quoted by Lynch (1960), colour can be used as a guiding mechanism which alters the space readability. Side by side, in a place with and without wayfinding measures, the user fell oriented or lost. Also, focal points and strategic repetitions can be applied according to Gestal and Itten's theories to capture the sight and to decode the urban functions.

- Colour is important to <u>identity</u>. By identifying or creating the colours of a place it is possible to construct meaning and strengthen the sense of belonging. Imageability is the concept that enriches the user connection to the place. On the one hand, we can survey of the existing colours and identify the predominant. On the other hand, and in the absence of a more effective strategy, the chromatic contrasts can create the elements for a new identity.

- Also, Colour is important for <u>user behavior</u>. From interaction of the previous concepts –communication and identity– the user is more closely related to the environment that he perceives and identifies with. Colour links these factors by manipulating the perception of peaceful or over stimulating environment. For this reason it is fundamental colour research oriented to humanist principles that can support urban regeneration, bringing the cities of the past to the living models of the future.

From literature and iconographic reviews, confronting urban scenarios with and without colour strategies, this paper aims to clarify what are the colour functions in the public place and how colour can be oriented as a tool for urban regeneration, in order to justify the importance of colour functionality as a regulatory instrument of urban design.

Keywords: colour functions; urban regeneration; communication; identity; user behavior

Urba Khroma: a tool for the analysis of spatial coherence in the city

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Abstract

The proposed paper aims to present *Urba Khroma*, an application that can be used to characterize chromatic attributes of an urban area and to approach, in an objective way, the complexity in managing visual urban environment due to the proliferation of perceptible signals. The challenge is to provide statistical and quantitative answers to these questions: how is colour organized, how does it develop its own structure in the city? How can colour appear as an indicator of homogeneity and spatial coherence?

The research is based on the development of a "colour metric" in a similar approach with the ones that were developed for analysing usual urban morphological features as form or building layout by analogy with the spatial and landscape metrics. Our method was tested through an application to 18 urban fragments of the city of Liège (Belgium). In the first step of the method, we present a protocol for chromatic characterization which provides a synthetic visualization of the colour distribution: the approach we have developed allows to synthesize the colour attribute of a street or a place, through visual graphic tools which revealed specific distributions of chromatic values for the 18 urban areas.

In a second part of the study, we use a K-means statistical clustering technique to produce chromatic types of building façades. The typological analysis of the 18 urban areas explains how colour is organized and how it developed its autonomous structure. We can also note that our chromatic typology makes the link with the concepts of type and typology developed in the theory of architecture and urban analysis. Once the chromatic categories are defined, the question of spatial coherence is investigated using the Shannon entropy value as an indicator to approach the complexity of the distribution of colours, in terms of heterogeneity/homogeneity of the urban fabrics. The results highlight differences between compact urban areas (historic center, 19th century developments), which appear coherent and homogenous concerning the chromatic distribution, and new urban configurations (city entrances, commercial and periurban zones) which reveal fragmented and discontinuous features.

Our application *Urba Khroma* combines, through a graphical interface, the protocol for chromatic characterization with the typological analysis and provides a numeric indicator to evaluate the spatial coherence. In the field of research on ambiences and sensory environment, our characterization method seems to be different of a sensitive dynamic approach since it is based on a metric instrumentation and standardizes the perceptible conditions experienced by users, such as variations in light intensity, spectral modifications of the light source, visual colour heterogeneities due to the material texture or the solar geometry. It is common to oppose an objective approach, related to metrology and parametric environment managing, with a subjective approach, oriented towards perception and sensory experience. We believe that the developed tool is complementary to a more sensory approach: according to Jean-François Augoyard, an architectural form involves both quantitative, physical and human characteristics, both theoretical and practical aspects.

Keywords: Chromatic characterization, urban analysis, typology, Shannon entropy, spatial coherence

The relevance of light and colour in current architecture. Possibilities and challenges

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Abstract

In the contemporary world, important changes in the materiality of the architecture are proved, where light and colour, as relevant components of urban architectural design, are generators of new expressions that help current technologies. They also have the ability to inform, suggest, rank, develop synesthetic associations and create atmospheres that transcend materiality towards new creative and perceptive dimensions.

Therefore, the consideration of the variables of colour and light in current architecture becomes an opportunity to explore possibilities and assume new challenges.

The relevance that the light and the colour have had through the time in the configuration of spaces and their expression is known. Light reveals colour and shapes, places us temporally and spatially, highlights qualities of materials and encourage our behaviour. At the same time, these variables have the ability to influence the tone of the environment, interfering in the perceptual and significant experience of architectural and urban spaces.

In recent decades there have been significant changes in electrical artificial lighting, resulting from technological advances in relation to their spectral characteristics and others, among others, because the light has the attribute of changing the perception of spaces, people and objects. Moreover, the colour has extended its expressive ability by developing new materials and possibilities of reproduction and chromatic perception. To this, the contributions in lighting are added to cause substantial changes in the design.

Regarding lighting design, changes accompanied by technological evolution and exchanges of experiences between different disciplines have been experienced, which have enriched the debate about the role of lighting. Thus, it has gone from considering it only in its quantitative aspects, to respond others such as human factors and the new cultural demands of today's society. What is significant in contemporary lighting is that it is no longer considered as a functional tool to take advantage of a spatial design resource.

The colour is an active part of everyday living and can be defined as a visual sensation. In relation to the chromatic design, it should be considered that the perception of colour results from the interaction between a light source, the characteristics of reflectance and transmittance of the materials, and the visual response of an observer. By modifying the spectral characteristics of the emission of the light source, the result will be different from the colour perceived in space, both in perceptual and emotional aspects. Thus, it must distinguish between pigment colour, light colour and colour light.

Among the relevant qualitative parameters linked to colour: the tone, the chromatic reproduction index and the colour of the light are the most significant to observe. This is verified in interventions of interior spaces, buildings and urban environments of Córdoba city, Argentina. In consequence, to investigate and reflect on the variables of colour and light, it propitiates the performance of readings of architectural and urban facts to interpret the answers to the possibilities and challenges of materiality in current architecture, emphasizing the relevance of light and the colour.

Keywords: light, colour, architecture

The color of the immaterial.
Thermodynamic representation of the urban landscape

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Abstract

"I felt satisfied with myself when I discovered that the sun, for example, could not be reproduced, that it needed to be represented by any other thing ... through color" (Varichon, 2005, p.50)

Behind the "sun" there is a definition of a *space* comprised between the subject and the sun as a physical fact. A perceptual subjectivity that gets close to what post-impressionists of the 19th century reflected. To the author, the *representation* of what is known as "atmospheric" can not happen in other way but through one color and the indirect reference to the series of sensations that it generates in people.

Color is a result of physical - chemical and lighting processes decoded by the perception of man. Likewise, the development of societies has given different meanings to it according to their relationship with other fields of life. Color is modified according to those relationships´ space and time, for different cultural constructions.

As a result of the above exposed, we affirm that color is a *product* in constant re-meaning.

The definition of a hue depends on the location within the electromagnetic spectrum and will depend, then, on its wavelength. This way, colors are classified into warmest, those of a longer length, and coldest in the opposite. A temperature scale is associated to this. Which is the chromatic result of the thermodynamic representation of a city's urban landscape?

The city is a direct modifier —passive and active— of the weather variables and as a consequence, of the thermal states of its public spaces; indirectly, the thermal sensation of people exposed to different weathers —natural and artificial— is altered.

The objective of the investigation is to graphically capture a lecture of the urban landscape, which allows us to establish a relationship between the different environmental conditions and the thermal scale of the color spectrum. That is to say, to reveal the chromatic range existing in the perception of the immaterial space, resulting from the work of the city.

The process consists on obtaining thermo-graphic images which could give us the opportunity to infer a degree of cold / heat of the environment through the radiation of the materials that shape it. All of this, will be possible after a study of the public urban enclaves using a sun / shade scale. The result is an urban cartography that exposes the classification of the different chromos according to the wavelengths.

Unveiling a chromatic lecture of space is a contribution that delves into the current movement and revolution of the immaterial. The possibility of associating a thermal state of the urban landscape to a color within the spectrum, generates a new point of view on the representation of the first one, complicates the definition of the second one(relation of ambient and corporal temperature with the chromatic) and reinforces the idea of cultural product.

It is an inclusive point of view of the subject, everyone feels.

Keywords: color, thermodynamic landscape, product

Water and color reflections in the landscape of a city: The cases of Venice and Milano

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Abstract

This visual essay proposes some reflections about the role that water plays in the changes and appreciation of the landscape two cities in Northern Italy that are profoundly different: Venice and Milan. Water, when taking the form of a river or canal inside of a city, is in constant fluidity, and can appear as a mirror as well as a filter, it can be seen as solid or diffuse. It can configure and change, even during the same day, the image of a certain space, neighborhood or, in the case of Venice, an entire city. Color and light interact with water, contributing from their own relative nature, and the result is an ever-changing landscape, in which the natural and the artificial environment must cohabit.

In the case of Venice, the city and its unbreakable relationship with the changes in the color of the water is exposed. The first impression of Venice can also be one of the sea. The sea embodies everything that is changing, variable and accidental. It is the restless and voluntary element. It arises in infinite variations of color and surface pattern. Color and light in Venice are as important as its space and form. The light in the water projects illumination upwards and outwards. Sunlight plays on walls and ceilings, with an effect of incessant undulation. Somedays, the buildings reflect against the surface of the water and the different materials becomes color on the water; other days, the water clearly reflects the blueness of the Venetian skies; but there are also some other days, when the canals appear to be of dark-gray nuances, without reflecting the characteristic ochres of the architecture. The color of the waters of Venice, depending on the day and on the weather, can be described as green, blue, black, gray, brown, pink, lavender, violet, orange; providing the landscape a multicolored changing image. As pointed by Peter Ackroyd, "*The colors of the sky and the colors of the city are refracted in little ovals of ochre and blue. It is all colors and no color. It reflects and does not own, color. It becomes what it beholds*". A reflection about what should be the real color of the city is proposed.

On the other hand, the Milan canals known as Navigli, are a network of navigable waterways that have evolved and have been transformed over more than two millennia. Since before the conquest of the ancient Mediolanum by the Romans, which took place in 222 BC, the original Celts of the area had to canalize and regularize the flow of water in order to cultivate lands originally marshy. These shallow channels of crystalline fresh water, are characterized by the perception of colors that depend on the position of the observer and the surrounding environment. The dominant blue color typical of the water of the canals is the result of the scattering of light in the H2O molecules and the reflection of the sky. However, in these fresh waters, which move slowly towards the horizon, often in the absence of wind, surface reflection takes on a predominant appearance. The blue then leaves room for other colors, like the golden ones of a sunset typical of the plains of northern Italy and the warm ones like red, amber and yellow, typical of the historic buildings that have stood on their banks for centuries. In summer the growth of algae transports the green of the surrounding lowlands to the canals. Milan was born on swampy areas of rotting waters, but today the waters that creep between its palaces are like gems sprouting from the ground to reflect its image.

Keywords: color and landscape, colors in water, color and light, surface reflection, color appearance

The Ksourian polychromy:
Investigating the urban/natural landscape of M'zab Valley, Algeria

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Abstract

Ksour (plural of Ksar) are original architectural models of fortified villages located in the north of Africa. They offer, through their urban and natural visual sceneries, specific visible features that we name them "Ksourian Landscapes". In this study, we develop a new approach to investigate the chromatic character of the natural and the urban landscapes of the region of M'zab valley in Algeria, which it is listed in UNESCO world heritage list.

Our method aims to investigate the chromatic integration of the Mozabite human settlements in their natural landscape, by working on the combinatoric theory of Anders Hård and Lars Sivik in NCS using "color relations" as a factor referring to the perceptual similarities or dissimilarities in a Color Gestalt. A natural palette (NP) has been conducted involving 12 representative colors from the natural landscape of the site, in addition to a second palette (HSP) involving 16 colors from the human settlements of the Mozabite urban landscape.

The identification of similarities between the two palettes / landscapes has consisted in their comparison through the NCS nominal identities (blackness, whiteness, chromaticness, yellowness, and redness) and the NCS relation identities (hue identity, saturation identity, delta identity, and beta identity), using a graphic representation in the NCS color circle, the NCS color triangle, and the NCS 3D color space.

Our results have taken out of 201 relations from 192 NP-HSP combinations, demonstrating the strong chromatic integration of the Mozabite vernacular architecture to its natural landscape and highlighting the importance of color as essential factor inseparable from the architectural and cultural heritage value. This research led us to develop a new research concept entitled "Ksourian Polychromy", aiming to study the color issue in the vernacular Saharan Ksour of North Africa.

Keywords: Algeria, Ksourian landscape, M'zab Valley, natural color system, vernacular architecture

Preservation and transformation of old urban areas

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Abstract

In recent years, the rapid development of China's society and economy has accelerated the process of urbanization, but also formed a huge impetus and pressure on the construction of cities. Some old urban areas in cities often have problems such as aging houses, narrow and congested roads, defective functional planning, backward public facilities and serious environmental pollution. Therefore, the process of urban renewal has been carried out in various parts of China.

Taking the protection and development of the main streets in the old urban areas of Beijing and Zhejiang Province as examples, this paper discusses the transformation and reconstruction of the old urban areas under the background of urbanization in different regions, and tries to find a balance between the protection of the old urban areas and the improvement of the quality of life of local residents. In the transformation of old urban areas, the color planning and design of buildings and environment should not only keep the historical features, but also become one of the strategies to improve the quality of life, promote urban innovation and diversity, and lead the sustainable development of urban culture and economy. By investigating and studying the natural color, cultural color, traditional architectural color and current architectural color of the main streets in the two areas, and combining with the two urban planning, this paper analyses the differences in color planning and design between the two old urban areas, and puts forward that different architectural and environmental color designs should be applied in different areas according to the construction methods and product effects of coatings. The design method can achieve the best visual and economic benefits, and provide practical methods for urban color management and implementation.

Keywords: color plan, color design, preservation & transformation

The extraction and application of regional features of urban colors: On China's urban color planning strategy in the context of globalization

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Abstract

This paper indicates that the mixed, featureless and identical urban colors in existing Chinese cities result from the blind copy of the popular culture in the trend of globalization, which can be eventually attributed to the loss of regional features of urban colors. As it points out, regional features of urban colors originate from the natural environment such as climate, geological and soil conditions, as well as the human environment comprising economic, technological, historical and cultural factors etc. The urban color system with regional features can make the region unique and different from others in color. Therefore, the key solution to the conflicts between regional features of urban colors and the trend of globalization is to identify and define the former.

This paper discusses the decisive influence of natural environment on urban colors through case studies of the urban color planning projects directly by author in Guangzhou, Zhuhai and Xiamen etc., and demonstrates the constructive role of human environment in cultivating urban color spirit through the case studies of the urban color planning projects directed by author in Suzhou, Yangzhou and Shaoxing etc.. Based on these examples, it also elaborates on the extraction of urban color spectrum with regional features through urban color research, chromatographic analysis, color image analysis etc., based on which the urban color planning strategies can be worked out for the construction of urban color environment. These strategies include the establishment of recommended urban color chromatography adapted to local temperature and daylight environment, color and space design approaches, and the expression of urban color image as cultural symbols. The paper considers the strategy an ideal goal for China's urban color planning in the trend of global convergence, and at the same time, a necessary way to conserve local color language in the context of global cultures and create a world of diverse colors each with its own individual beauty.

A case study on environmental landscape color harmony via the Zhengbin Fishing Port color scheme

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Abstract

The concepts of environmental landscape color harmony are highly dependent on nurture and culture. The purpose of the study is to analyze the significance of environmental landscape color harmony via the Zhengbin Fishing Port Color Scheme. The color scheme is, based on Jean-Philippe Lenclos's methodology of color geography, to adopt NCS environmental color survey tool for the regional local colors investigation and to develop a color planning strategy. The objective of color planning strategy is to maintain the balance between the color imagery of harbor city and Zhengbin Fishing Port area, to achieve "colorful diversity", and to develop a proper color scheme to enhance regional characteristics and cultural style of the Zhengbin Fishing Port.

A multi-color combinations façade of the seafront architecture complex is the target color scheme. A scientific NCS environmental color survey conducted to collect regional colors information and to establish an environmental color database. The overall environmental landscape color of the ZhengBin Fishing Port region is mainly blue and green, with yellow and brown dotted. The measurements of brightness and chroma distributed from 05~70 and 10~70 accordingly. The domain color hue ranged from R~B90G with medium to low chroma and brightness. The embellishment chroma distributed from G10Y~Y90R with medium to high brightness. The color appearance of the architecture complex's façade is common in gray and brown with an overall brightness distribution ranged from 05~60 (medium to high) and an overall chroma distribution ranged from 00~50 (middle to low). The perceived color imagery of the ZhengBin Fishing Port's landscape tended toward a turbid tone (flat and obscure).

A subjective environmental color analysis evaluated by the color planner helped to plan a color scheme. Based on the principle of color harmony, the color planner designed a multi-color combinations scheme by selecting domain colors and increasing color contrast in compliance with proper lightness, chroma, environment context, and color composition to fulfill the objective. The overall performance of the color scheme perceived quite harmonious with environmental landscape colors. Indeed, the color project not only enhanced the Zhengbin Fishing Port's regional characteristics and cultural style successfully, but also became a visual landmark as well.

Keywords: environmental landscape color, color harmony, color scheme, NCS environmental color survey tool, subjective environmental color analysis

The chromatic intervention as a proposal of urban image design for university contexts: The case of Coapinole, Puerto Vallarta, Jalisco, Mexico

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Abstract

The present work suggests the chromatic intervention, as a proposal for the design and improvement of the urban image in the contexts of University Campus, in the city of Puerto Vallarta, Jalisco, Mexico.

It is proposed to conceive color as an element of intervention to trigger the development of university contexts in the urban borders of the city. At the same time, color is considered as an articulating element of the urban fabric with the surrounding neighborhoods, in a city with tourist characteristics and with unequal degrees of development.

For the chromatic intervention, a methodology of qualitative research and action research is proposed that contemplates the color as an integrated element to the study of the urban image and the infrastructure of the context of the university campus taken as a case study.

The starting point was an integral diagnosis, to identify and select the areas to intervene, to involve the community with the participation of the stakeholders, to formulate an intervention proposal based on the existing contextual development.

The proposal of a chromatic intervention as part of the improvement of the urban image design in these contexts of edges of city, means that it constitutes, not only the visual memory of an urban area, but the living image of the city, the experiences of its inhabitants and how they interact together with the colors, in their streets, their squares, their constructions, the natural context, their facades and their textures.

It is emphasized here how all these elements, highlighting color, play a preponderant role in the configuration of the identity of a space or a certain area, and in the urban cultural construction of it.

The results, coming from the study and chromatic intervention, show the necessity in the contexts in which the public universities are installed, to generate improvements for the inhabitants and for the users, as products of a joint action, established between the University and the different social actors that participate in the community.

Keywords: urban color, urban image, color and urban edges

The management of color in the landscape of common spaces of high density social housing and its relationship with searching for visual quality

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Abstract

As a result of an analysis of the characteristics of diverse common spaces for green areas, projected in the high density social housing complexes in the Buenos Aires City, the need arises to carry out an approximation to the topic for detecting through a system of valuation, those failure and successes in the proposal of the landscape projected and determine the consequences that it produces to the habitable space and its immediate urban environment, so that it could serve as a basis for future landscape projects in common spaces of housing complexes.

Through observation and analysis of the characteristics of the common spaces of different housing complexes in the City, a first approximation to the topic was obtained, such as spaces valued for their landscape characteristics, with a correct choice of tree species, its relationship with the environment and its identity resolution of spaces. In these cases, the color that the space takes, understanding it as a visual quality, produces satisfaction in the users, allowing the strong sense of belonging to it.

On the other hand, other results showed situations where there is no landscape value, where the gradient of colors obtained is limited, damaging the user's relationship with space, getting a surface dedicated to common areas unrelated to the housing complex from which it emerges or it does not have a good resolution in urban aspects.

That is why the need to analyze in depth which are the projective deficiencies in the landscape of these common spaces, how the color obtained in the design of the space affects it, depending on the housing environment as well as its immediate urban context, in order to decide the true characteristics that make up successfully an area of common use and its constructive resolution, taking into account the importance of achieving visual quality in these areas of social exchange that take place in the housing complexes.

It is estimated that certain spaces were projected with due care and prior study of the characteristics of the existing landscape, respecting sun and native vegetation, taking into account the variables of the place, its chromatic scale and its relationship with the user, that is why their species have prospered in a positive way, as well as an intrinsic relationship between the user and the landscape color obtained, achieving high quality common spaces for those who live in the social housing complex as well as for those who walk through them.

It is necessary to generate basic guidelines on the project process of high-density social housing that involves the details of a landscape project in relation to color management and the consistency with the space where it should be developed, leaving aside preconfigurations that could hide good results.

Keywords: Landscape, social housing, color, common spaces, vegetation

Making color palettes for multi-unit apartment buildings based on the building color survey in Japan, Portugal, and the Netherlands

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Abstract

It is rare to be said that the Japan's townscape colors have been better even though the guidelines for townscape generally include color usage limits, primarily the color's Chroma. The purpose of this study was to check the efficiency of the color palette —a series of color usage— instead of color limitation.

The color survey for the multi-unit apartment building surfaces was conducted to make various color palettes. The survey analyzed apartment building surfaces in three countries, including Japan, Portugal, and the Netherlands. The three attributes of colors, Munsell Hue, Value, and Chroma, of the main parts of building façades were measured. The total number of measured buildings was thirty, ten in each country. The contribution of three values of color suggests the YR to Y low saturated colors dominated at the surveyed areas in Japan. The YR to Y high brightness - low saturated color dominated in Portugal, whereas the YR and Y, B, PB color high brightness - low saturated and low brightness - low saturated color dominated in the Netherlands.

In the experiment, a total of 180 apartment building images were projected on-screen and evaluated using four semantic scales by female university students aged twenty to twenty-two. Thirty images were taken at the survey. The 150 color-simulated images were derived from a combination of five buildings and thirty color palettes that picked up colors from the original thirty buildings. Simulated colors were adjusted to the RGB values of color chips for the image of the sheets of the Book of Japanese Industry Standard Color Standards in order to match the same lighting condition as the building images, which were taken on a cloudy day. As a result, the color on the images was the same color in the photos of the real building.

Three of the four scales showed that preference, calmness, and remarkableness have a high correlation, over 0.8 in absolute value. This means preferable apartment buildings have calm and unremarkable colors.

The images using only high brightness - low saturated colors and only high and low brightness - low saturated colors were relatively preferred over other images containing middle or high-saturated colors. The border of saturation to be preferred is roughly less than four on Munsell Chroma. The guidelines in Japan are set at less than or equal to four to the Munsell Chroma limitations. The buildings' shapes have a high potential to explain this phenomenon on the basis of the past study.

The interaction was observed when the middle or high saturated colors were used for either remarkable or unremarkable parts of buildings. The palette should be more effective when it contains two parts, one for base colors and one for accent colors.

Keywords: color palette, multi-unit *apartment, townscape, color control, preference*

Color ideas. Urban chromatic actions from teaching

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Abstract

With an express morphological focus, it is up to the operators of the city study those instruments that contribute to the identity construction of the urban image, with a social commitment that makes each city unique, memorable, with insertion in the local and regional framework.

Color is one of the tools for the revaluation and valorization of urban areas; it verifies and sustains its performance, builds, accentuates or materializes the image, makes it possible to achieve the expression of an urban scenario that is clearly legible.

The Faculty of Architecture, Town Planning and Design of the National University of Córdoba, is considered one of the consultative institutions for decision making in different areas of urban action. In this institutional framework, from the Institute of color, and from the chair of Urban Morphology, there have developed since 1996 the tasks of research, teaching and extension, in the field of urban morphology focusing on the language of color. In this way, this task is part of the relationship of action in a public sphere with the aim of providing from the University to the community the knowledge about colors, construction and strengthening the image of the city of Córdoba.

The work that is presented, relates the experience of the realization of a Student Competition in 2017, stimulating the transfer in the actions of extension towards the city of the teaching practices, developed in the degree space of the chair. From the approach of the urban color theme, the intention was to develop the transfer of urban color learning practices, into a real design situation in the city. This is, from the exercise of the construction of color palettes, and then its application by means of a chromatic arrangement in the composition of the façade of the old Children's Hospital Building, current headquarters of SENAF dependencies, Ministry of Justice and Human Rights of the Province of Córdoba.

The tasks are framed in a signed Collaboration Agreement, within the extensive activities that relate to the Faculty of Architecture, Town Planning and Design, and the Province of Córdoba, in order to generate positive synergy. This agreement represents an incentive to learn of issues inherent in the construction of the image of the city, and the improvement of educational quality in the training process for the students and teachers of the chair.

The results of this academic work are presented once the painting and renewal is done, finally in November of 2018, reaching a new façade for the iconic building.

Art and living environment:
Culturological analysis of city-land identity

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Abstract

The urbanistic history of Europe gives number of examples of tolerance towards the cultural differences in time and space. Multiethnic signs are there interlaced with a diversity of traditions of arts and styles, of materials and their interpretations in art forms. Since a long time, the European cities was building a unique aspect from the symbiosis between bright individual works of artists and architects whose names have marked entire ages in the cultural development of the world. These paramount achievements have their deep roots, and they are part of the spirit of the place, of the humans and the community. The skills and experience for absorption in the middle resulted in a symbiosis of the realities of nature are accumulated in the cultural monuments there throughout many centuries, have provoked and provoke many authors to non-standard artistic thoughts, which are growing into new artworks. These are not limited to only material works of art, but also literary and cinematographic achievements, which also represent a part of the unforgettable image of the landmarks.

In Paper will be presented theoretical framework of the methodology for Cultural Study carried during the research and educational project *Art and Living Environment* it was realised from 2011-2018 with couple of modules. Through the results of the current study illustrate the analysis symbol elements that form the city identity on the basis of the comparisons of the realities of city environment with its artistic interpretations in various arts, without overexposing certain events at the expense of others. Underlined the connection with local facts: history, traditions, characteristic materials, motives, atmosphere, etc., which are reflected into the image of the contemporary city, landscape and respectively, into its aspects. Outline the main strata, which are building the city-land identity, and the possibilities for the artistic interpretation there of.

The main conclusions provide opportunities for reflection on urban identity from lanscape point of view within the context of the lines of acquaintance, which are defined by the author. Untraditional routes will be used for the understanding of the particularities of the city through characteristic cultural signs and their implementation as an educational model for humanities students.

Chromatic variables of different influential physical contexts in urban spatiality

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Abstract

The relation form / context, architecture / environment, urban landscape, etc., has been in the last decades a concern of the academics and researchers of the western world and especially of Latin America. The answers to those relationships are many since each culture, each society, in the same way that it produces its own architecture, a language or an artistic heritage, it also elaborates and selects particular spatial manifestations in time. However, this is not enough since they are the architecture and design disciplines that intervene in the construction of urban spatiality. On the other hand, many formal responses to architecture only address the intrinsic problems of urban living as isolated phenomena, without taking into account the degree of connection with the physical context of implantation. The hypothesis that underpins the present project is based on a particularized reading of the urban landscape based on approaches and theoretical contributions from nearby disciplines such as topography, topology and theories of color.

From this perspective, the proposal is based on establishing relations between the architectural text and the theories of color, with the conviction that these relationships are possible from the significant perceptual fact and as such, it returns scenes and images that make up the urban landscape. Considering the architectural fact as a unit that articulates with other units in a specific urban environment, we can approach the idea that the grammatical coherence of the whole would determine the grammar of the unit or rather of the architectural units. From the discipline morphology and the confluence of other disciplines such as geometry, topography and topology, we understand that it is possible to define and model variables necessary for the transformation and re-signification of urban spatiality.

This presentation focuses on some aspects derived from the research project under my direction CAI + D 2016 currently in development, Modeling of topological and topographic variables from different influential physical contexts regarding the relation between full and empty spaces within urban spatiality.

Keywords: topology, topography, color, spatiality

Architectural landscape built by engineer architect Francisco Salamone. State of conservation of tiles located in Azul city, Buenos Aires Province, Argentina

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Abstract

The typologies adopted by Eng. Arch. Francisco Salamone in his public works constitute a historic architectural landscape that has left its mark in the Buenos Aires Province for the "futuristic and technological" qualities. He chose reinforced and architectural concrete as main materials in three types of buildings: municipalities, cemeteries portals and slaughterhouses. In addition, a plaza with all the urban furniture (benches, lampposts, pergolas, etc.) was designed and erected in front of the city hall.

In Azul city, one of these squares was developed as recreational space in which the floors were made with tiles (also called "mosaics") specifically manufactured for such application. The pieces, rhombic and different colors with low saturation values, i.e. in the gray scale, were elaborated with two types of mixture, one of them suffers the wear of the traffic and provides the color, while the another, located below the first, fills the previous one and is in contact with the subfloor. By updating the square' state the lack of some of its parts and the detachment of others were found.

The paper shows studies related to the aesthetic aspect. Such studies were used to characterize the parameters allowing to define the tiles color and texture and, therefore, make it possible to reproduce the original pieces. The information presented here was developed in the context of a methodology used in the "Laboratorio de Entrenamiento Multidisciplinario para la Investigación Tecnológica" (LEMIT-CICPBA), which is suitable to evaluate the chemical, physical and mechanical properties of elements or structures that should be subjected to maintenance works. The color evaluation tests were made by using equipment provided by the "Centro de Investigación y Desarrollo en Tecnología de Pinturas". It is important to emphasize that the main motivation of this work was to generate a database facilitating the interventions in maintenance works located in the Buenos Aires Province.

The works of Eng. Arch. Salamone located in Buenos Aires Province, Argentina, have a patrimonial meaning and fundamentally represent his ability to merge the knowledge related to the design and the materiality of a work. The present work shows the characteristics of the tiles found in San Martín square of Azul city by evaluating the mortars used for its construction. From these results, the original value of parameters related to aesthetic aspects such as color, yellowness index, gloss and roughness was obtained, knowledge that will allow reproducing the original pieces necessary to carry out the square' restoration and valorization tasks.

Keywords: historic architectural landscape, Francisco Salamone, San Martín square of the Azul city

Colors in the landscape of Buenos Aires

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Abstract

At this congress, with the presence of participants from all over the world, it seemed right to me to talk about the trees that ornament Buenos Aires city, since they will find them on their tours through all the streets and parks.

According to data from the Ministry of Environment and Public Space, the city currently has more than 420,000 trees. Buenos Aires is well known for the cultural value of its trees, with the benefits that help a higher quality of life to the inhabitants. The urban landscape shows an appearance that is modified by the trees in different seasons of the year. It is especially in spring and summer when important areas of Buenos Aires have modified their color due to the flowers coloring the city. However, also in autumn and winter the streets are colored by the leaves of the trees.

Jacaranda, a tree native to South America has been widely planted because of its beautiful and long-lasting light blue flowers in bloom all over the city. They appear in spring and early summer, grace the plazas, parks, line the major avenues and streets. The flower of jacaranda is the flower representing the City.

Lapacho, is a native tree of America, widely planted as ornamental tree due to its colorful magenta flowers. Flowering season is September, before the new leaves appear.

Palo borracho, called 'palo boracho' (drunken stick) because its trunk is bottle-shaped. It is native to Argentina and Brazil. Its trunk, bulging in its lower third, measuring up to 2 meters in girth, serve to store water for dry times. Trees bloom in spring. The pink flowers are very showy and remain for a long period. In winter open the fruits showing the white cotton surrounding the seeds.

Paraiso, is native to India and Pakistan. There are about 35.00 trees in the streets. Flowers are showy, fragrant, white to lilac. In winter, no leaves remain, just the "China Berries" fruit, small, yellow, that are also very ornamental.

Tipa tree, is a South American. Very parasol like shaped, provide shade and cooling effect in the summer heat. It is in full bloom in December. It is one of the most well known trees of our flora.

Fresno americano, is a tree from the temperate forests of North America, Asia and Europe. The foliage, glossy green, turns to bright yellow in autumn. It is the species with the largest presence in the streets of the city.

Liquidambar, is a tree from Southern USA, Mexico and Guatemala. In autumn the leaves turn yellow to red and burgundy coloring the streets.

Plátano, of American origin, which can reach above 40 meters high, providing a dense shade. There are about 35.00 in the streets. It bright green foliage turns to light brown in autumn.

Even in a big city like Buenos Aires is possible to take delight on the colors that surrounds us due to the beautiful trees. Flowers in Buenos Aires are so important that one sculpture of a stainless steel flower more than 20 meters high dominates the United Nations Plaza with its presence.

Keywords: urban trees, flowers' color, urban landscape, Buenos Aires city

Chromatic planning for urban furniture: the different typologies

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Abstract

This paper aims to present a way to approach various typologies of settlements or cities, when creating urban chromatic plans to urban furniture, improving their visibility and readability. The problem of applying an urban furniture chromatic planning methodology to urban places with different characteristics, aroused from a Post-doctoral research that has being tested in several case studies with quite diverse dimensional, anthropological and topographic specifications.

In order to establish a brightness and color application contrast to urban furniture, the main body of the methodology consists in recording all the existent settlement colors, arousing from the environment, including the existent building colors, which are the elements that interfere the most with the visibility of urban furniture; the vegetation and the sky colors, and their climatic variations; and the colors of other elements whose presence may also affect the urban furniture colors. All these colors are then registered on forms and maps, in order to create a data base whose interpretation will lead to the determination of the dominant colors which are essential to allow the establishment of a coherent urban furniture color plan.

The main stages of the applied methodology may be the same for every settlement or city. However, the procedure will take different steps depending on whether it is an old settlement with diversified colored buildings, a newly built neighborhood with a more or less homogeneous coloring, or an unfinished project whose colors are yet to be defined.

With few exceptions, most of ancient urban spaces don't have chromatic plans, being their buildings constructed at different periods, with a large chromatic range as well as different sizes and importance. Therefore, the registration of the present colors should be more exhaustive and take in account more accurately the relative importance of the buildings. Often, these settlements have a lot of small houses with one or two stories, making the natural environment and the sky more present, and these conditions make the definition of these places' dominant colors more complex. In these cases, the urban furniture may be more difficult to establish and fulfil its functions with lower efficiency.

On modern neighborhoods, the buildings have more or less the same size and although they may have some variants of shape and color, they are relatively homogeneous, which makes it easier the identification of their dominant colors and, consequently, the creation of a coherent chromatic plan is less complicated and can be more effective.

When the construction of a population cluster is still under development, it is easier to decide the color scheme for its urban furniture, because the choice of colors meets the same criteria of the architecture and should be included in the general project. Then, the choice is based on the registration of the colors of the surrounding natural environment. The difference between the colors of the buildings and those of urban furniture is that the first ones may contrast or integrate the colors of the environment, while the urban furniture chosen palette must establish a luminous and chromatic contrast with both architecture and environment.

As final considerations, we aim to demonstrate that the elaboration of urban furniture chromatic plans must take different approaches according to the place specifications that may include the local traditional colors and Historical identity.

Keywords: urban furniture, chromatic plans, visibility and legibility, settlements, modern and ancient

Image Analyser: A laboratorial tool to describe and analyse color in landscape images

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Abstract

The term landscape appears, in the 16th century, with an aesthetic appreciation of the territory. Color participates in this action as responsible for innumerable aesthetic sensations. Color and landscape began their relationship since the origin of the word, drawing values for territory which are associated with beauty and enjoyment of places (Zonneveld & Forman, 1990). With the scientific advance the aesthetic and visual role of landscapes has being replaced by its importance from the ecological point of view. "The notion of contemporary landscape has progressively shifted away from its importance, especially to get closer to ecology, geography and terrestrial physics."(Carchia & D'Angelo, 1999). Raymond (1973) returned to landscape first role, beeing the first author attributing cultural value to landscape. Slowly, since then, studies showing that images provided by landscapes are intimately related to places identities and memories, with strength enough to be considered a value to preserve, also as an natural resource (Schauman, 1988 apud Fadigas, 1993), have gained importance. Curiously, this awareness of a scenic value firstly happened in urban historical centres, even before we name it "urban landscapes", giving origin to urban chromatic plans.

Although the reference to color in the landscape arises in territorial planning instruments, as environmental impact studies, and on landscape's analysis and diagnosis, in most cases they are mere sensory observations and are far from the rigor in which its ecological characteristics are described. Surely the difficulty of measuring color in the landscape, where major components are biological contributes for this, remembering color complexity of its components, the high number of landscape planes and observation points, which transcend the complexity of color measurement in the built environment. Thus, knowledge that deepens the description of color in the rural landscape acquires relevance.

The paper herein presents a new methodology applied to two case studies – Samouco Salt Mines and S. Domingos Mine Fields, Portugal, two places of cultural importance with great presence of water as a common element. As a methodological process it was firstly carried out a photographic survey of the places (12 month), followed by a chromatic analysis in laboratory through a created computer software written in Visual Basic, which identifies and quantifies colors of an image in the HSB chromatic system – the Image Analyser. This software also starts an analysis of the contrast zones of each chromatic coordinate.

As main results we obtained a constancy of the hue, in all the surveys, in both case studies. This fact suggests that the chromatic changes of these places are carried out mainly by changes in the saturation and brightness coordinates. We also found a strong relationship between the analysis of brightness coordinates contrasts and the force lines of the landscape suggesting here that the differences in brightness coordinate values will play an important role in the perception of object boundaries.

Results show that this methodology may bring new data related to the analysis and description of the palettes of a certain visual field or importance of colors and their chromatic coordinates, in the perception of objects. It also serve as a working tool, not just for landscape design, but also in areas where color is an expression of the factor in study and be able to be captured in a given image.

Keywords: software, landscape paletts, color perception, landscape design

Color as a landscape component in townscape catalogues

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Abstract

A catalog of urban landscape is an innovative instrument generated to guide urban planning processes, with a landscape approach. The purpose of the catalog is to determine the character and type of value that a landscape possesses and to outline actions for its maintenance or improvement. And color is considered a landscape component that affects the character and value of the landscape.

The methodology for the construction of the catalog (developed since 2010 by the authors of this work) includes the analysis of the environmental color. It consists of the colorimetric measurement and definition of chromatic schemes of visual basins. The latter are recorded in opposite seasonal periods (summer-winter, autumn-spring).

At first, activities are oriented toward the definition of vantage points by determining observation spots to record panoramic views (through photographs). An observation spot is a place where landscape is mainly regarded as to its accessibility and visibility conditions. Observation spots are areas that attract the largest number of onlookers and visual opportunities. Panoramic photography, in turn, is a specific type of wide-angle photograph in horizontal format corresponding to an ultra-wide (360 degrees). The analysis of environmental color encompasses regular hue schemes (in square pixel format) to obtain a color measurement percentage: Even though color is a dynamic landscape component depending on light and environment changes, it is necessary to apply a pixeling process to the panoramic photographs taken in similar environmental conditions.

This phase of the catalogue preparation results in a set of file cards containing the landscape components of every one of the vantage points, connecting written, graphic and photographic information produced from the data gathered in photographs and field observations. The results of the environmental color analysis of each vantage point are contrasted with the others and the chromatic homogeneity of the landscape can be determined.

Data processing following this system allows circumscribing the character of every vantage point, which is – through consistency or difference– associated in the definition, delimitation and characterization of homogenous zones within the area of study. A homogenous zone is composed of the specific combinations of various vantage points whose landscape components share similar features and confer a marked idiosyncrasy upon the rest of the region.

This article exposes in detail the technical and conceptual aspects that are executed for the study of landscape color in the townscape catalogues.

Keywords: townscape, colorimetry, landscape catalogues

Seminar on color ambiences

Towards a theory of color and light ambiences in built and natural environments

How do we approach the continuously fluctuating color and light complexity of a city, a district, an urban space, or a natural landscape? The aim of this seminar is to study analytical and methodological approaches to color and light and to explore and discuss ways of creating ambience –the character, mood, special quality, or atmosphere of a place– in the natural landscape or in an interior or exterior space in the built environment. The basis for the study of color and light ambiences in these different situations is gained through insights from different points of view into how to create a relationship between color, light, and materials.

Looking back to the 1920s and 1930s reveals a growing interest in how color and light shape the human environment. Mutually inquiring into these historical principles and those evident today, the aim is to identify and track which color and light components have had longevity and which concepts and applications have newly appeared as well as disappeared. Our questions include: What has survived, but is actually out of date and what has endured and still seems appropriate to our times? What new means of color and light technology have appeared in the 21st century to create contemporary color and light ambiences?

We also aim to discuss whether the color and light of a building can be changed easily. Colors can become a fad, i.e., fashionable. Some colors are so unusual (Antoni Gaudí) that they appear to be good perennially. Other architectural colors are exceptional (Le Corbusier) and are therefore also considered to be eternally pleasing. Here we consider how fashionable or stylish color and light should be in new buildings and in architecture in general and at what cost buildings should be fashionable.

As we further inquire into the principles creating color and light ambiences in architecture, urban space, the built environment, and the natural landscape, we will consider the implications of Jean-François Augoyard's claim that for three decades the search for ambience (*la maîtrise des ambiances*) has been part of architectural education. The qualities of light, sound, ventilation, material, and movement are some of the main features of ambience. However, ambience is more than a product of technique and technology, it is the trigger for our overall response. Here ambiences –like cities– can be attractive, pretty, or ugly.

The principles behind how to generate –and critically sense– such features and effects will be developed in this seminar in order to ultimately distinguish elements for forming a theory of color and light ambiences.

The seminar's theme is related to the topic of the Midterm Meeting of the International Color Association, AIC 2019 Color and Landscape.

Organizers: Environmental Color Design Study Group, AIC
Verena M. Schindler, Yulia A. Griber, José Luis Caivano

The semantic color space

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Ambiences Seminar

Abstract

The current design trend is to improve people's lives on an emotional level. The consequence for architecture is a profound change from a preoccupation on how spaces are built functionally, or appeal esthetically, to what they mean to their users. Moreover, design needs to transform in ways such that methods of logic, mathematics and statistics can be applied. In short, a semantic turn in design is inevitable. This paper presents the semantic colour space as a scientifically based design method to connect psychology, emotion and meaning in an intuitive way to elements of visual language. The method is suitable for the analysis as well as for the creation of meaning and ambience in built and environments.

The cube-shaped color space is formed by 3 dimensions: depth, height and width. Each dimension represents a distinguishing aspect of meaning on an abstract level. The meaning is given by the elementary properties of the space, which stand as opposing pairs on the dimensions. In the depth the meaning is given by the contrast back/front. In the height it is above/below, in the width: left/right. The 3D-structure is essential for this model because it is inherent to human thinking. Not only we think in antagonists, but also dimensionally, according to aspects. Depth, height and width are dimensions of imaginary but nevertheless meaningful positions and movements that form the basis of the meaning. In the same way the three dimensions of emotion: pleasure, dominance and arousal, from the bio-informational theory, as well as a scheme of personality and design preferences, could be put together in the semantic color space.

In this model concepts are given a coordinate formula containing static or dynamic letters in depth, height and width, thus forming a codon, with which they get a place in the space and can orient themselves. The physical and psychological parameters of color such as wavelength, lightness, saturation, temperature, weight and activation are systematically compared with those from the space. The result is a set of 8 primary colors, assemblies of the individual color contrasts on the three dimensions, as such getting their fixed place on the 8 corners of the cube.

Because meaning is analyzed into abstractions, it becomes possible to make synesthetic comparisons with other sensory experiences. There is no difference at a certain level between colors, shapes and materials. For example we can call a colour, as well as a shape 'sharp'.

The model is simple and complex at the same time. It allows a hierarchical structure, an endless refinement of the meaning, of the colors and its synesthetic connections.

The semantic color space is the result of more than 20 years of research. By carefully comparing statistical correlations between the different sensory parameters and the psychological and emotional effects, a network of design handles is offered. The semantic color space makes it possible for architects to design in a scientific way without losing touch with their intuition, getting a solid grip on the meaning and the ambience they express.

Perception, color and user experience:
A study in a hospital environment of hemodialysis

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Ambiences Seminar

Abstract

The relationships between the built environment and health have been investigated using psychological and physiological indicators of well-being. Studies on the hospital environment indicate that color and light can affect patient recovery rates and improve the quality of general user experience (Dalke et al., 2006), as well as influence the association between environmental perception and quality of services provided by the medical team (Arneill & Devlin, 2002; Dijkstra, 2009).

Apparently, the proper use of colors, among other aspects in the environment, helps in the spatial orientation, location and communication between the teams; and can contribute to job satisfaction and well-being (Rangel & Mont'alvão, 2011, Andrade, Fernaud & Lima, 2013). On the other hand, the number of studies on the influence of achromatic colors applied ostensibly on the hospital environment is limited (Elliot & Maier, 2014).

This research investigated the perception of environmental color in the hospital dialysis sector, an environment that has not yet been studied. We sought to identify the levels of affection reported by users regarding the color of the environment, by which affective valence it is pronounced and its intensity; and compare these data with chromatic schemes indicated in the literature.

An exploratory study was conducted through interviews with patients, caregivers and medical staff of two hospitals, totaling 115 participants. The tool used was a two-dimensional model of affection (PANAS-VPR scale), depending on the real environments and their digitally altered photographs. In these simulations, 08 hot and cold color combinations were tested using the Munsell notations 1.75PB 9.09 / 2.1 (light blue), 4.08Y 9.08 / 3.0 (beige), 8.46GY 8.74 / 27 (light green), and 2.69RP 9.03 / 3.1 (light pink). Data analysis was performed using descriptive statistics. Spontaneous expressions of some users, their opinions and preferences regarding the colors of the environment were recorded, analyzed and categorized.

The investigated, mostly white, environments presented lower medians of positive affection than the chromatic schemes used in the simulations (photographs), which presented median positive affective meanings with the cold prevalent arrangements, followed by the hot prevailing arrangements, respectively.

Despite the tension inherent to the activities performed in the hospital environment of hemodialysis, the colors simulated digitally were well received by the respondents. Companions more often cited affective words related to color; the medical team used more expressions associating the color to the environment and the feelings of equivalent form and; finally, patients expressed themselves more often with phrases that connect color to the comfort aspect.

The overall user preference was higher for the chromatic arrangement with a predominance of light blue, followed by light green, beige, light pink and, lastly, the original mostly white environment. The data points to the preference for a gently colored location, including the ceiling, and with some contrast, as opposed to a white location that has only variations of clarity. These results corroborate the indications of the literature for visual stimulation through the application of complementary colors, tonal variations and use of light colors.

Correlation analysis of color and function of urban architecture: Taking Shanghai as an example

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Ambiences Seminar

Abstract

A point of view is very popular that buildings with different functions should correspond to different colors, and low chroma and high brightness are the basic principles for the use of architectural colors in Chinese color schemes.

This view will be verified by measuring the architectural colors of Shanghai in the field and analyzing the numerical intervals of the color attributes of different functional buildings. The main urban area within the outer ring road of Shanghai with 680 square kilometers are investigated. The block is the basic space unit and the NCS color card is used. 6811 valid samples were obtained. Buildings are divided into seven categories by function, including residence, business, office, culture, education, and so on. The color system is divided into five categories, such as red, yellow, blue, green, and neutral.

Both chroma and lightness are divided into five intervals according to the level of the value.

First, the color information of buildings of different functions is classified. Second, the color attribute information for each sample is split, including 20,433 data. Again, the scatter plot is drawn, and the number and proportion of color samples in different intervals are counted, and the distribution intervals of color tendency, brightness, and chroma are identified.

At the same time, the research group undertook the rehabilitating project of the old city of Jin'an District, the very central part in inner Shanghai. Search and practice show that color in space continuity is far more important than function itself. In the 11 old and dilapidated street facade, the color plays a very important and key role in the re-beautifying movement. For instance, in the old resident area street face, combined with the technique and material, the color is decided mostly not by the function but by residents' color bias, anticipation, neighbour colors, spacial importance, etc.

The research result shows a very interesting topic, in most case, the urban color plan should pay more attention to how to use color, instead of use what color. And, color in not connected with function, but with more of the environment and era.

A study on the fragmentation measurement of color space in historic areas: A case study of the old city chamber in Shanghai

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Ambiences Seminar

Abstract

There are many historical buildings in the historic area. Its architectural color features embody the local color style and features, and it is also an important carrier of the local color culture, and the source of the continuation of the color context. The color style of the historical landscape area should be based on the wholeness. However, many new modern buildings and high-rise buildings have been built in many historical areas with the large-scale urban renewal movement.

The color of many new buildings is quite different from that of historic buildings, which has a strong impact on the traditional overall style.

The overall color style is gradually becoming fragmented. The fragmentation measurement model was constructed. The historical landscape area of Shanghai Old Town Chamber was taken as the research object, in order to accurately measure the fragmentation degree of splendid color landscape. The quantitative fragmentation index and shape fragmentation index of each color system were calculated.

Traditionally, there are more white residential buildings and less yellow temple buildings. However, the research results show that yellow is the dominant color in the new buildings, and blue and red are the most common and the proportion is high, and there are also very few green ones. The area proportion of yellow block is the largest, which is close to 70% of the whole area.

The shape fragmentation index of yellow system is the highest, which is 0.0688. The second is the red line, which is 0.0591. The index of blue system is 0.05729. The lowest is the green series, which is 0.02837. Yellow buildings are mainly residential buildings, temples and commerce.

The statistical results show that the yellow patches are the most fragmented in the historical and cultural landscape area of the old city chamber. The largest color separation index is the green patch, which is a modern high-rise building. The red system is mainly a new commercial building, while the blue and green systems are mostly made of glass. The traditional color features have been weakened, and the fragmentation degree of the old city chamber color features has gradually increased.

It is necessary to combine urban renewal to reduce the degree of fragmentation of color in old city compartments and improve the integrity of their color features in the future. Some basic principles should be abided by, such as protecting the authenticity of color, maintaining the integrity of color, and continuing the memory of urban color when the historical landscape area is renewed and transformed.

Keywords: historical area, fragmentation index, color patches, integrity

Some flying ideas about color and light ambiences in built and natural environments

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Ambiences Seminar

Abstract

What is "beautiful"? All the golden ratio and rules of "beauty" depends on functionality. If something is a functional and useful feature in nature and/or in the life (lifespan) of humans, it becomes "beautiful" over time. If desired functions change over time, the "beauty" perception changes also. This a process which is time dependent. When needs and necessities in human life come to new levels it also changes the taste. Otherwise there should be no changes in artistic tastes.

Ambience is subjective. It depends on individual's (visual) perception and culture of the of each individual. It is a psychological and social phenomenon. Feelings like being in a nice ambience is society and individual dependent. When they change the ambience perception changes, also.

Visual and color perception are illusions. They are created in the brain and not in the eye. Visual and color perception can be created in some instances even without any input in the eye (dreams, synaesthesia, hallucinations, etc.). So, perception of images and colors cannot be explained directly physically. Scientific illusions can show the discrepancies between perception and physics.

Until about 200 years ago the cities had only artificial lighting with candles. The light of candles had only the wavelenths of flames. Over time with the invention of electrical illumination the spectra of artificial lighting has changed. Today one can have even daylight light properties at darkness or at night. The availibility of new spectra allows the mind and the taste to have new horizons. Illumination technologies have changed in the last decades rapidly. New LED technologies allow any color temperature and any color of artificial lighting with relatively simple devices at financially affordable prices with less energy consumption then some decades ago. So illumination and its color composition can be managed as desired.

Humans eye physiology best perception wavelengths in darkness or in nights have a shift to blue (so called blue shift). These is an adaption (or a change due to Darwin's theory) to seeing in natural darkness at night. At evening and at night natural illumination spectrum is shifted also to blue. New illumination technologies change the light avaiable at night.

Due to human physiology one can only see a colour on an object when it is given in the spectra of illumination luminaire. So the perception changes with illumination. New technologies like smart cities, smart illumination, very new technologies like street illumination on smart phone signal detection change the lighting in the cities and the corresponding human perception rapidly. On the other hand augmented reality and virtual reality with new visual and pseudocolor perceptions may change all the conventional visual perceptions.

So, beauty or ambience in illumination and light color composition of cities and their change is dependent on the change in functions of humans, changes in lighting and imaging technologies and the physiologic illusions and nature of humans. The ambience of cities due to illumination and color should be in accordance with human functionality and physiologic needs.

Color and cultural landscapes

Colour associations for the words *feminine* and *masculine* in nine different countries

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Abstract

The main goal of this study is to examine how colours with different hue, lightness and saturation are associated with the words *feminine* and *masculine*. Both concepts are among the leading concepts actively circulating in society, and thus being familiar to the great majority of adherents to different cultures. Their content reflects gender stereotypes, gender roles, actual and perceived sexual orientation and significantly differs across countries and time periods.

The objectives of our investigation were three-fold: (1) to reveal colour structure of both concepts in different cultures; (2) to visualize the obtained color associations and (3) to understand their cultural significance and specificity in different countries, ages, sex, and religious backgrounds.

The method used in this research was previously implemented during a pilot stage in Sweden and Nepal in 2016 and first presented at the AIC2016 Conference in Santiago. Since then the number of countries extended from 2 to 9. The data in the present study was collected in Germany, Iran, Japan, Nepal, Russia, Saudi Arabia, Sweden, Turkey, and Uganda.

The experiment participants were given 26 words, including the words *feminine* and *masculine*, and asked to match each word to a sample from a chart with 27 selected colours from the NCS system. The subjects participated in the experiment in English. They did not have any known colour defects, and they were born and lived in the same country.

In total, the final dataset included 18,072 responses received from 753 participants.

The results will be presented with statistics and diagrams showing the chosen colours, and analyzed in terms of how coherent are the answers and which potential patterns emerge specific to the countries and their cultural contexts. It will be possible to compare the answers of groups separately and to analyze if there are differences in the chosen colours related to the subjects' sex, age, religion and experience of colour.

The research possesses wide prospects for further development, based on the material of other cultures, together with a potential for considerable application. The obtained results could be valuable in compiling topical dictionaries and reference books, teaching activities, as well as contributing to a great spectrum of practical tasks in architecture, design and advertising communication.

Keywords: Colour associations, design, psychology, culture, architecture

Colour and landscape in Octavio Paz's *Libertad bajo palabra* [*Parole*] (1935-1957)

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Abstract

The purpose of this paper is to analyze the colour significations in Octavio Paz's *Libertad bajo palabra* [*Parole*] (1935-1957) in relation to the landscape reflected in the figures of the garden and the paramo. The landscape is considered as a figure of nature (Silvestri 2011) and it is found in many literary texts. These texts are conceived as places where the social, cultural and aesthetic reflections are viable and fruitful (Collot 2011, Ferreira Alves and Feitosa 2010). This is the case of *Libertad bajo palabra* [*Parole*] (1935-1957): a book of poems displaying a lean palette principally and exclusively composed of green, sepia and gold.

The first two colours are linked to the settings designed throughout the book: the garden and the paramo. Gold is related to the poetry of light which can also be found in *Libertad bajo palabra*. Significantly, green is the predominant colour throughout the poems. Firstly, I am interested in highlighting that Paz's taste for colour derives from the need to renew the poetic strategies which take modern poetry as a model (Hamburger 1982). In this context, it is important to consider the relationship between poetry and visual arts (Manrique 1974). Secondly, I am interested in considering that green symbolizes the fullness of life, transcendence and nature (one of the most fundamental categories in *Libertad bajo palabra*). Finally, sepia recovers the landscape of the paramo representing the creative aridity of the poet and the alienation of the modern human being. The paramo is opposed to the garden, which suggests harmony. The garden, then, implies the appropriation of nature since nature is conceived as the perfect orb but inaccessible to the human being. This appropriation is set by means of analogy.

By focusing on the landscape, Octavio Paz can build two interesting poetic strategies. On the one hand, he is able to distance himself from the nationalistic aesthetics' parameters (Diego Rivera's muralism is a good example of this); on the other hand, he is allowed to build his own culture from universal categories (landscape and colour). In this case, he is able to express his own through a universally intelligible language (the long-established tradition of the landscape and the tradition of modern poetry in the symbolic use of colour).

Keywords: colour, landscape, Octavio Paz

Color and art shaping contemporary landscape dimensions

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Abstract

Landscape is a term from the late 15th century used in painting to refer to the representations which have *natural* scenery as primary subject matter. Since the 16th century it has been defined as "all land that eye can grasp" (Rey, 1992). Calhau (2002) observes two implicit elements in this word's first sense: the observer and the object looked at from a distance, and highlights what happens when we make a "canvas translation". By doing so, a space between both is defined, as well as the possibility of a path to be followed and its resultant memory. By assigning space, time and memory dimensions to the landscape's experience, it differs now, from that enunciated in the 16th century. Its aesthetic components, such as sea, mountains, sky, fauna, flora, colors, or human constructions, in relation to a certain idea of *nature*, remain, but we see it differently because landscape's concept has been enlarged. It should be noted that ecological evolution has removed the landscape from its aesthetic function (Carchia & D'Angelo, 1999), bringing it closer to biology, as a living system: landscape mosaics (Fernandes, 2006). Later the awareness of landscape's living components' vulnerability, some of them dependent on human systems, made culture emerge as a key element for preservation of landscape itself, transforming it into the arena for human culture.

The issues brought forth by the contemporary landscape concept, highlighted by art, put in question the nature of the *Nature* we see, which part of it we will still be technically able to control, or have political freeness to inhabit. Thinking about the unprecedented transformation of landscape we witnessed last century, through exploration of resources along with biological research, we are now more alert than ever to observe that the *romantic nature* painted in Casper David Friedrich's canvas, was the result of a human construction, as much as he was shaping a landscape experience.

Throughout a bibliographic review in the field of color, art (installation, site specific, performance, bio art) and landscape, and by analyzing color effects as physical and symbolic media, this visual essay aims to show how the use of color by artists enunciate landscape's new dimensions and issues. Hence, the complexity of *Nature* will be explored by "Asphalt Rundown" by Smithson (1969), "Alba, GFP Bunny", by Kac (2000), "Nature?" by Menezes (1999, 2000) and by "Virtual Garden" by Ydreams (2001). The performances "To Raise the Water Level in a Fishpond" by Huan (1997), "Memorial Project Nha Trang, Vietnam: Towards the Complex - For the Courageous, the Curious, and the Cowards" by Nguyen-Hatsushiba, (2001) and "When Faith Moves Mountains" by Alÿs, (2002) will clarify social and political landscape dimensions. Attention given to non-places (Auge, 1995) and to globalization, where territory is now a technical product neither *natural* nor *artificial*, will have an arena with "Airports", by Fischli & Weiss, (1987-2006), "Terraced Rice Field" by Krue-On (2007), or Poro's poetical actions, "Image ... color" (2003, 2004), "Garden" (2002, 2004). Finally, the imperceptible blue of "Descent into Limbo" by Kapoor (2018) will point to the view of a landscape from outer space without a horizontal plane, or perhaps, a return to a time before time or distance existed. The return not to the two-dimensional canvas, but to a dimensionless state: the point.

Black, white and red: archetypes and symbols

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Abstract

Colour is a complex cultural construction, a rebel against generalisations, something to which we assign values, qualities and meaning.

In our lengthy experience in teaching about colour and its role in the visual project, in addition to colour theory, we have always also analysed its emotive and communicative aspects. But we still wonder to this day how much students perceive the difference between the archetypal, and therefore universal meanings, and those symbolic meanings specific to the culture they belong. We are talking about archetypes and symbols of articulated situations where, if one doesn't grasp diversity, in today's globalised world, one risks formulating an imperfect or ineffective communication. For this reason it is important, in research and education about colour, to begin with knowledge of its archetypes, understood in their supra-historical and supra-geographical sense, followed by the symbolic crown that each culture has developed in an independent manner.

In its symbolic declinations colour has represented the property which renders intelligible to the eye the meaning concealed behind the surface: the image of the mystical in nature, of the transcendent within the immanent, of the hidden properties of interdependent elements which, according to ancient knowledge, formed the universe.

As a means to knowledge and interpretation of the real and as energetic form able to interact with the natural forces, in archaic societies colour has been an instrument of medicine and magic; as image of mystical forms and of their relationships within creation it has coloured religious language; as mark of belonging or exclusion it has characterised social life organising itself in codes.

This work analyses the universal meanings of colours which over time have specialised historically, namely the progress from archetype to symbol, leading the inquiry through ancient religions, cosmogenic tales on the formation of the Universe and the myths of civilizations that developed around the Mediterranean sea, cradle of European society, taking as an exemplificative title the three principal colours from an anthropological point of view: black, white and red.

This is an exploratory and comparative survey on the archetype of colours and their structurisation in symbols born to reveal the inexpressible through colours, which concludes with an observation on contemporaneity, where despite destructurisation of society, the archetypical meaning endures, while the symbols which developed over centuries starting from the original meaning have become fluid and evanescent along the way, and they are now used irrespectively in social and communication contexts where they continue to change meaning according to the environment in which they are found.

Analysis of the relationship between fashion trend forecasting color and clothing color of fashion brand

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Abstract

The purpose of this study was to analyze the relationship between colors of fashion trend forecasting agencies and clothing colors of fashion brands. For this research, the time scope of research was set as 2019 SS, and the forecasting colors of trend forecasting agencies and the clothing colors shown in the 19SS Ready to Wear Fashion Show were collected as research stimuli. For the trend forecasting colors, 326 colors proposed by 7 domestic and foreign major fashion trend forecasting agencies (Pantone, Premiere Vision, Intercolor, Fadi, FirstViewKorea, Promostyl and SamsungDesignNet) selected through interviews of fashion color industry workers were used as research stimuli.

Color collection applied to fashion brand clothing was targeted for 130 fashion brands participated in the 2019 SS Ready to Wear Fashion Show of VOGUE Korea online. And, 650 images were selected from among 6,402 images shown by the fashion brands in a systematic method. The selected images were reprocessed according to the types of top, bottom and top & bottom of garment in accordance with 'KSA0006 (Textiles and Clothing Terms)', and the dominant color of each clothing type was extracted by using the YSACA v1.6 program.

Color analysis was classified based on Munsell's 40 colors and PCCS tones and Munsell Conversion 12.19.1 and Make Tone program were used for color conversion. For the research data, Microsoft Excel 2013 and the statistical program R 3.4.4. were used for frequency analysis, analysis of variance, and post hoc tests were run using False Discovery Rate. The results of this study are as follows. N/Wh (7.65%), 2.5P/p (1.8%) and 2.5PB/p (1.85%) among Hue & Tones proposed by the trend company were overlapped.

The most widely used hue/tone in fashion brands were in the order of N/BK (13.3%), 2.5P/p (7.6%) and 5P/p (2.4%). In addition, there were many cases where the colors proposed by the fashion trend forecasting agencies were applied to the fashion brand clothing and the most frequently applied cases were N/BK (19.1%), 2.5P/p (10.8), 5PB/p (2.4%), 10R/p (2.15) and 7.5R/v (2.1%) and so on. Among the 7 trend forecasting agencies, the colors of Intercolor (27.6%) were most widely applied. The following colors were Pantone (19.7%), FirstViewKorea (19.3%), Fadi (15.1%), SamsungDesignNet (8.5%) Promostyl (6.8%) and Premiere Vision (3%).

The significance of this was to identify about the relationship between forecasting color of fashion trend and clothing color applied of fashion brand.

Keywords: trend forecasting color, trend color, clothing color

Boy wears blue and girl wears pink:
The meaning of colors in a political speech

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Abstract

Damages Alves, Minister of Women, Family and Human Rights of the new Brazilian government, gave a speech on the day of her inauguration (January 2nd, 2019) during which she enthusiastically celebrated, in chorus with her supporters: "Attention, attention. It is a new era in Brazil. Boy wears blue and girl wears pink". The event was filmed and the video released on January 3rd, 2019.

This last phrase caused great repercussion, and was the subject of numerous discussions in various settings throughout the country. The Minister's response was that she used the phrase as a metaphor, meaning that this new government believes in and respects the "biological identity of children". From this justification, big questions were raised: what are these beautiful colors doing in this speech? What content is its significance reinforcing there?

In this article, we attempt to find answers to these questions by analyzing the presence of these two colors (pink and blue) in the context of Minister Damares Alves's speech.

It is known from semiotics studies that colors are signs, and as signs they reflect and refract the symbolic constructions of the society in which they are inserted, that is, they reflect the beliefs of a society while simultaneously interfering in the construction of these same meanings. This construction is collective and seeds from a social function. Pink is a color associated with the female, the passive, measured and almost angelic universe. Meanwhile, blue is the color of dreams, quest, faith and royalty, and is associated with the masculine universe.

The presence of these two colors in the contextualized speech of Minister Damares Alves reinforces the dichotomies of gender and a conservative biological determinism. In addition, they praise and embrace male dominance and normative heterosexuality, not promoting the inclusion in society of people who do not feel included on either side of this dichotomy.

Since the sixties, the feminism movement (along with other movements) has been working to blur the lines between these dichotomies, valuing critical thinking and promoting inclusion. For this, the pink color and the blue color of the biological determinism are transformed into all colors, together, considering all their differences.

Development of color charts through the organoleptic of food as a tool for design

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Abstract

The contemporary design world breaks and paves the history of human daily life, studying behaviors, cultures, perceptions and desires of people in different contexts.

Design explores the senses and those emotions that derive experiences in the research of answers that drive to innovative practices in all the areas of the knowledge; the academy as a laboratory of thought finds the reality of its own environment, to communicate and teach the new generations, diverse ways of observing, creating and take part through languages, which, like color, become a powerful means for creation of new forms of expression of imaginaries through narratives full of meaning.

This document presents a sample of research studies carried out in the course Color, of the Department of design of the Universidad de Los Andes, Bogota – Colombia. Focuses mainly on as design and its surround thought in human activities explore one of them related to color and Colombian food culture, which gives possibilities for re-discover and reinterpreting the essence and identity of food, through the organoleptic memory leading this activity to instances that are more sensitive.

Since it is from the evocation and memory referred to the act of feeding, where individual memories are recorded (personal narratives) and collective through images for the development of moodboards about food and moments, places, situations, people, etc. Becoming an important input for the understanding and construction of new sensory, cultural and morphological universes through color.

From this academic practice, the question arises: How organoleptic memory from food becomes a creative tool for the construction of new expressions of color in design.

The methodology used to motivate the creative field with the students begins with the exploration of food and its configurational and compositional components "natural"; that enable random interventions, and allow the construction of "Color Cards", as a new color tool designed under contextual, temporal and emotional parameters. Is a challenge that students assume using basic design principles as a tool of morphological making and complemented with creative mechanisms extracted from observation, interpretive analysis, ideation, prototyping and testing of their creations.

The result is to discover and apply innovative color patterns (chromatic tables encoded), shapes and textures re-signified, associated with multiple experiences such as detonate memories, re signify the past, "feel the present."

The cause a taxonomic deconstruction of the food taking as main axis the color and everything that is implicit in its environment; are some of the inputs that this research and exploration work presents.

The use of color cards applied in the construction of new visual, text and configurational narratives is finally exposed, that allows to recreate from different playful dimensions of the design, in the pedagogical, in the communication and other knowledge.

Dulce de leche as part of the gastronomic landscape of Río de la Plata

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Abstract

Dulce de leche is a typical dairy confectionery product and is part of the gastronomic landscape in many South American regions. Although there are discrepancies on its exact geographical origin, and many stories regarding its creation, the most frequent references on its spread and wide consumption are particularly set in Río de la Plata region, shared by Argentina and Uruguay. The shop windows of food stores, bakeries and bars are thus influenced by the color of this typical sweet delicacy.

When people are far from home, the finding of familiar gastronomic products like *dulce de leche*, make them feel in a more accustomed environment. That is why, in late years, migration currents and globalization have made the commercialization of the many variants of this dairy product increasingly popular in faraway countries.

Sensory characteristics of these products are crucial to define consumer acceptability: especially flavor and visual appearance (gloss, visual texture, color, transparency) are considered as determinant criteria for the decision of consumption or rejection.

Even though the formulation is simple, different industrial and home-made procedures are employed, which results in very different sensory outcomes. Also, in different countries and at different times color preferences of *dulce de leche* continually change (more or less solid, clearer, darker, glossy or matte).

In *dulce de leche* preparation, mixtures of milk and sugars (mostly sucrose, with or without other sugars, such as fructose or glucose) are concentrated by the action of heat at normal or reduced pressure at mildly alkaline medium. Maillard reaction (non-enzymatic browning) is responsible for sensory changes, mainly browning and flavor generation. Changes in sugar composition or alkalinity bring about drastic sensory changes.

In present work, the chromatic displacement of *dulce de leche* with different formulations during product preparation stages has been characterized. Several commercial samples from Uruguay and Argentina, with other samples of *arequipe* and *manjar* from Colombia were included in the CIE chromatic diagram for comparative purposes.

During *dulce de leche* preparation the samples show a color displacement from the achromatic region with very low saturation values, becoming saturated with cooking time through the yellow region up to an intermediate saturation value, and finally deviating with an increased dominant wavelength in the red region in the more saturated samples.

The commercial *dulce de leche* samples from Río de la Plata region were located in the chromatic zone between the intermediate yellow saturation area and the more saturated, "reddish" zones, with a wide variation range. However, the range was even wider when samples from Colombia and other preparations of caramel jam from other geographic zones were added. *Arequipe* and *manja*r were found to be located closer to the achromatic area, while other preparations of caramel jam were dark brown.

Typical customary food preparations, indicating the wide chromatic range of *dulce de leche* and its influence in the urban landscapes of Río de la Plata region, are also presented in this work.

Keywords: dulce de leche, browning, chromatic displacement, gastronomic landscape, Río de la Plata

Color identity in South American natural landscapes: herbs, flowers and fruits crops

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Abstract

Natural landscape is associated to national identity. Particularly, local flora expresses national differences and diversity through a number of sensory characteristics. For example, national flowers are symbols representing a country, that may have cultural or religious roots.

Depiction of color landscapes may be related to the naturalization of the region, which gives primacy to nature and is typically found in countries which have been former colonies, such as South American countries. Sensory experiences interact with memory and values to create a specific regional uniqueness generating an intimate alliance among individuals of different countries. Thus, in this region, borders of each country become diffuse and a regional identity is historically established.

Among sensory experiences, color perception is the first contact of individuals with the landscape, eliciting emotions and memories. As such, color characterization offers the possibility to approach the assessment of this regional identity. Therefore, this work is an outcome of a CYTED network composed by members of eight Iberoamerican countries. This network focused in the effective valorization of unexplored plant sources of bioactive compounds for food, medical and cosmetic applications and in spreading their advantages in several workshops and seminars. The meetings were held at several different locations. During these meetings the different natural and cultural resources prompted the attention of participants and the idea of sharing photographs sprang up.

Inspired by the AIC meeting call, color characterization of local *flora* peculiarities became appealing. However, this characterization is only possible if a rigorous color standardization methodology is developed, such as evaluating the color reproduction of the imaging system and calibration of digital cameras.

For the purpose of this work several plant materials considered of special value, have been selected in different countries of the network. After agreeing upon the common reference charts to be included in each picture, photographs were taken. Image analysis was performed with Adobe Photoshop and Image J software. A calibration with a Minolta photocolorimeter has been performed employing the reference charts. The chromatic coordinates have been thus obtained. The color characteristics were evaluated through all seasons, from January to September, and throughout several South American regions, and located in a chromaticity diagram.

Preliminary results indicate that image analysis techniques are innovative and helpful tools to portray different landscapes thus depicting regional integration, particular idiosyncrasies and common features.

This work displays the relevance of multidisciplinary and multicultural networks which enable a shared vision and multiple and unexpected outcomes.

Keywords: flora, South America, color, natural landscape

Color in art and design

The color in the representation of homosexuality in the films
A single man, *Blue is the warmest color*, and *Moonlight*

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Abstract

The analysis of color in the cinematographic image can be done without the knowledge about the creative processes by which the piece has passed. Through careful observation of the narrative of the film and its relation to the chromatic aspects of the image, it is possible to analyze the logic chosen for the use of a given color at each moment in the film. The important matter is to understand how the narrative determines the symbolic aspects of color and its relations with other cinematographic elements and, consequently, with other colors.

The *look* is the term used to describe the image appearance proposed for the movie by the professionals of the area. It is an aesthetic mark that highlights and characterizes the films. Through some association between color and places, characters or situations of the film narrative, the color can be loaded of symbologies, whether these are usual, cultural or historically constructed, or even different symbologies, made specifically for the piece.

This paper will seek to observe three contemporary films that bring together the theme of homosexuality, and how color is used to symbolize different situations regarding this theme. The films chosen were *A single man* (Tom Ford, 2009), *Blue is the warmest color* (Abdellatif Kechiche, 2013) and *Moonlight* (Barry Jeankins, 2016).

The theme of homosexuality is recurrent in the three movies observed, it is possible to perceive in this movies how color symbolism constructions can be developed with the theme, and how the *look* is fundamental for the perception of the cinematographic images of the present time. The film *A single man* presents a palette with few blues, the images contrast shades of greys to reds and oranges. Among the three films, is the one that presents a character with less questioning about the difficulties encountered by homosexuals. *Blue is the warmest color* and *Moonlight* brings images with a naturalistic aesthetic constructing their color symbolism through the costumes and scenarios, using especially different shades of blue. The characters in these two films have great difficulty accepting their homosexuality and being accepted by society. The color blue, in both films, is representative as a mark of this individual and social acceptance.

This text will seek to establish through colors a possible dialogue between the three films in which the reds and oranges of A single man are in symbolic opposition to the blues of Blue is the warmer color and Moonlight. And, also, it can make a reflection about the construction of a color symbolism that can be used as reference about the theme.

Keywords: cinema, color, homosexuality

Painting, landscape, cinema and color

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Abstract

The proposed paper has a painting (*Way to calvary* by Pieter Bruegel the Elder) and a film (*The Mill and the cross* by Lech Majewski) as expressive references. Through them, we will try to understand the evolution of the concepts of landscape and color in the Flemish art of the 15th and 16th centuries, and also to verify in retrospective how the concept of cesia appears.

From the Greek-Roman Western antiquity to the modern European movement of the 20th century, both architecture and landscape, and their conceptions, have been related to the painting of each historical period. At the beginning of European modernity, in the 15th and 16th centuries, there is a change in the conception of landscape, rethinking the ideas of village, urban and rural life, terms that take on new meanings in the context of capitalism, still incipient but in clear progress and development. These changes influence the idea of landscape, which is clearly expressed pictorially by a member of the Flemish pictorial school, Pieter Bruegel the Elder, who especially addresses the subject in his work *Way to calvary*. This painting, remarkable for its complexity and detail, is taken by Lech Majewski to compose his film *The Mill and the cross*, in which the artistic and sociopolitical concepts of the painting by Bruegel are analyzed through a fiction about its realization and the events that animate it.

In this paper, topics treated in Majewski's film as well as other complementary topics of interest are addressed, which allows to understand the aesthetic and social value of Pieter Bruegel's work, especially with respect to the concepts of landscape, perspective representation, and chiaroscuro. It is also interesting to emphasize the importance given by Majewski to the subject of color in order to respect the chromatism of the pictorial work using advanced technological means.

Also, there will be references to an intermediate expressive instance between painting and cinema, the so-called *tableaux vivants*, which are realistic dynamic representations of the subjects depicted in paintings. In fact, other films that comment cinematographically on works of painting (as, for example, *Nightwatching* by Peter Greenaway, or *Dreams* by Akira Kurosawa) are technologically modern versions of 19th century *tableaux vivants*.

Finally, we will make a tour through the evolution of the technique of oil painting in the Flemish school, which was initially applied on wooden boards and later on canvas, referring to the chromatic effects of cesia produced with aesthetic purposes.

Keywords: tableaux vivants, landscape, color, cinema, painting

Hybrid views: Color in Brazilian landscape painting in the beginning of the XXI century

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Abstract

Along art history, landscape painting turned out to be a genre of art depicting the relationship between man, space and nature as its main theme (Cauquelin, 2007). As time went by, landscape depicting took on visual system model experimentations (Mattos, 2008, p. 11) highlighting the nature-society relationship. Thus, it started to translate cultural values involving, besides perception, economy, politics, science and technology issues (Besse, 2014).

In the complex landscape depicting visual system, color is one of the main items to be taken into consideration. Human beings learned to notice landscapes through culture and depictions, as well as to catch the color meaning in such context. Over the years, the way color has been chosen and used strengthened different artistic discourses that provided, for instance, a sense of hierarchy and space illusion as in the Renascence period, or asserted the canvas surface as in Modern art.

In Brazil, landscape depicting has a tradition of exuberance and tropical aspects mainly built by European traveler artists from the XIX century on. Such Brazilian landscape depicting was built on the basis of visual canons brought by the aforementioned artists who had the so called scientific, picturesque and sublime view. Those past images were transformed to suit time and artist style, and continued to be present in the Brazilian pictorial images in the beginning of the XXI century. There is conflict between tropical exuberance, fauna and flora, and human occupation in the XXI landscape visual production in Brazil. Several images were produced through collage or overlapping so building hybrid images. Such hybridization is created through observation, photographs and images leading to other forms of landscape depicting. Color mediates image building and we can sometimes notice certain visual contradictions and contrasts, and in another times a search for visual harmony. This way, the chromatic use in landscape depicting is carried out based on tradition, but at the same time new values are added through a constant dialogue.

The present article aims at showing landscape depicting in the XXI Brazilian painting through identifying how color was used taking into consideration cultural, historical and technological aspects. For this purpose, we will carry out an accurate research on the productions of two Brazilian artists: Luiz Zerbini (Brazil, 1959), Brazilian artist whose landscape painting depict assemblages showing the human occupation and nature conflict; and, Ana Elisa Egreja (Brazil, 1983), whose works explore inner and outer space relationship through compositions which join different visual contexts. The present article will use a bibliographic research and image analysis methodology that has as its main parameter to analyze color choice and use by the aforementioned artists in their paintings, based on cultural, historical and technological processes.

Timelessness and temporality of landscape colours

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Abstract

It is established that influences from the environment condition the way we see and think about colour, starting with the adaptation of the visual system and continuing with what is apprehended from nature and the cultural domain. Natural elements seen in isolation amidst the man-made world constitute essential pieces of local identity. Certainly, the colours that form the major part of the visual field at regional and city scale encompass the shades of the natural landscape in its different cycles and, even if the perception of natural scenery varies due to man's intervention, the basic qualities of a landscape are imperishable.

The overall perception of nature's colours depends on life and weather patterns. As a manner of enriching the palette, superimpositions result from fixed and moving elements. From wind and surf, to a flock of flamingos, circumstantial colours spice up the scheme of the natural landscape. The recording of a scene is facilitated by temporal colours, as the phocus of attention changes from what is ordinarily expected to something unusual or beautiful. With experience we learn to appreciate ephemerality. Visions such as the luminescence of dispersed clouds, the smoothness of hills or a multicolored sun disk next to an isle contain descriptive information that corresponds to the material world. Additional to the data provided by colour about meteorology, physics and biology, lighting conditions generate an atmosphere identifiable with a mood which affects the viewer's emotions. Moreover, perceptions are intensified by the value that is granted to them in the psychophysiological aspect, for the landscape imbues the viewer in colour by means of necessity and comfort. On one hand the colours of a natural surrounding may provide variety and rest to eyesight, whereas these may also cause boredom and fatigue.

Along the coastal landscape of Peru, parallel to the grayish-green ocean waters, the desert and the cloudy sky seem to follow a continuous linear scheme, in which humidity induces perceptual variations. In the monotony of the scenery, the temporality of natural colours is brought up as a theme, as a post-rationalization of my personal experience as architect and colour designer in Lima and the northern coast of Peru.

The aim of this paper is to introduce temporality as an important factor in the appreciation of landscape colours. The concept will serve to enrich colour intervention in sensitive environments and public spaces where culture is continually infused.

The methodology for this premise starts with a general picture of the coastal landscape of Peru and its colour characteristics, followed by the relevance of architectural colours in the built environment. Emotionality is highlighted as a resource for observing and registering temporal landscape colours. Then, a selection of ten examples of landscape-inspired colour application is presented, with a short outline of each project and its context. The results focus on the strategies used for achieving the design objective. The observations open up new hypotheses on the transference of colours from the natural landscape into wall paint, and point out the usefulness of synesthesia and colour naming in the design process.

Colour and place making; an artist's influence on spatial production

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Abstract

The Norwegian painter Harald Sohlberg (1869-1935) has had a special influence in the production of a national romantic and symbolist iconography of place and identity, producing a mythology of geographic colour and atmosphere that are particular to northern light and geology. This article will focus on two bodies of work, the Røros paintings, in particular "Efter snestormen, Lillegaten" (1903) and the "Vinternatatt i Fjellene"-series (1901-1924).

"Efter snestormen, Lillegaten" – *after the snowstorm, Lillegaten* - presents a seemingly meticulously observed colour, form and topographic rendition of a street in the isolated mountain copper mining town after a winter storm. These paintings' subsequent exhibition in Oslo raised interest and awareness of the "picturesque value" of the remote, and at the time, relatively inaccessible site, and played an important role in moves towards the towns' first heritage site designation and preservation that would ultimately result in a UNESCO listing.

"Vinternatatt i Fjellene" - *winter night in the mountains* - is a highly atmospheric semi-symbolist rendition of the cold, blue atmosphere of the mountain night, and is an enduring national icon for the sublime "blue hour" that has a particular resonance in Scandinavian life. The special cultural role of this painting in the production and identification of a mythology of place and atmosphere made the site from which Sohlberg painted "iconic", and the ideal placement for a Norwegian Tourist routes project initiated by the Norwegian public road administration. This leads to the commissioning of a landscape integrated architectural viewing platform "Sohlberglassen", Rondane, designed by architect Carl-Viggo Hølmebakk and completed in 2006.

This article examines how a visual artists representation of two kinds of colour, the mineral colour used in house painting and the atmospheric colour of a night time landscape, have proved instrumental in both the preservation of "place" and in the production of a new architectural place. Both these works and their romantic mythologies contribute to a mediation of place that is central to the development of viewing landscape scenography and colour as the production of imagistic moments for an increasingly economically important tourist industry. Drawing on sources from heritage research and the authors own observations, the question of the authenticity of colour and place in the face of the distorting demands of the tourist driven spectacular will be examined in the context of the concept of the "genius loci" as defined by Norberg-Schulz.

Keywords: place, architecture, art, landscape, tourism

Aquarelle: a powerful tool to represent the colors of the landscape

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Abstract

Because they are easy to carry (even in your pockets), many artists and professionals use aquarelles in their notes of urban and natural landscapes. An aquarelle made on site may be intended as a work of art in itself; a note for a larger work in a different technique (for instance, an oil painting); a rough draft to remember certain colors that will be used later, or a sketch to understand, by doing, certain spatial chromatic relations existing in the landscape.

As any sketch or note, aquarelles not only contain what you see in the paper; additionally –given its immediacy– they project in the paper all the previous attempts dismissed by the artist. Every satisfactory sketch encompasses all the tryouts that the artist considered as lacking. Such a way of working encourages the artist to make a large number of attempts –which may lead us to what has been misnamed as error or accident– so as to manipulate it, change it or reinvent it.

As with every technique, with these tryouts we can become aware of every decision made and its potential effects; hence, little by little, the aquarelle technique can be used to the benefit of the artists' goals. Such a trial exercise and the awareness in the process help us understand to what extent we can control a technique known for immediacy and chance. Preparing a firm and known ground to play with disarray is crucial to lead aquarelle towards the work we are pursuing.

This latter work methodology has been used as a teaching tool in the Design Workshop of Universidad Austral de Chile, in Valdivia. Aquarelle as a technique was complemented with texts –tying image and words– so as to facilitate visual discourses. The technique was selected considering the students' need to capture their immediate environment in a territory identified by humidity, rain and a changing atmosphere. The analogy flows naturally: In an environment marked by water, by rivers and rainfall, using a technique based on moisture and aqueous movement is ideal for the exploration of landscapes and their colors.

The findings and the discussion are presented, concluding that the use of this technique in the pre-graduate level of design careers could become a powerful research tool to understand and apply spatial chromatic relationships.

Keywords: color, aquarelle, teaching, design

Between skin and landscape: color as a mimetic agent

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Abstract

Landscape, as a genre of art, has undergone a series of transformations over time, following the same paradigm breaks that have taken place in all fields of artistic production. We can say that for a long time, painting has had as its primary function the representation of nature, and the exact fidelity of this representation was of great relevance. In this sense, the classic concept of mimesis was fundamental within the development of Western painting, also incorporating the contours of its transformation.

Color appears as a basic element in visual representation, since, for painters of the landscape genre, the fidelity to the colors of external space was an essential aesthetic objective within the prevailing mimetic premise, although the sense of "fidelity" varied much from one artist to another.

In fact, in terms of representation, it is possible to think of color as an expressive sphere of connection or break with reality, within the framework of a principle of recognition and construction of similarities. The color choices made by artists can denote their intention of correspondence or transgression as to the appearance of things in the world, as well as the desire to simply employ visual signs, symbolic senses.

The artistic work that I intend to address in this paper starts from a displacement of landscape representation, in which I identify a link between landscape and the surfaces of the human body, a relationship made possible, among other factors, by the technical procedure which draws mainly on color to achieve the proposed convergence. It consists of an authorial series called "Crosta" of three hybrid large-scale paintings in which color plays a fundamental role in the construction and communication of the meanings that the images arouse.

Color, in this art work, is the main link of visual correspondence between printed and painted image, between natural and fabricated landscape: the driving factor that defines the degree of proximity established between photography, painting and the body outside the image, the viewer of the work. The ambiguous character of this production involving body and landscape, as well as photography, painting and space, provides an up-to-date discussion of the concept of mimesis in contemporary art work and the influence of color on the representative issue of landscape. Bringing the senses of mimesis to the contemporary artistic context, through references such as Anne Cauquelin and Walter Benjamin and through my own work, I intend to demonstrate that it can be used to reflect the process of a fictitious composition, not the mere duplication of nature.

Within this discussion, color will be approached as an agent that propitiates mimesis, emphasized as a sign that, employed with intention and purpose, can enable or intensify a mimetic relationship: in the case of the work presented, the relationship between body and landscape. The analysis of the works proposed in this article intends to associate procedures, experiences and historical and theoretical references related to the proposed theme, in order to contribute and dialogue with the knowledge of the artistic making in its current manifestations.

Colours of clothing as a factor influencing the colourscape of cities

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Abstract

The idea of this research came from the concept that the colours of people's clothes would play a main role in creating the colour scape of a city. The colours of the clothes worn by people is connected to the everyday view of the city we are living in. It seems that when people walk through the pavements, streets and alleys with black and gray clothes, the city seems gloomier. Based on the authors' initial observation in the cities, nowadays people, living in different cities in Iran, mostly wear black, dark blue and a wide ranges of greys (achromatic) clothing. Surprisingly, the relevant literatures confirm that, in Iranian culture, people preferred to wear colorful clothing including different ranges of hues in.

The current research has been defined to investigate the colours and colour patterns in ancient clothes in Iran. The existing colour patterns in Iranian clothing, imply that the arrangements of clothes' colours included a wide ranges of hues, chromas and lightnesses.

The aim of this research is to apply the colours existing in the culture of Iran, for everyday clothing. By reviewing the history of applied colours in Persian costumes, a lack of sufficient documents limit the current research to the Qajar era, from 1789 to 1925. The most relevant documents, including numerous pictures, illustrations and itineraries, are available from the mentioned era and depict the types of clothing used. Pictures and images that have been used in this research are from the V&A and Brooklyn Museum, State Hermitage Museum and also Sa'dabad and Golestan Palaces. Documents validate the authenticity of the colours used in pictures compared to costumes that has been used and worn in the Qajar era.

All colours in the images were pixelated in order to find the number of colour pixels which were covered by each colour. The occupied areas of each colour were measured and for each image the first three colours, which cover more surface area than the others, have been selected. Based on the NCS color system, the NCS color codes that match the selected colours were identified. New clothes were designed using the colours identified in the clothing of the Qajar era. The forms and techniques of the Qajar women's clothing were translated into a new design by developing and making connections between the past, present and future. The clothing which were based on the findings of the research, were assessed by different observers.

The colour charts obtained according to the clothing of the Qajar era seem to be one of the valid solution for changing the existing colour scape of the cities in Iran. Due to geographical differences and the existence of different ethnicities and cultures in Iran, the current research is predicted to create a wide range of possibilities for further research, introduction, and development of effective colour charts based on the other Iranian cultures.

The colour charts obtained from this research can be used to modify contemporary clothing and therefore the city colour scape.

Keywords: colour, Qajar era, clothing, colour scape

The inherent colours draws from the perspective of emotional design: a reflection

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Abstract

Colours have several emotional characteristics that are inherent to them, which have been psychologically and physically demonstrated. The importance of knowing this relationship is in the fact that emotions lead to discovery: there are inherent colours draws. This statement was perceived by design students in the discipline "creative processes", from the faculty of design at the University of Sorocaba.

In this discipline students should develop creative-inventive thought facing the design. The inspiration of didactics came from the *Vorkurs* of the Bauhaus and the studies of Johannes Itten. Using observational methodology and exploratory research, the content of the course is first experienced and only after its perception and association is that students have contact with the theory. The results of this practice have been quite interesting, with a fragment already reported in Maffei-Simacek (2018).

After taking introductory knowledge about colour theory and reproducing the colour circle of Itten, the students grouped the studied colours according to the emotions visually perceived in the hues. They made chroma and value variations, grouping them, according to the emotions as well. They created harmony palettes for each group of colours.

Then, following through the mentoring of eight emotions determined by Maffei-Simacek (2016/2019), the students created abstract lines with each colour of each emotional group, in the same frequency and intensity of the selected emotion. Thus, they had the results the lines and drawings for each hue, according to every emotion which this was belonging. Experimentation has led students to perceive the shapes inherent in colours.

As part of the experience, they created a three-dimensional structure from bi-dimensional abstraction and applied the colours of one of harmonies palettes created. In this application they realized that certain colours, actually, fit more harmoniously in certain draws, validating experimentation. This exercise greatly enriched the creative process of the students involved and ensured a more effective learning, because instead of theory being just said, it was experienced, felt and validated.

Colours in children's illustration:
an emotional analysis in coparticipative design project

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Abstract

The ludic plays a fundamental role in the development of a child. May appear as games, educational activities, readings, among others, the lucidity encourages the child's imaginative-inventive and leads to take a greater interest in the teaching-learning process and personal development itself.

In this process, colours have an important creative-inventive function, and children, especially in the early years of second childhood, apply them in their illustrations in this way. However, throughout a project of creation of children's book, we noticed that the use of colours occurs in different ways, being more inventive and emotionally expressive if it occurs in the creation of an illustration and more rationalized and less emotional if applied in ready illustrations.

This affirmation was observed in the occurrence of a social project of design course of the University of Sorocaba, in partnership with the Educandário Bezerra de Menezes, between the years 2018 and 2019. Entitled "Coparticipative Design as a Social Tool for Creating a Children's Book", the project, which was the responsibility of five students, members of the CoForMa Lab, aimed to develop a children's book, whose illustrations were created by children between 5 and 10 years of age, in a situation of vulnerability, that integrate the Educandário. The students worked ludic narratives with the children (Monteiro Lobato stories), which developed illustrations. These illustrations were designed by the students and placed in a children's colouring book, which was intended to Educandário for educational and recreational purposes of his children.

Through the storytelling, the students responsible for the project assisted in the rescue, even momentarily, of the children's creative imagination and also encouraged them by proposing that each child draw characters, scenarios and other situations of the stories told according to their own perspective. During storytelling times, children made free use of colours in their creations. According to the emotion passed by the stories, the colours were equivalently chosen.

Then, in the execution of the book project, those responsible left only the contours of the drawings to make a colouring book. Returning the books ready for the kids, they were invited to colour them. So, we noticed that the choice of colours was more rationalized; the children observed the surroundings to choose the colours and did not seem to be concentrated in any emotion related to the story.

We could conclude that the project of the children's books proposed moments of positive experiences for these children, giving them the satisfaction of seeing their creations reproduced in a printed book. However, the blank page corroborates significantly more with the ludic and the emotional expression than coloring illustrations, because it confers the creative and emotional freedom, mainly regarding the use of colours.

Designers' experience and use of colour information

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Abstract

Wang (1997) notes that ideas are subject to visualisation by designers and then expressed through compositions. Such compositions are composed of shapes supplemented by colour schemes. For designers, colour is usually not only the most important but the fundamental design element in information design regardless of designers' domain area (Lee *et al.*, 2017).

This study investigates designers' mechanisms on applying colours in creating accessible information. In addition, it is intended to find out what colour schemes designers would prefer to use and how user data affects their colour selection.

Experimental data on colour application will be obtained, where participants are asked to indicate which colours they would use for various aspects of a design (such as background, main, sub, and information colour) in various contexts (such as for a medical product or a commercial product). Data will be obtained from 42 participants whose educational background is design. There will be three groups of 14 design participants each: expert designers, novice designers and design students.

The study with designers involves two stages (initial and secondary) each comprising two sub-stages. Thus, the study includes initial colour application experiments, initial individual interviews with designers, secondary colour application experiments, and secondary individual interviews. After the initial individual interviews, designers will be offered user information for consideration in the secondary colour application experiments, to be taken into account also in the secondary interviews. In the initial stage, a design task created by the researcher using Adobe Illustrator will be provided to design participants. This task will comprise two pre-formatted elements based on two types of packaging. At this stage, little information will be offered to design participants in order to explore their usual colour using behaviour. As noted, for the second stage of the research, user data, especially from visually disabled and older people, will be provided to design participants. They will be asked to modify their previous colour application considering this user data to find out how they deal with such data on colours.

The collected data from the initial and secondary stages of the colour application experiments (with or without user data) will be compared quantitively to investigate different use of colours in terms of hue, contrast, background and so on. These differences will be compared and analysed for the three groups of design participants in relation to the two different pre-formatted design elements. After conducting each of the two colour application experiments, individual interviews will be carried out by email. This will adopt a qualitative approach and ask the designers which information resources they used, the resources they believed they needed, types of information they wanted, and the difficulties they faced, to explore the challenges they experienced and their perspective on using colours in real world information provision.

It is hypothesised that expert designers will be likely to use colours from an inclusive perspective. Also, although all design participants may use some information sources to apply colours considering user information, they may need more designer friendly information formats containing colour information for different types of users. Overall, it is expected that the findings from the colour application experiments and interviews will provide support for the creation of a designer-centric colour design tool to change the behaviour of designers and thus improve the visual accessibility of colour use in information provision.

Role of color in visual complexity and visual interest

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Abstract

Everybody experiences and encounters with color both in natural and built environment every day. It is a well-known phenomenon that color has various effects on psychology, physiology, emotion, mood, attention, and well-being and so on. Despite the vast number of studies on color and its effects, there are limited number of studies on the association between color, visual complexity and visual interest together. Complexity is defined as the state of having countless parts that cause difficulty in understanding and interpreting the whole (Kocaoğlu and Olguntürk, 2018) and for this study complexity is interpreted as the Delta E (ΔE) values of the colors which were used in the abstract images. ΔE indicates the perceived difference between two colors, thus it is the metric measure of change in visual perception of two given colors for understanding how the human eye perceives color difference. This study aims to find the relationship between visual complexity, visual interest and ΔE values of colors in abstract images.

In order to understand the role of color in visual complexity and visual interest, an abstract image was created. This abstract image resembles with Composition 8 by Vasily Kandinsky which includes 103 different colors with different geometric shapes such as triangles, circles, rectangles and polygons varying in size, orientation and allocation. The new generated image was as visually complex and interesting as the original one since it included the same geometric shapes at the same allocations as the original one. The generated abstract image contains 106 geometric shapes and 106 different colors. For the generated abstract image, 106 different colors were chosen from the CIE Chromaticity Chart by using Adobe Photoshop CS6. After the colorization process 15 differently colored abstract images were obtained.

The participants for the study were undergraduate students from the Interior Architecture and Environmental Design Department. Each participant voluntarily answered two questionnaires (5 point Likert scale for both visual complexity and visual interest) where the 15 generated abstract images were shown randomly by the researcher. The questions were asked in the subjects' native language in a controlled lab environment and each participant was sitting in front of a calibrated computer screen and asked to fill a form about gender and age. There was no time limitation for answering the questionnaire and participants were free to ask questions.

According to the results of the study, the abstract image with blue- green color combinations (ΔE: 61,7619 and 65,7629) were rated as the most visually interesting ones among other color combinations such as blue-red or green- red. Purple- orange combination was rated as the most visual complex abstract image (ΔE: 56, 9727). Those are the initial results for understanding the role of color in visual complexity and visual interest. Further evaluations are in progress with expanded number of abstract images and participants.

Reference

Kocaoğlu R., Olguntürk N. Color and visual complexity in abstract images. *Color Res Appl.* 2018; 1–6. https://doi.org/10.1002/col.22266

Proposal of a model for reinterpretation and sustainable use of cultural values in graphic design

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Abstract

The excessive commercialization of culturally charged objects and products has resulted in the distortion and devaluation of cultural elements. In Mexico, the clearest example of this is the case of the excessive marketing for the "Day of the Dead" as a representation of Mexican-ness around the world, with numerous products that go from movies to apparel and countless merchandise that exploits the imagery to the point of turning the tradition into a meaningless commercial product without any further value.

Nowadays, with the easy distribution of audiovisual materials through the internet, globalization and migratory movements, national cultural identity and cultural heritage are at risk of being lost due to the distortion and misinterpretation of cultural elements. This distortion may not only result in stereotypes, but also in the people who belong to the culture in question losing their sense of identity and interest.

First of all, we must understand the role that Design plays, not only in the preservation but also in the creation and evolution of culture. Design is present in the environment where humans, hence, culture develops. However, this impact is often overlooked.

Propose an educational strategy that aims to preserve and disseminate cultural values and intangible cultural heritage in a socially sustainable manner.

Raise said strategy for its implementation in the higher education sector within academic programs in creative areas to achieve responsible use of national cultural values through a correct reinterpretation without limiting creative freedom and thus reassess the creative industry in Mexico.

The initial objective is to define the concept of visual national identity, that is, all the graphic elements that achieve the identification of a nation, both by nationals and foreigners. In the same way that a company has a corporate visual identity consisting of graphic elements such as logo, shapes, colors and a user manual for such identity, nations have built their visual identity through history with different elements taken from different cultural aspects to recognize and differentiate themselves from others.

The aim is to explore how the Mexican visual identity has been constructed from different areas, including art, history, and audiovisual media.

Each of these sections will provide visual elements that have come to shape this visual identity, exploring forms, colors, patterns, and themes.

This paper will be a chapter of a much wider project and will be focused entirely on color. Color is an essential component of the visual image, hence one of the strongest identity drivers.

Once these elements have been identified and defined, the aim is the creation of a strategy for their protection and responsible use within a socially and economically sustainable scheme.

The fieldwork will focus on collecting a wide compilation of visual evidence, including photographs, printed materials and a selection of key audio-visual resources for the construction of an inventory.

Subsequently, the information will be classified to generate a database of the design products, the information on the perception of the control groups, their characteristics and the configuration of the visual codes that result from their analysis.

Keywords: identity, heritage, color, design, sustainability

Design workshop for young people with down syndrome: Color as a creativity enhancer

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Abstract

The Education Centre for people with Down Syndrome, CEDAC, offers training in different crafts in order to create work opportunities that will allow them to carry a more independent life. Bakery, jewelry-making, and agriculture are some of the workshops offered by the institution. Each of them requires special training and skill set development. However, these activities do not promote a role in which youngsters can make decisions and solve problems on their own. How to boost inclusivity and learning within a working environment? By studying success-cases of people with special intellectual needs who have developed creative skills, we came up with the idea of this project, which aims to use design as a channel to acquire knowledge and to develop skills that will allow them to have an independent self-sufficient life.

Creativity in Down Syndrome, within the educational context, is a communication-promoting agent. Drawing and other arts serve as a medium through which they can express ideas and assign meaning to their creations. Use of lateral thought is highlighted by noticing a spontaneous perspective of their surroundings in their artwork.

Within the proposed educational model and workshop, a color module was included.

In this module, it is sought to sensitize the participants by the recognition of the properties of color. It includes an introduction to color theory and the use of primary and secondary colors. These theoretical principles on color will not only provide new knowledge but also the development of an aesthetic and formative sensibility. With these topics, the aim is to professionalize the workshop towards the acquisition of concepts of the design discipline, seeking a formal training of the participants.

A workshop with the duration of three days will be carried out, where they will learn about color, its properties, uses, composition, and meaning.

By the end of the sessions, the students will be able to apply those principles in the making of different products based on their conceptual proposal.

The results of this workshop will be analyzed in order to come up with a proposal for an educational model that will allow establishing relationships with universities and companies to contribute in the development of education and inclusivity in a working environment within the creative economy.

Keywords: inclusion, creativity, color education, down syndrome, design

Universe in six colors, atlas of natural dyes

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Abstract

"Universe in six colors, atlas of natural dyes", is an research that seeks to map natural dyes, methods that has been obtained and used in the traditional Mapuche textiles. This Project consisted in registering dyer´s in exercise of Mapuche communities Williche, Lafquenche, Pehuenche and Wenteche, who work with this ancestral knowledge, collecting both the techniques and ingredients and natural supplies for dyeing. As well as the daily knowledge and practices of this trade and, therefore, its indissoluble connection with nature.

The investigation covered the regions of the Bío Bío, Araucanía, Los Ríos and Los Lagos in the South of Chile. From August 2015 to August 2017, 49 field trips were made, visiting more than 200 textile weavers with a survey of 2,390 samples of dyes applied to looms of 10 x 10 centimeters from a 50-native plants cadastre.

The investigation allowed the generation of a color cadastre obtained through natural dyes in the mentioned territories, associated to the native resource existing in it and to the ancestral traditions involved in its obtaining. The final result identified 6 main colors with a great chromatic variety obtained by the different vegetation floors from mountain range to Cost with variety in their PH, according to the season of the year in which the native flora was collected.

This cadastre included the dyes extracted from each native plant of the macro zone (south) of Chile, its nuances and change of tonalities, through the use of different mordants. In this way, the maximum possible variety of nuance and hues was extracted from each dye. This diversity of colors is determined by the natural resource, the extraction method, but mainly by the processes of pre-mordanting of the wool and a second process called "revealed", where another range of colors is obtained.

The project pointed, along with the protection of the old techniques, to the generation of much shorter productive processes and possible to explain in a didactic way, in a format designed to be a consulting tool for those interested in the subject of dyes natural.

"The knowledge is not in finding the formula that allows to dye the wool of this or that color, but in understanding a delicate natural ecosystem, a territory and a culture in which this activity is carried out guided by the voice and the generous hand of these women teachers, who through their yarns, dyed or each woven cloth, carry with them the threads of a life story".

Keywords: mapping, Chilean forestry, natural dye, color cadastre

The role of colour in a successful logo

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Abstract

This research is concerned with the role of aesthetics and its importance in the design and success of corporate logos. The specific interest is in visual aesthetics; that is, how the logo looks without reference to the context in which the logo is applied or the brand or company that it represents. Aspects of visual aesthetics includes colour and form.

This study aims to ascertain the feature space in which consumers evaluate the visual appearance of logos and to determine the role and importance of colour in this feature space. In this work, therefore, a psychophysical scaling experiment is described to measure consumers' responses to visual attributes of logos.

A total of 50 logos were evaluated by 22 participants in terms of 10 visual attributes (complex, proportional, unique, familiar, memorable, colourful, feminine, bold, friendly and modern). During the experiment each participant was presented with one of the logos and asked to respond to each of the 10 attributes in turn. Responses were collected in the form of a 5-point Likert scale. Colourfulness was shown to have statistically significant positive correlations with the following attributes: friendly ($p<0.001$), feminine ($p<0.001$), bold ($p=0.022$), modern ($p=0.036$), unique ($p=0.003$) and memorable ($p=0.036$). Correlations between other attributes were also found, suggesting that some reduction in dimensionality of the feature space may be possible using factor analysis.

Keywords: colour, aesthetics, visual communications, art and design. Logo design

Colors of the wheat fields: Strokes of Vincent van Gogh and transformation of colors among seasons

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Abstract

Nature has its own color palette and it changes along day and night, from winter to summer. The existence of nature offers unique and numerous colors to mankind. Most of the people are only the observers of natural landscapes, however, only the gifted ones such as Vincent van Gogh could internalize natural landscapes and could reflect its beauty hidden in the varying colors. The interaction between the colors of the natural landscape and van Gogh can be called as one of the most valuable products of nature and an individual. Through the mental image of the observer; van Gogh, now, in 2019 we can see and even feel the atmosphere of wheat fields of the 1890s and can observe the transformations of colors among seasons.

This study aims to understand the transformation of colors according to the seasons in van Gogh's landscape paintings with introducing numerical analysis by using K-Means Color Clustering since the differences in van Gogh's color usage (hue, saturation, and brightness) and number of colors could reflect his feelings at the beginning and at the end of summer. van Gogh painted many natural landscape paintings in his life and for this study, his five paintings named as or included the word "wheatfield" were evaluated in terms of color usage and its transformation among seasons. van Gogh's paintings; Wheatfield with Partridge (June-July, 1887), Wheatfield (June, 1888), Wheatfield with a Reaper (September, 1889), Wheatfield under Thunderclouds (July, 1890), and Wheatfield with Crows (July, 1890) were evaluated with K-Means of Color Clustering in order to objectively calculate the number of colors used in each painting. For evaluating the change in color according to seasons in those paintings, an image processing algorithm; K-Means Color Clustering should be used since it is not easy to distinguish all colors by naked eye even by expert observers.

According to the results of K-Means Color Clustering; Wheatfield with Partridge (June-July, 1887) has 282 colors, Wheatfield (June, 1888) has 320 colors, Wheatfield with a Reaper (September, 1889) has 383 colors, Wheatfield under Thunderclouds (July, 1890) has 271 colors, and Wheatfield with Crows (July, 1890) has 378 different colors. With further analyses, the five most used color in Wheatfield with Partridge were greyish blues and greyish greens, in Wheatfield were greens and yellowish greens, in Wheatfield with a Reaper were yellowish greens, in Wheatfield under Thunderclouds were blue and its shades and tones, in Wheatfield with Crows were purplish blues. In terms of the number of colors used, there is no difference between the beginning and end of summer, however van Gogh expressed the beginning of summer (June) with shades of greens, mid-summer (July) with shades and tones of blue, whereas for the ending of summer (September) he used widely yellowish greens. Those are the initial results for understanding the preference and variety of colors which van Gogh used while painting wheat fields. Further evaluations are in progress with an expanded number of natural landscape paintings of Vincent van Gogh.

Keywords: landscape, painting, colors, K- Means Color Clustering

Cesia in nature and in the representation of nature.
Luminous cesia: a special case

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Abstract

We have naturalised the colour as it appears in the matt opaque cesia, a homogeneous colour, distributed almost without change on the surface of objects, without being distorted by the reflection of the light, or by the colours of the objects surrounding it. Since the distribution of colour in the space varies in accordance to its cesia, such as has been systematised by Caivano in "Cesia: A system of visual signs complementing color"; from the perceptual point of view, it appears in our visual world associated to other phenomenal aspects, as postulated by Katz in *The world of colour*. Our proposal is to analyse the cesia in nature and in the representation of nature, specially the luminous cesia, and to reproduce it. The luminous cesia (Jofré 2014), a reformulation that we proposed to the variable absorption of the system of cesias proposed by Caivano in 1991, includes the light itself - luminous colour, according to the denomination of Katz; the incandescence, the phosphorescence and the fluorescence, and also has temporal attributes. We can consider that the reflections of light in bright colours are also sensations of luminous cesia, since they are perceived and represented in a similar way.

In landscape paintings the attention to cesia was belated, unlike the cesias of garments, which were meticulously represented. Umberto Eco comments that when John Constable realistically painted the glare, in Wivenhoe Park (1816), the meticulous representation of the reflection of light on the water and the fields, which seems photographic, was not interpreted as a form of imitation of real luminous relations, but as an odd whim. In later paintings, Constable advanced in the realism of representation of glare, and William Turner painted the luminous cesia of the sun and the fire.

Nowadays we can create our works with light, and with materials that reflect light in different ways. We make immersive landscapes inspired by nature in general, and specially in elements that emit light or re-emit it in different ways: in lightning, in the iridescence of certain plumages, in fluorescent corals, in the bioluminescent seas.

Keywords: cesia, art, representation, natural landscape, perception

The impact of user-centred information design principles on the public's use of transport map design. China's high speed railway map as a case study

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Abstract

This study aims to investigate the problems and limitations of the current China's rail map, in terms of reading speed and information searching efficiency. The target users are international travellers. Different research studies were conducted, which included an online interview, structured questionnaires and usability test of the current rail map. Results show valuable quantitative data about user experience, as well as qualitative data about how to improve information design features to enhance reading efficiency and information searching accuracy. These findings can inform map design for public transportation, not only for rail maps, but also for bus maps and airline maps.

In the first stage of the study, 15 Chinese participants were interviewed online and all had experience of using the current China's rail map. The following was ascertained: which information the users searched from a rail map; when and in which situation the users prefer to use a rail map. Users' evaluation of the rail map and suggestions on how to improve the design of the information were also collected. In the second stage, 30 participants were recruited from different countries and none had used the current China's rail map. User tests included an interview, an information searching test and questionnaire test.

Results show that tourist attractions and transportation service are the most popular information needs among international travellers. The average time to search for a train route between two cities was long (119 seconds) and only 7 out of 30 participants finished all tasks correctly. In terms of user feedback, results show that users hoped that more information could be found on the map, they found the design confusing in places, colours unclear, and that lines and numbers affected the reading efficiency and accuracy. Several participants suggested to add more useful information on the map, such as other services or functions like underground stations, airports, travel time, etc.

In the next stage, the researcher will redesign the current China's rail map based on research- and practice-based information design principles through a series of usability tests and iterations, and then conduct an empirical test to test the effectiveness of the new design in comparison with the old design. The aim with future research is also to establish information design guidelines that are specific to transportation system maps and can be applied to other transportation systems.

Keywords: map, information design, colour

Color and landscape in textile design

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Abstract

Color is a meaningful aspect of a textile product. At the Textile Desgin degree, we are interested in promoting a textile design that is carrying a sense of identity that is meaningful to designers and users.

In some of the exercices, the objective of the use of color is to recover a space for reflection on the symbolic aspects of color, typical of the students' personal and national culture, partly lost owing to the commercial importance attributed to international trends and homogeneity that this produces in the color experience (Nirino, 2013 and 2016)

In others, we work in a more traditional way, following the international fashion trends and adpating them to the requeriments of our market and customers.

Sometimes color is chosen first and the product is develop related to that choice, with an enfasis in cultural aspects.

Other times, the chromatic decision is made at the end of the process according to comercial considetarions.

But all the exercices involves the use of color as a fundamental part of the product system. Color comes from the personal, urban or natural landscape.

The aim of this presentation is to share the strategies we develop through the diferent levels of Textile Design Degree to find, select and use color as a significat aspect of the projects. This strategies involve different types of approaches: surveys and interviews, bibliographic research, trends research, dye and painting materials experimentation, digital processes, collection of materials, production of sample books and color paletes of textile elements and products.

Keywords: textile, design, methodology

Bodygraphy – Complementary colors in landscape

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Abstract

This article proposes to analyze an artistic production that intends to construct chromatic complementarity landscapes, using for this the body as part of the landscape. It will be presented a series of photographs that narrate the relationship between color and body and that weave dialogues with the concept of landscape, intimacy, displacement.

These are situations in which the claims the landscape through the presence of body in it. Questions and reflections about this conflict are presented in order to visualize a process of creation in which the body is thought of as an element that delimits a territory. An organic body that interferes in the landscape and at the same time became a part of it.

This study aims to reflect on a series of photographs recently produced that refers to a body that claims a geographic place. In several environments, internal and external, the body becomes an object and for some minutes is part of the landscape. I call at this present artistic fusion process *Bodygraphy*, an intermixture between the body, geography, photography, and biography.

The body emerges as a territory of a place that affects the artist. Be it a childhood memory, strangeness in the routine of everyday life or a way of dealing with the unknown. In the photograph series presented, it is proposed the construction of intimate landscapes. It is not a frontier body, but a landscape somewhere. I think of photography as a vestige of the present and in that way, *Bodygraphy* becomes vestige that soon thereafter it will become a visual biographical archive to the artist, bringing a problematization that deserves a reference.

In this article, I present an analysis of the process adopted in the series "I am what I am" and in it we can understand the linguistic resources used operate in the register of visual perception, in which, the complementary colors seem to speak directly to my way of looking at things. By displacing elements of their usual characteristics, I as an artist, create an ideal situation so that, in the strangeness of everyday life, we can be sensitive to the attribution of new meanings to the landscape. The photographs create a distancing of daily discourses so that new ones can appear. The artistic practice, manifested in this case trough photography, appears as a fundamental element in the understanding of the body and the color in the landscape.

Color and psychology

Evident color and underlying color. A color constancy approach

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Abstract

In the study of color it is convenient to make an important distinction: color as a physical element in which *white* light decomposes into different wavelengths, and the light that impresses the eye's retina is transformed into energy of a neuronal nature that, through the optic nerve, is sent to the brain where the color is actually perceived. The distinction is necessary because sunlight entering the Earth's atmosphere causes wavelengths are altered with a relative ease; vary by intensity, source location, climate, dispersion, temperature, etc. These variations cause the photosensitive cells to constantly modify the sensory impression by registering an immense amount of wavelengths.

This would logically suppose that each sensory alteration could be a different object of perception. For example, a vase, seen in the intense light of noon would be *another* (vase) in the dim light of the sunset, since the coloration has altered over time. In order for sensory impressions to follow the course of *history*, perception has a mechanism called *invariability* or *constancy of color*. It is due to the fact that the same body can show a surprising wealth of values which can be modified in time intervals by variation of light. However, perception maintains the same color pattern by providing continuity and permanence to the object perceived under changing lighting conditions. In order to achieve stability, constancy recreates an illusory effect that causes the visual object to show a flat and uniform coloration despite what the sensory impression dictates.

For this purpose we have called it *evident* color, typical of the look for everyday uses. Outside the framework of constancy there is such a vast chromatic universe that it is not possible to apprehend it even though it is in *sight*. We have called this characteristic the *underlying* color. Both approaches share the same visual scene; however, perception does not distinguish one property from the other because they are integrated into a *Gestalt*. The underlying color is shown in several fields of which we can mention: color temperature, color in the reflection of light, color affectation by atmospheric gases and simultaneous contrast.

We start from the thesis that perception is in the central process for the acquisition of knowledge, which at the same time supports the visual education that artists have experienced; first as apprentices and then in their professional practice. Their training has allowed them to access the aforementioned underlying color fields, which they have explored in the following pictorial treatments: color temperature and landscape painting; reflection of light and chiaroscuro; coloration by aerial perspective and simultaneous contrast or color interaction.

The purpose of this essay is to show that perception circumscribes the vision to limits that establish the constancy of color in which the evident color is framed and beyond these limits, there are vast and complex chromatic fields in which color is perceived as underlying by those who have access to the educated vision of artists.

Keywords: visual perception, sensory impression, lighting, color constancy, artistic vision

Effect of intensity of short-wavelength light on human alertness

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Abstract

It is now well known that exposure to light in the evening and night-time, especially of short-wavelength, leads to an increase in alertness in humans. There are generally several measures used in studies in order to evaluate human alertness – subjective alertness measures using questionnaires, and objective alertness using EEG (electroencephalogram), as examples. As a more quantitative measure EEG is used frequently; however, the literature reveals that different authors tend to interpret EEG data in different ways. Specifically, it does not yet seem completely clear how the power of different brainwaves relates to brain alertness, and hence what is the best way to measure alertness using EEG (for example, using alpha waves or beta waves). This study aims to evaluate how effective EEG is, as a technique, in measuring alertness, and explores the best way to use it in such kinds of studies.

Nine participants took part in a within-subject four-night study. In total there were four lighting conditions used in the experiments – three blue lights of different intensities (40lx, 80lx and 160lx) and a dim light (2000K, <1lx). For each of four non-consecutive nights, each subject went through one of lighting procedures – 20 minutes in dim light followed by one of the three blue lights for another 50 minutes, or only the dim light for 70 minutes. The blue light had a maximum intensity of about 470nm and its wavelength distribution was approximately Gaussian with a half-width half-height of about 35nm. The order of the lighting procedures was selected randomly for each of the participants. During each evening study EEG was continuously recorded over the 70 minutes and subjective sleepiness (which was assessed using the KSS questionnaire) was rated every 20 minutes.

Power densities of EEG were recorded and averaged over time (using 10-minute integration periods). Five power densities bins were calculated and compared: theta (3-7Hz), alpha (8-13Hz), lower alpha (8-10Hz), higher alpha (10-13Hz) and beta (13-30Hz). Subjective alertness measured by self-rating questionnaires were also averaged from all participants. The subjective results showed the highest alertness in the brightest blue light session (160lx), and the lowest in the dim light session. This is consistent with previous research findings that short-wavelength light/brighter light increase people alertness more than other lights/dimmer light. With this being justified, we compared the relations between different EEG power bins and alertness. Results showed that the dim light has the highest theta power and lowest alpha power. Also the alpha power increased as intensities increased. Variations in beta power, however, did not show clear relationships with subjective alertness. These results suggest that alpha might be the best frequency to look at when evaluating human alertness in the relevant studies.

Keywords: alertness, lighting, EEG

A method for scaling impressions of a scene

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Abstract

This paper describes the results of an experiment to evaluate people's impressions of a landscape scene. It forms part of a teaching module called General Colour Science, which includes 6 sessions (colour specification, colour appearance, colour vision, colour design, imaging technology and illumination technology). Students are asked to study a famous scene at West Lake in Hangzhou, China. The purpose of the experiment is to enable students to study how light and color in a scene can be described by recording their emotions obtained by means of questionnaires. There are 100 students from a wide number of disciplines, including science, engineering, art and design, medicine and social science. The students are mainly first and second year undergraduates. The module will run in the spring term from 1st March for a period of 8 weeks.

In industrial design, affective or Kansai engineering techniques are commonly used to help designers in the creation of products. The results are valuable in obtaining consumer preferences, making product development more consistent. For example, customers may, through experience and habit, make choices of a particular feature of commodity appearance, such as, material, texture, or degree of durability. The innovative aspect of the present work is to describe those perceptions brought about by a live scene rather than a static product scene.

Colour is a perception, not the property of an object. Therefore, the perception is very important for the evaluation of an object, a scene, or an environment. The goals of this study are to find a method to evaluate the perception of a live scene, and to reveal differences for subjects from different backgrounds.

Various papers have described the evaluation of, for example, different room settings, using perceptions of colour emotion and harmony. Some of these perceptions together with new ones reflecting the scenery will be used here. These are presented in pairs. They are safe-unsafe, peaceful-noisy, tranquil-active, comfortable-uncomfortable, natural-unnatural, clean-dirty, sacred-secular, artistic-commercial, beautiful-ugly, formal-informal, cheerful-sad, pleasant-unpleasant, interesting-boring, warm-cold (cool), tense-relaxed, tough-tender, strong-weak, fast-slow, refined-vulger, tenacious-yielding, hard-soft, and refreshing-depressing. Note that all perceptions and scales are set in Chinese.

In the experiment, all subjects will sit together and look at the lake from one similar location. The whole scene will be divided into 3 parts, i.e. the sky and cloud, the grass and trees, and a major focal hub ". For each target, each student will judge the 4 parts (three parts and the whole scene) using the above perceptions using a 6-point category scale, e.g. (-3) extremely cold, (-2) cold, (-1) a little cold, (1) a little warm, (2) warm, (3) extremely warm. Finally, the students will make judgements of the distinction between different targets in the scene. The perceptions to be judged are complexity, dominance percentage, and texture.

The results will be analysed to find the main components describing the scene, and to learn about differences obtained from subjects having different academic backgrounds. The students will learn the methodology of affective engineering and of psychophysics. All these will be reported in the full paper.

The novel features in the work are the assessment of scenery using the affective engineering technique, to perform the experiment outdoor using a large number of people, to have observers from various backgrounds, and to provide a new teaching method for colour science and colour design.

Colour influence of input button on user's pressing motivation: Analysis using different background colour and shape of button

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Abstract

The user Interface design on mobile devices such as a mobile phone and a tablet PC is important from the aspect of usability for visual communication. Input buttons are an essential element to operate touch screen devices. They need to be preesed by uses. There are various colours and icon designs for input buttons. Colours and icon designs could affect usability and it could be related to user preference, visual attraction and pressing behavior.

In our previous studies (Nishiyama, et al. 2013, 2014, Mizutani, et al. 2016, Mizutani, et al. 2017), the series of experiments were conducted. The colour influence on user's motivation to press an input button, visual attraction of a coloured input button, and colour preference were discussed based on the results of the visual experiments. It was found that the buttons with yellowish, orangish and reddish colours were frequently pressed. It was also found that the user's pressing motivation was similar to visual attraction and visibility.

The aim of this study is to understand the influence of background colours of buttons on user's pressing motivation on touch screen device, through the similar experiments of our previous studies. This study was also carried out to understand the influence of an icon button design on the user's pressing motivation. In this study, two visual evaluation experiments, Experiment I and II, were conducted using a mobile phone. Experiment I was to know the influence of a background colour. Experiment II was to know the influence of a icon button design focusing on shape and colour.

Twelve button colours consisted of four hues: Red (R), Yellow (Y), Green (G), Blue (B) by two colour tones and four neutral colours (N) based on the PCCS. Eleven back ground colour were used in the Experiment I. Eight icon shapes were circle, square, cross mark, thumbs up, star, drop of water, heart and clover, in the Experiment II. Button colours were the same to the experiment for background colour. Background colour was middle grey (N5). Two input buttons were displayed in randomized order on the touch screen. Using paired comparison method, the subjects were asked to press either colour button of the two buttons by their finger which they had higher motivation to press.

The experimental results the large influence of the colour on user's motivation to press input buttons. The colour which had the highest scale value was red and yellowish colours. These results agree with the previous studies. The icon shapes did have a large influence on the pressing motivation.

Correlations between colorimetric values and the scale values of the colors were also analysed. The scale values of the circle button were highly correlated with colour difference (ΔE*ab) values between the colours of the buttons and their background. The results of the various icon shapes suggested that the scale values were correlated well with lightness (V and L*).

Keywords: input button colour, background colour, icon shape, user's pressing motivation, touch screen

Color preference and emotion among Japanese students

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Abstract

The purpose of this study is to explore how Japanese children respond towards colors and emotions. The subjects were Japanese elementary school (N=47), Junior high school (N=39), and high school (N=39) students. The experiment was done between November and December 2018, and consisted of 3 steps.

During the 1st step, a questionnaire was given to the subjects and they were asked about the color they like the most/least, the color they would like to wear the most/least, the color they want their room to be, and the color of their most favorite toy. Once completed, the answered questionnaires were gathered, and they were guided on the second part of the survey.

In the second phase, they were presented with 8 facial emotions (happy, angry, sad, disgust, anxious, guilt, surprised, and tired) – each presented in 11 different colors (yellow, orange, pink, red, purple, blue, green, brown, white, and black) and were asked to judge the color that represents the given emotion the best.

After gathering the answer sheets from the subjects, in the 3rd step they were presented with 10 different color card boards (the same colors chosen for step 2) and were asked to rate how they feel about the represented color on a five-point Likert scale from very unhappy to very happy. The experiment was done in groups among the older children (Junior high school and high school students) and individually among the younger children (elementary school students).

It was observed that happy face was associated with yellow, and angry with red among all age groups. Sad was mainly associated with blue with the exception of elementary and junior high school students who associated both blue and black with the sad face. Yellow was associated with surprise, while elementary school children associated both black and yellow with the surprised face. Tired was associated with black and white among elementary and junior high school students, while it was associated with gray among high school students. In sum, regarding the facial emotions, it was observed that elementary school children were the only age group who associated black with negative emotions (sad, disgust, anxious, guilt, tired).

Regarding the 3rd phase of the experiment, purple, blue, gray, brown, and black were mainly considered as unhappy colors except for elementary school boys who found blue as a happy color. Orange, yellow, red, and pink were generally happy colors among all genders of all the age groups, except for elementary school boys who rated it as an unhappy color. Gray, black, and pink were among least favorite colors of the elementary school children. Half of the elementary school girls wrote black or gray as their least favorite color, while 66.7% of the boys wrote pink as their least favorite color.

The least favorite color of junior high school students was mainly brown, while it was purple for high school student boys. 53% of the junior high and high school students wanted their room to be white or beige, while 23% of elementary school children wanted their room to be white – the rest wanted colors such as green, orange, blue, light blue, pink.

Keywords: children, Japanese, color, emotion, preference

Research on the influence of children's building block color on children's learning process

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Abstract

Currently, STEAM education is becoming more and more popular in various countries around the world, and the emphasis on early childhood education has increased dramatically every day. As a kind of teaching aid commonly used in STEAM education, building blocks are well-known in terms of spatial cognition and logical education. Therefore, the use of specific building blocks as teaching aids for enlightenment education and toys to enhance children's interest in learning is becoming an increasingly popular choice for teachers and parents.

The building blocks for children in the market today are generally rich in color and strong in color contrast. Strong color stimulates the senses, at the same time, it is easy to bring discomfort. The matching or mismatch relationship between some certain colors is influenced by cognition, which will produce strong guidance in the process of building blocks. These guidance factors are very likely to affect or interfere children's creative outcomes. Color is especially important in cognition and learning process of early childhood. If used improperly, it is very likely to affect children's interest in learning and reduce the efficiency of use.

In this study, we focus on the effects of the color of building blocks in children's learning and entertainment, try to explore the reasonable plan of the color scheme: 1. Exploring the influence of the color scheme on children's construction behavior, including the relationship between the color scheme, the guiding role of teaching, the promotion of the learning process and the learning efficiency, etc. 2. Exploring the relationship between the guiding nature of building blocks color scheme and the generation of children's creativity.

Video and post-study interviews were conducted by observing the process of children's using monochromatic bricks and colored bricks for certain course learning. By collecting information and feedback from teachers and children in the teaching and learning process, compare the time, efficiency and results of children completing tasks when using monochrome and multi-colored blocks. Furthermore, when children use monochromatic and multi-colored blocks to learn, whether the color scheme of the building blocks affect the children's learning behavior or inhibits the child's creative behavior is explored.

Through the research and experiment, the influence of the color of the building blocks on children's learning and entertainment behavior is summarized, and the color schemes of the teaching materials such as children's building blocks are evaluated, and the design criteria for the color scheme of children's building blocks are proposed. The results show that: 1. Some color schemes with strong color contrast and cognition have a certain impact on children's creative outcomes. 2. Some strong color schemes will enlarge the aesthetics of color matching, thus affecting children's creative outcomes. 3 In the color scheme of some functional building blocks, the cognitive color matching scheme can help children quickly master the construction method, thus improving learning efficiency.

Keywords: color cognition, children education, color scheme design, teaching aid

The effect of the number of colors in teaching blocks on children's learning

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Abstract

University of Pennsylvania professor of Urbanism Witold Rybczynski has found that the earliest mention of building bricks for children appears in Maria and R.L. Edgeworth's Practical Education (1798). Called "rational toys", blocks were intended to teach children about gravity and physics, as well as spatial relationships that allow them to see how many different parts become a whole. Nowadays, building blocks have become an important member of the teaching aids. Major manufacturers and schools have developed corresponding teaching programs to promote products while allowing children to receive scientific enlightenment at an early age. In the existing teaching blocks, the color is mixed and chaotic, and will it have a negative impact on children's learning and affect the quality of children's learning? The purpose of this paper is to explore the most appropriate color scheme, to provide guidance for manufacturers to design toys, and a reasonable color scheme can help children learn.

To explore whether the number of colors and colors in the teaching aids will have a certain impact on children's learning, and thus provide some guidance for the toy design color scheme of children's toy manufacturers.

By investigating the sales data of manufacturers selling blocks worldwide, we selected 10 hot-selling building block toys, and conducted color analysis on 10 hot-selling products to obtain the current color scheme and color matching method. According to the above color scheme, the color of the teaching aids is colored, and 10 sets of color matching schemes are obtained, which are solid color, two colors, three colors, ..., ten colors. The children of the appropriate age are then grouped according to the number of color schemes, and the efficiency, time and memory of their tasks are compared by completing specific course tasks.

On the building blocks used by children, monochromaticity has a certain impact on the spatial construction of students compared with multi-color, and is significantly lower than multi-color in construction time and efficiency. Compared with less color, when the color is too much, the attention of the child is not easy to concentrate, resulting in a decrease in the completion rate of the task. Therefore, this paper proposes that the color design should use complementary colors and limit the color to 8 kinds, which will have a strong auxiliary effect on children's learning.

Memory effects for metallic colored objects in different memory periods

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Abstract

It is widely known that a memorized color can differ from the original color. However, it has not been deeply investigated whether this observation exists for metallic colors. In our previous study, we revealed that brightness contrast, in addition to chroma, was emphasized in our memory paradigm using gold materials (Horiuchi et al., CIE 2016). Furthermore, in our earlier experiment, we found that the memory effect varied based on the metallic color (Kondo et al., AIC 2017).

In this study, we experimentally consider how the memory effect for metallic colors changes under different memory conditions by conducting psychometric experiments using the following three types of copper-colored objects: a metallic colored object with metallic glossiness (sample #1), a matte object with the same shape and color as sample #1 (sample #2), and a matte object with the same shape and color as sample #1 with painted glossiness using a highlight color (sample #3).

In our previous study, we found that even if the reproduction image had physically the same color as that of the original object based on colorimetric reproduction, observers judged they were not equivalent in their side-by-side comparison. This may be caused by the problem of observer metamerism. Therefore, before the memory matching experiments, we conducted side-by-side comparisons between the original objects and their rendered images and determined perceptually equivalent color images for each observer as an origin. Then we conducted the two experiments under different memory periods.

- Experiment A: The observer gazed at the object for 20 seconds and memorized it. Immediately after memorizing, the object was hidden, and an image with a perceptually equivalent appearance to the memorized scene was selected from among fifteen displayed images in which the saturation and contrast were changed.
- Experiment B: The observer gazed at the object for an unlimited amount of time and memorized it. After three days, an image with perceptually equivalent appearance to the memorized scene was selected from among the same fifteen displayed images as in Exp. A.

The experimental results of memory matching in Exp. A showed that both saturation and luminance contrast were enhanced, which was also observed in our previous study. In more detail, the results for samples #1 and #3 in Exp. A, and the results for samples #2 and #3 in Exp. B had the same tendency. On the other hand, we found that the saturation and luminance contrast of the memorized metallic color reduced during the three-day period. To clarify the underlying cause, we investigated the relationship between color category and focal color for each observer and found that the color category was irrelevant to the focal color.

How could the colour "blue" become a "cool / cold" colour?

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Abstract

Aim: Blue is perceived as a cool / cold colour, which doesn't reflect the physical properties defined in colour temperature. This discrepancy is not discussed interdisciplinary.

Work: Interdisciplinary knowledge is needed to explain this phenomenon. In the colour perception blue is considered to be a cool / cold colour. In fact colour temperature is measured for many reasons in science which can an part of perception characteristics in illumination, human and biological vision and perception. As the wavelength of the light becomes shorter, the colour temperature becomes higher. That is the colour of a warmed black body at the given temperature in Kelvin. So blue has a higher energy and is perceived in higher temperatures. The direct hot perception is with a fire. Normally the outer part of a flame is seen to humans, which has the red colour. It is actually the part of the flame next to the air, so it is the coolest part of a flame. The center of the flame, which is hotter, has blue colour, which is mostly not seen by human's eyes because it is covered by the outer red part. Another blue perception is with stars in the sky. They have the colour blue, when they are young and hot, when they get older and cooler they become reddish yellow. But the stars are far away from the earth, so they are seen in the relatively cooler hours of a day which are in the night. There are many examples for this human perception in nature.

Results: Blue is the actual colour of warmer things or flames, but at the interface between the object and the air it becomes cooler. Due to the colour perception wavelengths of humans the hotter part below reddish yellow parts are not seen. So blue colour is perceived by human beings as the cooler or cold colour.

Keywords: Blue, cold / cool perception, discrepancy, scientific colour temperature

Would a digital colour-picker based on 3D be more user-friendly?

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Abstract

While software in general is constantly being improved, colour picker interfaces have not changed. This is surprising, in particular since existing tools are both difficult to use and un-efficient; users do not always achieve what they want, for instance a specific colour. Infrequent users encounter problems, and the design is therefore of great importance. "*The colour picker in all major software is crude and unhelpful to understanding, using and applying colour creatively*", says professor Koederink, University of Leuven, the Netherlands.

In this study a traditional colourpicker (the one in Microsoft Office) is compared with a new kind of colour picker, a prototype called "Kolorpicker" from the Swedish company Kolormondo. The fundamental difference between the two is that Microsoft presents colour in 2D, while Kolorpicker uses a 3D globe to show the world of colour. Both efficiency (search-time) and accuracy (ability to find a specific colour) is tested on mostly colour naive subjects. Most of the subjects are American students.

The prototype, "Kolorpicker" can be tried by signing in at the very bottom of www.kolormondo.com. Please use test@kolormondo.com and the password "ColourPickerTest" to log in. Here follows a short presentation:

Kolorpicker is based on a new, patented, way to present colours in a globe. It is developed to be easier to understand and more intuitive to use. All colours are seen in relation to each other, rather than on a flat two-dimensional "spreadsheet". One can compare with presenting the Earth on a flat map; maps distorts and sometimes even destroys proportions and relations while a globe gives a full presentation. Kolormondo and therefor also "Kolorpicker" is inspired by Philipp Otto Runge, but have modernized his concepts by basing the globe on CMY (and, for the digital version using RGB).

The results show that the 3D application gives better efficiency as well as accuracy. The main conclusion is that naive users of colour pickers would benefit if these where based on 3D.

Keywords: colour, software, colour-picker 3D

"Skin color" or colors of skin?
The faces of violence in children's drawings

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Abstract

This work is part of a broader research entitled "Rhetoric of graphic violence. Semiotic analysis of drawings by school children", that was carried out simultaneously in Buenos Aires (Argentina) and Mexico city. Here, only results about the use of color by school children of Buenos Aires city will be presented. Within the set of analysis variables, focus is made on the use of color in the representation of faces in violent and non-violent drawings. According to the actions depicted, children identify the victims of violence with certain skin tones, while the aggressors (murderers, thieves, kidnappers, rappers) are shown with a different chromatic selection.

The subjects are 108 sixth grade school children (10 to 12 years old), to whom the same questionnaire was applied and who made two drawings: one with violence and the other without violence. Thus, the corpus consists of 216 drawings, analyzed qualitatively and quantitatively through narrative variables and rhetoric semiotic methods. Starting from the two main groups, violent and non-violent drawings, the results are considered in relation to the variables of gender, type of school (public or private), and the kind of violence represented (physical, with or without weapons, verbal, emotional) in order to obtain the color palettes that children select to emphasize the traits of the characters they draw.

Within the aims of the research, we proceed to identify and make an inventory of the chromatic palettes used by children to make violence and non-violence evident, according to the tones selected for the skin. The colors are analyzed in relation to objects, symbols and represented scenes, and compared to the questionnaire answered by each child. Our research questions are: What colors do they use? Is a realistic handling of color what predominates in the characters drawn, or there are disruptive or rhetoric uses which show the faces of violence in a symbolic way? Is the palette of violent and non-violent faces similar? Are the victims represented with a different skin color than the aggressors? What social stereotypes appear?

According to our observations, the uses of black to express death, red to represent the blood of wounds, or violet for the marks of strokes, are constant in the drawings; these are chromatic signs codified by culture. However, the senses attributed to these and other colors must be recreated in the interpretative analysis of each case, and as a function of the iconography and the story told by the child, in order to reach the fullness of their meanings. It is in this framework that the color of the skin can be interpreted as a recreation of the context or as a prejudice.

The drawing can be a diagnostic element to know the degree of violence in which the child lives in his social environment. At the same time, in the graphic expressions of children we can find the traces of a codification: figures, strokes and colors express symbolic forms with which *clichés*, stereotypes and prejudices about violence are reproduced in each culture.

The relationship between color harmony preferences and personality types

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Abstract

There have been multiple studies on the relationship between color preferences and personality types, predominantly focusing on introversion and extroversion. There have also been several studies on color harmony or color combinations and personality types, also predominantly focusing on introversion and extroversion. The aim of this study was to look at the relationship between personality types as defined by the Myers-Briggs Type Indicator (introversion/extroversion, intuitive/sensing, thinking/feeling, judging/perceiving, and assertive/turbulent) and color harmony preferences. These letters are based on four dichotomies in Carl Jung's theory: information, decisions, structure, and favorite world. The goal of the MBTI is not to classify people but to "understand and appreciate differences between people" and is a psychological instrument.

To test this, 46 color pairs were created based on Kay and Berlin color name theory. As the experiment was conducted via an online survey form, the colors were chosen based on the Kay and Berlin color theory name and hexadecimal color codes. For participants to select a personality type, the survey provided a link to the website 16personalities.com and a dropdown menu for the selection of personality type that they were provided from the website. They were also asked to select their current mood (for example, happy, calm, frustrated). Then participants were taken to the color harmony pairs and were asked to rate each color pair on a Likert scale of 1-5, 1 being very disharmonious and 5 being very harmonious.

There were a total of 74 participants, 44 of whom were female and 30 of whom were male who were born between 1940-1999, with a majority born between 1970-1979 and 1990-1999. Some data analysis has already been completed, where participants have been sorted by overall personality type (their 4-letter type indicator, for example ESTJ), their more specific personality type (for example ESTJ-A), and sorted by introversion/ extroversion, intuitive/sensing, thinking/feeling, judging/perceiving, and assertive/turbulent. Further analysis is being conducted via frequency matrices, interval ratio data, and an aim to calculate color harmony scores based on theory from Ou, Yuan, Lee, Sato, Szabo, Sueeprasan, and Heurtas. Based on the data analysis conducted thus far, there is considerable correlation between general personality types and agreement on color harmony preferences.

Keywords: personality, color harmony, color pairs, preferences

The language of color

Blue color in Turkish culture

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Abstract

Social culture is formed by material and moral values such as beliefs, norms, objects, behaviours and customs in a community life. This formation evolves under the influence of other communities in the historical process. The one of the major components is color which is used for the expression of values such as architectural style, art and costumes in a social culture.

Throughout history, Turkish society has existed on a variety of lands from the eastern borders of Asia, through Middle East reaching up to Europe where it has interacted with many different cultures. As in many other cultures, colors in Turkish Culture have been loaded with meanings in the historical process under the scope of religion, geographical conditions, production and political systems. In Gokturks which is one of the first Turkish Societies that was given its name from the Sky God, blue color as the color of sky had a special status in their belief system symbolizing supremacy and greatness. Therefore, it is not a coincidence that Old Turkish States such as Gokturks, Khazars, The Seljugs, and Timurids had preferred blue color as flag color. Turquoise color (which beloged blue color family) as in the spectrum of blue is located on the religious beliefs of Turks. After Turks accepted Islam, blue color had been used on the surface of sacred spaces in mosques and shrines. "Blue Mosque" (Sultanahmet Mosque) located in Istanbul as one of the master pieces of the Ottoman Period is an magnificent example of using blue color.

This paper includes the examination of the change of colors used by the Turks since their existence from past to present day.

Keywords: Turkish culture, blue, turquoise

"Edible" colour names: Age-related differences in Russian

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Abstract

The present study is an extension of our analysis of Russian colour terms derived from names of food and edible substances. Such colour names metonymically stand for the colours of the objects in question and constitute a substantial number of secondary colour terms in the modern Russian language.

Colour names were elicited in a web-based psycholinguistic experiment (Mylonas and MacDonald 2010; http://colournaming.com). Colour samples (N=600 in total) were approximately uniformly distributed in the Munsell System. An unconstrained colour-naming method was employed. Native speakers of Russian (N=1,824) who took part in the study, were aged between 16–91 years. They input their responses using a Cyrillic alphabet keyboard and could produce any colour descriptor to name the presented colour samples (either a single word, or a compound, or term(s) with modifiers).

The dataset included 50,640 responses and those of observers with normal colour vision were considered.

The sample was drawn using a combination of several sampling schemes. At an initial stage (n<1000), we used a simple random sampling; this was followed by a stratified sampling, with the focus on different age groups: 16–19, 20–24, 25–29, and so on to 85+.

For each age group, we estimated the following linguistic measures:

(i) the list of 'edible' categories and the inventory of colour names in each category;

(ii) frequency of each colour term's occurrence;

(iii) patterns and number of mono- and polylexemic descriptors derived from each 'edible' object name (the term's derivational productivity).

In the present study we focused on 14 specific categories of objects, functioning as colour-term referents (Fruits, Vegetables, Berries, Herbs, Nuts, Cereals, Spices, Fish, Poultry, Dairy products, Sweets, Alcohol, Hot and Soft Drinks) and compared their inventories between the different age groups.

To visualize denotata of the most prominent Russian 'edible' colour names in each age group, we trained a colour-naming model based on Maximum a Posteriori (MAP) program – which favours more frequent colour names over less common and inconsistent – solely by colour names related to food (cf. MacDonald and Mylonas 2010).

Our findings allow to conclude that the inventory of 'edible' colour terms offered by different age groups of Russian speakers reflects diversity of their social "gastronomic" reality – characteristic cuisine and variation in flavour preferences.

Color, identity and space in digital games

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Abstract

In Game Design, color has many functions and is widely used as a tool to facilitate the identification of objects, evoke emotions, create ambiance or even reduce emotional impact. According to its expression and language, it assists in the identification of the vocation as a Casual Game or a Core Game, has the ability to give a visual hierarchy to the elements explored as well as facilitate the perception of the passage of time and space. Some games explore color in order to generate the perception of new mechanics, that is, color is exploited as a resource for intuitive understanding by players, as it is used by designers as an Identifier to clarify the properties of an element in the game, being an item or an area, since color can communicate whether these elements are interactive or not and how they can (or should) be used.

This article aims to analyze and understand how color contributes to the generation of identity and meaning of space by the player in digital games that present more elaborate fictional worlds. Based on the questions "Does color confer identity and meaning to the game space?" and "how the player gives significance to the space?" we intend to analyze the roles of color in games, using the concepts of landscape, space and place according to geography, understand how these are represented in digital games and how the decisions in the aesthetic dimension of the game reverberates to the narrative, mechanical dimensions and technology considering the concept of Magic Circle.

The relationships between colors and fictional worlds and how they are part of the digital game associated with rules and narrative will be analyzed and discussed. This study seeks to identify repetitive practices, to serve as a reference to the designer supporting his creative process, as well as providing him and the player the meaning of space, and also generating a new stimulus to the motor and spatial intelligences immersing the players into a space unknown compared to their everyday life.

The hypothesis outlined in this article is driven by concepts of information design and how colors contribute to the identity and significance of space by the player, using case studies as references. It is glimpsed that the inherent complexity of the field of game design is fertile ground for investigation and elucidation of events around the landscape and color as expression and information.

Keywords: color in game design, identity, space, digital color

Decision of validness in custom color names of JIS Z 8102: Case of Japanese color names

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Abstract

Generally, color names tend to be used for daily communication in color. Especially in Japan, "Systematic" and "Custom color name" are used based on JIS Z 8102 (Japan Industrial Standard). Custom color names have origin in plant, material, food and so on. But it was not revealed whether each custom color name is used accurately or not.

To clarify this question, 3 indices "Color distance between a given standard color of JIS Z 8102 and subject's choice for it in CIE L* a* b*", "Familiarity of color name" and "Imaginableness of color name" were acquired from color choice experiment and questionnaires to subjects (2009, Yoshizawa et al). These indices lead new 2 parameters "Degree of recognition" and "Distance in color space" in each color name for decision of how much recognition in each custom color name.

In the other aspect, distinguishes between in custom color names included basic color – ex. Chinese RED, Chartreuse GREEN, Cobalt BLUE and so on - were clarified, and valid color names were decided in each group with included basic color based on Berlin & Kay's 11 color words (2009, Yoshizawa et al).

And another aspect, cluster analysis made 26 clusters from data of color choice experiment in each 122 foreign names, and the representational color names in each cluster were decided based on Berlin & Kay's 11 basic color names and color difference between a given standard color of JIS Z 8102 and subject's choice for it in CIE L* a* b*", and validness of each custom color can be appeared (2015, Yoshizawa).

This paper is about another trial to decide valid color names from the rest of 144 Japanese custom color names in JIS Z 8102 (ex "*Aka*" instead of Red, "*Enji-iro*" instead of Crimson, *"Ao"* instead of Blue and so on). This trial leads to decide the number of clusters and the representational color names in each cluster. And based on the comparison between foreign and Japanese names and their clusters, validness in each color name of JIS Z 8102 will be clarified. And the result will lead to make discussion about color communication in Japan and the future state of JIS Z 8012.

Keywords: Japanese custom color name, color term cluster, degree of recognition

Color education

Colour training at IACC Academy, Salzburg, Austria

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Abstract

As head of the IACC Education in Europe (International Association of Colour Consultants/Designers) it is with immense pleasure that I present the colour teaching curriculum of the IACC Academy Salzburg, Austria, which combines results of scientific researches with practical experiences.

The IACC Salzburg Seminars (now the IACC Academy Salzburg) were founded in 1958 in Hilversum, The Netherlands. They were established by colour scientists from many countries, in response to a total lack of trained colour consultants. As a consequence, the first president of the association, Dr. Heinrich Frieling, biologist, psychologist and artist of Marquartstein, Germany was asked to create a training programme for this new profession. The aim was to educate a new type of specialist able to create, but only with colours, well-balanced environments for the wellbeing of humans according to their activity.

Since its beginning the IACC has dedicated its full activity to colour education.

For colour planning the IACC curriculum does not provide the use of computers. The two different mixtures of colours, the additive and subtractive one, cause serious difficulties. These two worlds are never going to meet: one is light; the other material. This fact has to be respected, when dealing with colour.

The IACC Colour Academy starts its training with an exercise, which is – in our view – very important for the whole profession: to make the students aware of what they really see, and not to see what they think they know. Analysing some special images and observing their physical reactions helps to educate the eye, the mind and the sentiments.

Practical exercises in colour mixing, basics of colour theory and aspects of architectural spaces are the first guidelines. Seven to nine different experts lecture on various subjects such as physiology and psychology, which help with understanding human responses to colour. Other subjects include instruction on different building materials, their characteristics, surface, colour variations and practical use. The IACC philosophy is that working as a colour consultant means not supporting one's own egoism, but serving people, to provide a human space in which to live and work.

Also important to the curriculum are colour-planning exercises as homework and their correction in the next seminar.

In a cycle of 4 seminars held over 2 years, students progress deeper and deeper into an understanding of the medium of colour. Their study ends with a verbal examination of all presented subjects and if wanted a thesis.

The human body is primed to receive various stimuli. Among them is colour. This means that working and living in a monotonous environment is stressful to the body. Research has shown that strong and saturated colours also create stress.

In the Austrian press, a recently published article on the internet stated that more than 75 percent of all illnesses are caused by stress. We colour consultants really need to pick up this perception and create a balanced colour climate for each type of environment and for any kind of work.

Colour is much more than decoration.

Challenging current colour theory and practice using thermochromic and photochromic inks in textile design

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Abstract

In the latter decades of the twentieth century, chromic colours that reversibly change colour according to external environmental conditions were introduced, and so became available to designers, including textile designers. Leuco-dye based thermochromic inks are coloured when below their activation temperature and clear or have a very light hue above the activation temperature. They are usually blended with static pigments in order to change from one colour to another. Photochromic inks are clear when not activated, and become coloured after exposure to sunlight or other UV radiation for 5 to 10 seconds. Although many textile practitioners and researchers have experimented with and investigated the design possibilities offered by thermochromic and photochromic inks, research into creating dynamic surface patterns for textiles has progressed relatively slowly. This may be due to a lack of understanding of the challenges that textile designers face when designing dynamic surface patterns using thermochromic and photochromic inks, the unchallenged status of existing colour principles and systems with regard to the properties of thermochromic and photochromic inks, and a lack of proposed solutions to these issues. This deficiency may have caused textile designers to see only complexity in the use of thermochromic and photochromic inks, rather than extensive and practical possibilities.

This paper attempts to use two series of design experiments, which used reversible, water-based thermochromic and photochromic inks, to highlight the challenges that come with using thermochromic and photochromic inks when studying, teaching, and designing with them. It stresses the fact that we, as textile teachers, researchers, and designers, need to rethink the ways in which we teach, study, and design with colours. The complexity of the challenge that we face today perhaps lies in the foundations of our colour knowledge and design processes, which are not appropriate when smart colours are involved. It may be that an entirely new colour system or model that can be applied to both static and dynamic colours should be established.

Keywords: *thermochromic inks, photochromic inks, textile design, dynamic surface patterns, colour theory and practice*

Presenting colours in a museum:
Mediation and scenographic principles

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Abstract

Since 2013, the association for a Museum of Colours has worked on the conception of a permanent exhibition dedicated to this multidisciplinary topic, while following an anthropological approach. To illustrate our ways to implement colours in a museum, we will take the example of the first part of this permanent exhibition: the perception of colours. This is an especially interesting one, since it also contains the introduction of the whole museum. Since October 2018, we have worked with scenography students based in Berlin, who helped us create innovative installations to display elements of knowledge.

Since the beginning of the project, one main question is what is essential about colours to present to a wider audience. We picture three levels of reading in the exhibition: the simple text displaying key-information in order to understand the globality of the exhibition, the main pathway for the average visitor, and the in-depth approach for an advanced audience (cultural audiences, colour specialists, and very curious people). Regarding the multidisciplinary nature of the topic, we also need to accompany the variations of background knowledge.

Next, defining contents is about setting limits: in introducing the perception of colours it is necessary to begin with light and a few starting explanations, but without coming back to Newton, otherwise we open a whole "chapter" of colour theories, which will be addressed later in the museum. This is where our anthropological approach lends its importance: we approach the topic of colours depending on their relationships to humans. Thus, Newton should be attached to a cultural context and set in perspective with other colour theorists.

In order to transmit knowledge to a wide audience, we need to implement various mediation means, which adapt to the diversity of people's background knowledge, but also their profiles and ways of learning: learning by watching, reading, but also doing, experiencing, inhabiting, leaving a trace.

We wish to create devices involving interactivity to allow a better understanding of theories and concepts. For instance, we developed a game to implement the Stroop effect on our visitors. This game can take multiple forms but its principle is based on mediation reflexions: how to bring our visitors to action which will make them understand and remember concepts.

Immersion is a key-concept of our scenographic approach of colours. For instance, we will create phosphenes rooms: dark rooms with 360° projections of patterns corresponding to what one can see with closed eyes. The visitors will be invited to switch the patterns until finding the one that resembles their personal experience the most.

Scenography can also help to convey knowledge: to illustrate Berlin & Kay's theory, we picture a structure in steps (going higher), to fully embody the transition from one stage to another in the development of languages.

This presentation aims to show many examples implemented by our association and its partners, in order to make colours understandable and lively for various types of audiences. Our next exhibition will take place just before the congress, and we would like to show short videos and thus give a - lively - oral presentation.

Assessing the color learners' competence in multiple topics of essential color knowledge

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Abstract

During the past three years, the colour scholars and color industrial experts in Taiwan Colour Association(CAT), Industrial Technology Research Institute (ITRI), and Taiwan Association of Color Application (TACA) have jointly developed a standardized teaching, training and certification system to elevate Taiwan's color profession. The enrolled color learners who passed the certification exams are recognized as "Certified Color Planning and Managing Color Specialist" (CPMCP). The exam subject Basic Color Theory is the compulsory subject to whoever choose the field of the color planning or engineering, as the subject content comprises multiple topics of color knowledge that are considered essential to establish one's color professional ability. These five crucial topics with corresponding sub-topics and resultant correct rates are listed below. The correct rates are derived from over one thousand examinees' scores in answering a total of 80 multiple-choice questions that evenly cover all exam sub-topics. This very first assessment of various aspects of color knowledge has illuminated the direction of improving CPMCP educating and training system.

Exam Subjects	Exam Topics	Exam sub-topic	Correct rate
Basic Color Science	Color Phenomenon	Seeing Color	75.16%
		Color Vision Theory	74.96%
		Color and Lighting	76.17%
		Components of Color Vision	72.91%
		Color order System	60.88%
		Principle of Color Mixing	77.58%
	Basic Color Application	Digital Color	58.76%
		Basic Colorimetry	64.61%
		Color Reproduction	71.20%
		Basic Color Planning	97.38%
		Basic Color Management	51.25%
		Basic Electro-optical Color	50.96%
	Color Psychology	Color Perception	68.74%
		Color Visibility and Saliency	93.13%
		Color Contrast and Assimilation	71.58%
	Principle of color Harmony	Color Tone and Color Harmony	78.84%
		Hue Difference Based Color Harmony	90.51%

Keywords: basic color science, essential color knowledge, standardized teaching of color, color certification

Project work experiences in post-graduate education on color design

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Abstract

In this research we expose some of the most significant color design experiences and results conducted in the Master program in *Color Design & Technology* that is organized by Politecnico di Milano in cooperation with Associazione Italiana Colore. This Master aims to provide advanced training to professionals, so as to enable them to understand and manage the technological and design issues, often across many disciplinary areas, typical of all the professional and research sectors in which the use and management of color are essential.

Since it has been established, one of the most remarkable characteristics of this post-graduate program has been an approach to color with a multidisciplinary attitude with regard to the teaching of contents. This master has also been promoting cross-cultural backgrounds and profiles of the students with university degrees in Architecture, Art History, Engineering, Fashion Design, Graphic design, Industrial Design and Product Development, Interior Design, Psychology, Visual and Performing Arts. In 2019 the students come from 9 different countries (Chile, France, Guatemala, Ireland, Italy, Mexico, Russia, Spain and USA). This multidisciplinarity is emphasized in the recognition of color as a complex, multi-scale element, which can and must be addressed from different background and know-how. Color, because of its relativity, is a place where different disciplines can be mixed and becomes an interesting challenge for designers, artists and architects professionals who works together, contributing with their different knowledge and methodologies to solve the proposed requirements.

This one-year post-graduate master program consists of three main phases: the first one is composed of lectures and theoretical lessons on color and taught by different academics and professionals; this part of the teaching activity is organized by the Associazione Italiana Colore. The second phase is composed of a series of five different three weeks design experiences organized by the Politecnico di Milano. This Project Work phase is carried out by teachers different from the first phase and focuses on the methods learned: the students are asked to integrate the knowledge and, at the same time, to propose and develop color projects, solutions and applications for different design assignments, such as "color in Communication design", which is focused on the function and communicative dimension of color in the context of communication, and "color in Fashion design", which defines and experiments how to use color in the world of textiles and fabrics. These two design assignments are followed by the project work on "color in Interior design", which is dedicated to analyze the chromatic choices for the creation of innovative spaces, also in order to establish a harmonious relationship between the environment and the brand identity. The project work on "color in Product design" develops a methodology and experiments how to design a product through the CMF project management in relation to product shapes. Finally the project work on "color in Urban Space design" addresses the link between color and meaningful impacts in terms of human responses and relationships which take place in urban identity. In this paper we present some of these challenges and solutions about the methods used and the main results obtained in these five project works. In the third and last phase, the students go through an Internship period, which is meant to establish contacts between the academia and companies who work with color in the field of design, architecture, textiles and paints, among others.

Fundamentals of color teaching in post-graduate education

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Abstract

In this research we present a framework on the theory of color culture and science education in the context of a master program in *Color Design & Technology* organized in Italy since 2014.

This post-graduate master consists in three main phases, the Fundamentals, the Project Work and the Internship. The first phase is composed of lectures and theoretical lessons on the topics of Color History and Perception, Color Applications, Digital Color and, Colorimetry and Color Systems, taught by different academics and professionals. The Fundamentals gives the students a base from theory and technique, training them in the aspects of measurement, control, digital reproduction and comparison relating to disciplines such as physics, optics, colorimetry, chemistry, psychology and perception.

The fundamentals are assorted during the first three months of the master giving to the students the possibility to face with all the different purposes of colors study and to see all the applications in heterogeneous domains.

At the beginning, we present the theme of color from a physical point of view, as electromagnetic radiation and we show application on how the light interacts with different materials. Hence, we link the study of the physics of colors with material diagnostic and pigment/colorants characterization. Considering the analysis of the materials some lessons are dedicated to the chemistry of colors and to them contributes also the experience of some of the biggest producers of varnish for interior/exterior design.

The study of the materials is combined with lessons about the psychology of color and color naming. Different experts from those fields are called to teach the bond between color, culture, linguistic and psychology. In this context, the multicultural environment deriving from students coming from different countries and nations turns on the class discussion increasing the learning ability.

A particular attention is given to light and light design in the process of formation and valorization of color. Experiments are set up in the classrooms and the students in first person have the possibility to learn how to use different instruments for light measurements and to understand how the lights asset can change the perception of colors.

During the fundamentals the students have the possibility to interact with experts in design application such as jewelers, fashion designer and interior designer, but also to discuss about copyright and law, and to discover how to manage the digital color for advertisement or film restoration.

After the Fundamentals, the classroom is ready for the following phase of project works. The first phase is meant to give all the base knowledge that the students are then asked to integrate in the project works, to propose and develop color projects, solutions and applications for different design assignments.

The last phase, the Internship, establish a link between the academia and companies who work with color in various fields like design, architecture, textiles and paints, among others. Here the fundamentals will allow the students to build up their future professional experience in the chosen field.

The Shillito Design School: An influential colour curriculum with historical links to the Bauhaus

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Abstract

From 1962 to 1979, the Shillito Design School was a landmark educational institution that represented Australia's unique link to the Bauhaus, one of the most influential design schools of the 20th century. In its era, the Shillito Design School was well-known for its comprehensive colour and design curriculum, devised by its founder, Phyllis Shillito.

The School's curriculum was so effective that a lasting legacy are the many former students who rose to prominence in Sydney, including Edmund Sykes and Donald Johnson, founding members of the Society of Interior Designers Australia; David Denne, Head of Design at the University of Technology, Sydney; Olga Kardos, Head of Design Studies at the Design Centre, Enmore TAFE; and Mary White, who established the Mary White School of Art. Former Shillito Design School students Eva Fay and Prue Leith replicated the School's colour and design curriculum when they established the School of Colour and Design, Sydney, in 1983. In turn, the curriculum was adopted by the Sydney Design School some years later.

Due to the unique and influential nature of the Shillito Design School and its historical link to the Bauhaus, this paper honours its eminent status by providing an examination of the origins and extent of the School's colour curriculum. Shillito claimed that she "borrowed progressive ideas from...schools in Ulm and Munich" and there is no doubt that Shillito's ideas about colour were also influenced Johannes Itten and Josef Albers. There are many patterns of similarity between Shillito's colour curriculum and that of the Bauhaus foundational course. However, Shillito incorporated additional theories of colour that provided graduating students with expert knowledge about colour application in design and the built environment.

While colour is an integral element in design, colour curriculum is slowly being marginalised in universities across Australia. The reasons for this are many and varied, not the least of which are the relative absence of adequately trained and informed educators, and the abundance of amateur colour knowledge easily found in mainstream media and online. Drawing on recollections and portfolio documentation of former students of Shillito Design School, this paper provides an invaluable record of the School's colour curriculum. In an era where curriculum in general is being increasingly shifted to online delivery and colour curriculum in particular is being sidelined in tertiary education, this paper will serve as the only record of one of Sydney's most influential design schools.

Keywords: Colour curriculum, colour education, colour theory and application

Colour harmony: A 2020 perspective

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Abstract

Theories and research studies that focus on colour harmony abound in the academic literature on colour theory and application. In addition, mainstream media is awash with amateur theories about colour harmony; theories that are simplistic and lack an evidence-based understanding about colour. As we move towards 2020, there is an opportunity to revisit colour harmony from a new perspective. Advances in critical and theoretical analysis and discourse provide a clearer view of this often debated construct.

This paper discusses not only definitions of colour harmony but examines both side of the interface between colour and human response. While Burchett (2002) suggested that 'colours seen together that produce pleasing affective response are said to be in harmony', this statement provides little insight into the complexity of colour or our responses to colour.

Early theorists proposed a range of colour harmony principles, guidelines and formulae aimed at achieving colour harmony. These theorists include eminent figures such as Newton and Goethe, as well as Ostwald and Munsell. From their perspective, the construct of colour harmony is underpinned by ontological assumptions that are now considered outdated and unsound. Specifically, colour harmony is viewed as predictable and deterministic, universal and nomothetic. In addition, a number of theorists were not only biased in their approach to colour harmony but inculcated their definition of colour harmony with a secondary agenda, removed from colour. For example, Newton proposed that colour harmony was underpinned by an analogy with 'the concordance of sounds' and the music of the spheres.

Subsequent theorists acknowledge the complexity of human response to colour. Albers was one of the earliest theorists to suggest that 'no mechanical colour system is flexible enough to precalculate the manifold changing factors (that impact colour harmony) in a single prescribed recipe'. O'Connor (2010) addressed the complexity of the interface between colour and human response by suggesting that colour harmony is a function of the interaction between colour and a range of different factors that include individual differences, variations in social and cultural conditioning as well as contextual, perceptual and temporal factors. In summary, most colour theorists now accept that colour harmony is idiographic, stochastic and extremely difficult to predict.

On the colour side of the interface, Hard and Sivik (2001) acknowledge the complexity of colour and the huge range of colour nuances that we are able to perceive. Given this complexity, Hard and Sivik suggest that the number of possible colour combinations is 'almost infinite'. More recently, Caivano (2018) drew attention to colour gradations and transformations; other dimensions of colour appearance 'beyond the usual conceptions based on taxonomic divisions and categorical oppositions'.

An updated conceptual model of colour harmony is presented that acknowledges and draws together these new perspectives on colour and human response to colour.

Local colour and patterns (essence of place)

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Abstract

This is a pedagogical project for first-year OCAD University design students with the objective of exposing them to the concept that every geographic location around the world is unique and that specific colours and forms may be exclusive to a particular site. These unique features can be researched, studied, analysed and then become a source of inspiration that can be applied to a contemporary design in order to capture the spirit and essence of that locale.

This three-week project had three phases. First, students selected a geographic location, this could have been a location that they have personally visited and experienced or they could have researched it online. They were instructed to download at least four images of the site (from different times of day or seasons) from the internet or to use their own images. Next, they had to uploaded their images to Color Explore or another similar colour identification website (http://www.colorexplorer.com/imageimport.aspx) and extracted the colour information using the colour palette option. For the second phase, students had to create a composition that was atmospheric or abstract in nature using that colour palette (various Photoshop filters were suggested as a good starting point). Additional research was conducted to find forms or themes that could be used for a decorative pattern from the local environment (flora, fauna, animals or built forms, etc.) of their geographic selection and transform it into a contemporary design. A written explanation of their choices, process and citing image sources was required. The final project format consisted of three pages, a one-page research document, a composition that combined their abstract image and pattern and then an image of their design applied to either a 2D or 3D object or surface.

The learning outcomes of this project was to encourage students to think about local colour and patterns from specific geographic and cultural locations and how they may be used in contemporary design, evoking and celebrating the essence of a place.

Keywords: colour, education, geography

Light and color

Color rendering of window glass:
Analysis of the occupant's view with hyperspectral imaging

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Abstract

Window glass can have a strong impact both on the colour appearance of indoor spaces and on the view outside. When they are specified, its colour rendering properties are generally expressed, by an amended Colour Rendering Index where D65 is the reference illuminant. Previous research has shown that CQS and MCRI (other colour quality metrics) work also well to predict colour rendering of such kind of product. Another method has recently been published in a context of advanced glazing technology. It couples the analysis of the transmittance of the glazing with the analysis of eight CIE colour samples in the CIE 1976 (u', v') chromaticity diagram.

This paper aims at presenting an alternative graphical method that provides descriptive information about the colour content of the view outside, and shows colour shifts due to glazing. The paper illustrates the interest of the graphical method by testing it on various landscapes (typical views of parking lot, vegetation and urban context) and various tints of glazing.

In the first part of the paper, the proposed graphical colour rendering method is described. It is proposed to analyse colour distortions through a graphic icon in a similar way to recent developments in lighting colour quality. Instead of making predictions based on a predefined set of colour samples, as traditionally done to characterise colour rendering, the specific colour content of the scene is analysed through hyperspectral images. The icon was developed both for representing the colour content of real scenes and for improving the colour rendering prediction due to illuminant and window glass. It was thought to be easily understandable by end users and to provide intuitive information about which colours are impacted and what kind of distortion should be expected.

The second part of the paper presents a database of hyperspectral images acquired using a VNIR4 SPECIM (sCMOS-50-V10E model) hyperspectral camera attached to a SPECIM rotating scanner. The database consists of a set of high spatial and spectral resolution images with large field-of-view and is composed of various types of landscape (vegetation, rural and urban).

The third part of the paper discusses the interest of this graphical method in comparison to other existing methods for predicting colour rendering properties of advanced glazing. Contrary to single number colour metrics, colour graphics make possible to visually analyse shifts as a function of hue and chroma. Moreover, the graphical method proposed here makes possible to adapt the colour rendering analysis to the particular context of any building because calculations are done based on hyperspectral images and not on a predefined set of colour samples. The idea is to let the user choose a landscape in the database or upload an own image of the view from the studied building.

Keywords: window glass, view outside, colour rendering

Quantitative condition for making the appearance of fluorence in actual architecture using chromatic light

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Abstract

1. Backgrounds and purposes

"Fluorence" is a region of the surface mode of colour appearance, defined by R. M. Evans in 1959, which contains no gray and appears to fluoresce. Recently the development of full colour LED technology has brought about an increase of actual buildings which have the appearance of fluorence illuminated with chromatic light, however, lighting methods to produce it are still ambiguous. The aim of this research is to reveal a quantitative condition for making the appearance of fluorence in actual architecture.

2. Experimental methods

A subjective experiment shown below was conducted in this research. The experimental space was a darkroom and the observation boards were located at a distance of 1500mm from the observer. The observation boards consisted of two layers, a background board and a target board, and each of which was 900mm square in size. Subjects observed the target board through the opening of 265mm square bored at the center of the background board, which was closer to the subjects.

There were three colours for the background board, black (Munsell N1), gray (N5) and white (N9.5), and the target board was white (N9.5). Two RGB spotlights of which intensity could be changed gradually were set between the background and target boards, and the target surface was illuminated by their chromatic light. For the ambient lighting in the experimental space, high-color rendering fluorescent lamps (5000K) were used and the background surface was illuminated by this fluorescent light.

15 stimulus patterns, which had 5 target colours (red, green, blue, yellow and white) and 3 background colours (black, gray and white), were randomly presented for each observer. The intensity of the target colours was stepwisely increased/decreased. At the start of the experiment, after 10 minutes adaptation, a subject observed the target and background surfaces simultaneously and evaluated the appearance mode of the target surface. After that, the experimenter started to change the target colours by increasing/decreaseing the spotlight intensity, and the subject responded just when the target turned to appear fluorence.

3. Results and future works

The luminance values where the appearance of fluorence appeared on the target surface were compared with those of the optimal colour in reference to the previous research by Uchikawa et al. Although there was a certain difference in absolute luminance between the optimal colour and fluorence in their experiment, the result in this research showed that the calculated luminance of the optimal colour and the measured luminance of fluorence were almost the same. It could be inferred that this incompatibility resulted from the fact that a CRT monitor was used in the experiment of Uchikawa and the target and background surfaces were seen on the same plane in their experiment, whereas the target surface in our experiment appeared to be the aperture colour separated from the background. The result leads us to the conclusion that the quantitative condition for making the appearance of fluorence in actual architecture using chromatic light, when it is seen as an aperture colour through an opening with a sharp edge, could be estimated by the optimal colour calculation.

In the future work we would like to examine this estimation method of fluorence in the actual buildings such as Le Couvent de la Tourette, or House of Light by James Turrell, etc.

Keywords: *mode of colour appearance, fluorence, optimal color, aperture colour*

Effects of object colour stimuli on human brain activities and subjective feelings in physical environment and virtual reality

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Abstract

The potential of controlled light and colour environments in improving emotional well-being has received progressively more attention (Volpe, 2016). Existing works focus on the impacts of colour temperature, colour experience on positive human's mood, focus and improved productivity (Küller et al., 2007 and Jalil et al., 2012). Meanwhile, increasing studies have demonstrated that immersive technologies, specifically virtual reality, (VR) are demonstrating strong potential to serve as a substitute for the exposure to real-world environments. For example, studies have shown effectiveness of VR exposure for treating anxiety disorders (Carl et al., 2019). Compared with specialist lighting and colour equipment, VR exposure is currently more economical and accessible to control over the real situation. To our knowledge, there are limited studies comparing the effectiveness of controlling colour temperature and colour experience for improving human's mood, focus and productively between specialist lighting and colour equipment exposure and virtual reality exposure. The purpose of this work is to draw a comparison between human response to colour and light in the physical reality and virtual reality. To answer this research question, comparison psychophysical experiments are designed in order to compare the virtual lighting and colour environment with the same settings as the environment with specialist lighting and colour equipment. An evaluation of 15 VR-enabled applications is a key aspect of the work to develop a more in-depth understanding of these arguably essential elements and attributes for the design of virtual environments in Unity.

Further, the same level of colour and light in a 3D digital colour lab was compared with that in the physical colour lab. A fundamental issue is that many people are less able to put emotion into words. Thus, throughout the experiments, all participants' emotional valence and facial expressions was assessed by specialist measure equipment, given that human facial expression can reflect individual's emotions. At the same time, data was gathered from interviews, video recordings and questionnaires. Moreover, we use mixed methodologies including both qualitative and quantitative analyses. The qualitative method focuses on content analysis, subject interviews, and field observation.

In the future work, a VR rehabilitation program will be designed and developed with VR technology; focusing on the principles of colour and design for positive human functioning and well-being. Experiments based on human-app interaction will also be carried out to explore the effects of such rehabilitation program on individuals. Data will be collected and quantitative research methods (such as the PANAS questionnaire for assessing positive and negative mood) will be used to explore the effects of the program on human emotion and responses. The implications of this study might help to explore the potential of applying color temperature and experiences in virtual reality game, animation and etc., and help treat mental health issues and disorders.

Keywords: colour, lights, virtual reality, emotional well-being

Light, color, art, science and technology: Photography as an instrument for the learning of science and artistic production

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Abstract

This research work collects the presence of art in the learning of science and especially the technological contributions of photographic capture, digital postproduction, with visual pedagogical examples that combine science and technology to make art with phenomena that produce light.

Experimentation that allows us to understand from the very phenomenon of atomic physics by which light is produced, passing through chemistry, bioluminescence, IR and UV radiation and electricity.

The unstoppable incursion of the digital photographic age has exponentially triggered the way new generations learn more visually than ever.

With this series, we can visualize several exploration processes in reactions and experiments that allow us to understand the spectral behavior of light, the laws that govern the physics of light, the electromagnetic reactions that occur from chemistry and electricity to create light phenomena and its Subsequent capture in special conditions of assembly and lighting under study under technical conditions of night photography and in critical light conditions to convert them into digital visual art.

Seven laboratory experiments were chosen with theoretical scientific accompaniment that allowed capturing a process and seeing the result in a creative way in an artistic photograph, the initial idea is to be able to mix art, science and technology in the production of a photograph.

Experience 1: Photographic capture of chromatic luminic refraction effects with different wavelength with laser. Fusured industrial crystal. The molded industrial crystal.

Experience 2: Microprismatic refraction on natural mineral crystals. Natural mineral crystals. The microprismatic mineral composition of autunita, fluorita or selenita makes the passage of high frequency light travel internally in all directions, with red wave laser and long wave green laser lighting techniques.

Experience 3: Chemoloiniscence. Chemiluminescence, produced by the chemical reaction, by combining an excited base dye with a fluorescent dye reagent, this reaction releases energy by jumping electrons in the mixture that is converted into light and that can be increased if the energy is increased in this If the case is heated, that electronically excited state manifests itself in photons that are quantumly captured by the camera's sensor and not seen by the human eye.

Experience 4: Capture of UV radiation. With the use of fluorescent elements, its spectrum is stimulated with high frequency ultraviolet illumination to generate colors in photographic compositions.

Experience 5: The electric light of plasma. A transparent glass sphere, which is filled with a mixture of several gases at low pressure is driven by alternating current of high frequency and high voltage that is generated by a high voltage transformer or a kind of miniature Tesla coil.

Experience 6: Audiovisual of an animated mandala. With the collection of images captured in camera, chromatic compositions are made with radial and bilateral symmetrical shapes that are manipulated every 2 degrees along the 360 degrees of the chromatic circle, attaching music or synchronized sound effects that achieve audiovisual projects.

Experience 7: Application to works of landscape photography. With the process of capturing different spaces of the spectrum to take them to digital manipulation by layers of color, they create impossible landscape photographs in one shot.

Keywords: light, color, art, science, technology

Colour and light in exterior architectural illumination: From efficiency to aesthetics

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Abstract

Artificial light changed our relationship with the city, and it has enabled us to experience the urban space in its full potential at night.

The new lighting technologies brought different possibilities to present the architectural structures, working with different intensities, different colour temperatures, different illuminants, etc. But these choices could completely modify the presentation of the architecture from day to night. That raises many questions to be discussed: can we define what will be a correct illumination to a specific architecture? How can we do so without causing any kind of distortion to the Architecture's perception? Should the aesthetical attitude of the light designer overpower the simple presentation of the object? Are we preserving the right hierarchy in urban perception, or are we destroying it?

Since light can deeply modify the perception of what is being illuminated, we must define parameters for a correct perception of the building's characteristics, of its colour and materiality, of its parts, of its identity as a whole, and of its role in the urban space. We should also take into account the visual comfort of the artificial illumination regarding its inhabitants, by avoiding excessive levels of illumination, glare and excessive contrasts.

We could use different colour temperatures in urban space illumination, not randomly, but so it would help define different ambiances, or different hierarchies, enhancing the buildings that are more relevant (heritage buildings for instance) from others less so. Sometimes we see common and uninteresting buildings being excessively illuminated, for commercial sake, to the detriment of others that are much more important for their architectural and cultural value.

This research is not a technically driven one in the field of illumination, but tries to relate the perception of architecture and the inherent characteristics of its colour and form in the transition from day to night. We propose the following parameters, to bring the realm of the discipline of architecture into light design, working from technics to aesthetics:

i) Technical solutions should always obey to the superior objectives of the correct architectural presentation.

ii) Aesthetical idiosyncrasies of the light designer should be reserved to enhancing architecture when working with its authors, or in ephemeral events, and should never be applied in Heritage buildings. In that case, we should observe the recommendations expressed at the Taxco Chart.

iii) At all times we should preserve the identity of the building, eventually enhancing its details without losing their relative importance to the building's identity and coherence as a whole.

iv) We must observe the building in its natural and/or artificial environment, and its problems of contrast and continuity in perception.

v) We must consider the balance between the desired effect of the architectural illumination and the impact on the visual comfort in urban space life.

By observing these goals, we will have a less technical and less economically efficient solution, but we will surely have a more sensible, comfortable and correct interpretation of the object.

We will illustrate and discuss these concepts with images of good and bad practices as case studies.

LEDs and urban landscape

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Abstract

From the '70s, yellow color was predominant in urban landscape: roads, motorways, streets, parks and squares. High Pressure Sodium (HPS) lamps luminaires were (and are until now) the preferred light source due to its high efficiency and long lifetime. Modern white light sources, as Metal Halogen Lamps (MHL), with short operational lifetime and lower efficacy, were reserved for situation with high visual requirement, as commercial streets or highlight green areas, sacrificing energy efficiency and the economical aspect, for the sake of a better visual impact.

We are living now a "Light revolution". SAP and MHL lamps, and other traditional light technologies (incandescent, High and low pressure mercury discharge lamps) will be replaced by LEDs: Light emitting diodes a solid-state device who produce directly photons from an electronic juncture. High efficacy and long lifetime and (the more important) a strong commercial impulse together with the practicality of an electronic device, are transforming to LED in the future exclusive and unique light source.

The paper gives a short LED technology introduction with special emphasis in the characterization of LED spectrum and the ways to produce white light. The effects of color rendering, chromatic coordinates and color temperature are shown from different points of view: aesthetical, exactitude and pollution. From the three topics, researches from LAL CICPBA are described. For the first, studies about the influence of the geometrical point of view in the color luminaire perception, that affects the appearance of the light installation. The second research shown as the light spectrum introduce differences in color traffic signs discrimination. Finally, the last topics cover the LEDs luminaires light pollution in the "blue" spectrum zone and its influence in astronomy.

In the three analyzed aspect there is a strong influence of LED spectrum. For street, park and road luminaires, LED emission is based on a blue juncture that interacts with the secondary emission of a phosphorous cover. With this, light LED have a "natural" tendency to be very cold and in several senses is t is important to teach the users how choice the adequate color temperature by each application. It is the main objective of the present paper.

Keywords: LED, lighting, street, spectrum

Color science and technology

Color reproduction problems of telemedicine with the use of smartphone

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Abstract

Smartphone has been spreading explosively since 2010 everywhere in the world. In Japan, most young people in their 20s have at least one smartphone. The common operating system of smartphone used in the world is Android OS, but iOS for Apple iPhone has a 70% share in Japan. Smartphone display has advanced by means of technological innovation. The organic light-emitting diodes (OLED) are used for smartphone displays in 2018, and they have higher definition with larger size, higher luminance and deeper black, higher contrast and higher visibility, and wider color gamut. On the other hand, a problem about color appearance of OLED smartphone displays occurs. The wider color gamut by OLED smartphone displays may lead to excessive color representation like cinema film, and may produce different color appearance from actual color.

In Japan, the medical practice with communication equipment as computer, facsimiles and mobile telephones (Telemedicine) is on the way as part of efforts to tackle super-aging society and doctor shortage. Usually a doctor examines/sees a patient face-to-face. As treatment in the chronic phase for some significant period, the doctor can use telemedicine methods as complementary practices. The color reproduction of telemedicine communication equipment become a challenge to dermatological treatment such as decubitus care and atopic dermatitis. Therefore, this research examined the color reproduction problems of telemedicine with the use of smartphone.

For this experiment, 24 color charts of Macbeth Color Checker and two photoprints of decubitus were used as visual targets. In a darkroom, these visual targets were illuminated at 500 lx by six kinds of light sources (an incandescent lamp of 2468K, three fluorescent lamps of 2832K, 5064K, 6458K, and two LED lamps of 2651K and 5041K). We used REALAPS 2.0+Clum Color system made by Visual Technology Laboratory in Japan as measuring equipment for color tristimulus values CIE XYZ. We used iPhone XS Max made in 2018 too.

Experimental results were summarized as follows. (1) Under lower color temperature lighting conditions than 3000K such as incandescent lamp, color reproduction of the smartphones display was not good, and the color tristimulus values were strange as compared with the values under higher color temperature lighting conditions. (2) Brightness of color on the smartphone display tended to express higher than the real color. (3) Saturation of color on the smartphone display tended to express higher than the real color, especially when the object colors were high-chroma. (4) Judgement of decubitus symptom, color difference tended to be over evaluated.

Keywords: *telemedicine, smartphone, color reproduction, color difference*

Comparison of colorimetric data from spectroradiometers and spectrophotometers

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Abstract

Established methods exist for the measurement of colour for opaque, spatially uniform and flat objects. These methods typically involve the measurement of spectral reflectance using reflectance spectrophotometers. However, there are materials that are difficult to measure using a conventional spectrophotometer and these materials may be translucent or non-planar, for example. Materials that may be difficult to measure include teeth, skin and some food products such as meat. As a consequence, the need to measure the colour of materials such as these, some researchers have used camera systems that, when suitably calibrated, can measure CIE colour coordinates or even spectral data. There are also some commercial devices that have appeared in the last decade that are imaging spectrophotometers. Other researchers use tele-spectroradiometers that record spectral radiance; methods then exist that can employ calibration to convert the spectral radiance into spectral reflectance factors. There are, however, limited studies that have compared the use of spectrophotometers and spectroradiometers in terms of accuracy and precision. This study is concerned with this comparison.

In this study, measurements of spectral reflectance and CIE colorimetric data made using a tele-spectroradiometer are compared with data from reflectance spectrophotometers. A set of 20 opaque coloured samples were used as the data set. The comparison was made for two optical geometries (45/0 and approximately d/0). Two reflectance spectrophotometers were used (one which is 45/0 and one which is d/8). For the tele-spectroradiometer two optical geometries were used; one that employed diffuse lighting provide by a DigiEye system (provided by Verivide Ltd) and one using a copy stand with 45/0 configuration. The data from the different instruments will be compared using spectral and colorimetric error metrics.

Keywords: colour measurement, spectrophotometer, reflectance, spectroradiometer

Metamaterials: "Lenses" without chromatic aberation?

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Abstract

Aim: Some new metamaterials have unusual optical characteristics. One of these is to allow them to build new optical "lenses" (metamaterial in layers) which don't have chromatic aberration, which may change the normal visual perception and accuracy of optical systems.

Work: Interdisciplinary knowledge is used. Metamaterials are artificially structured materials used to control and manipulate waves in physics and also in light. Conventional optical systems have eight different aberrations, from which no one can be set to zero. If one or more of these aberrations can be decreased, other aberrations become increased. So optical systems are build not to have "no aberration" but to have optimal balance of aberrations. Metamaterials like TiO_2 (titanium dioxide) or graphene are used to make "lenses" (which are actually no lenses but layers of material or atoms) without any chromatic aberrations. These materials may help to have very sharp optical systems and no or very little colour aberrations in optical systems. These may change the image and the colour perception in everyday life, science, photography and imaging.

Results: Some metamaterials have optical characteristics which are changing the conventional optical rules. "Lenses" made of some metamaterials may have no chromatic aberration, which may result in sharper images and better colour reproduction and so better colour perception.

Keywords: metamaterials, lenses, no chromatic aberration, colour perception

What is the goal of the wine chromatic characterization in a CIE color space?

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Abstract

When you think about wine, one of its paradigmatic colors pops out into your memory: red, white or rosé. Thus, color becomes undoubtedly the first wine classifier. For a taster or a more sophisticated consumer, wine color can also provide much more information. For example, blue shades suggest a young wine while brown or yellow tones suggest a vintage one; clarity informs about wine health and bright wines are more acidic than dim ones; varietal information can be recovered from red nuances. Even more, color can be a deliberate feature that identifies a certain brand. All this information explains why it has been researched and invested so much in reaching a correct characterization of wine color, both through visual and instrumental procedures. However, even today, there is little correlation between color assessment based on these two types of procedures. This lack of correlation between instrumental and visual procedures motivates the present bibliographic revision.

Our sample of reviewed works covers only those adopting the CIE's color spaces, since these color spaces are the most elaborated until the present. We found specifications in CIE XYZ, xyY and L*a*b* color spaces. A common issue among the revised papers was the lack of clarity on the role of color quantification. In the vast majority, the question "why and for what, color quantification is needed?" remains without answer. In general it seems that the quantification of the color is only a derivative of the chemical characterization, and not an objective in itself.

Based on this review, our future goal is to help clarify the technical use of these color spaces applied to wine and help converge in a precise color vocabulary.

Keywords: wine color, CIE color space, color characterization

Prevention of the color changes in waterbone antimicrobial coatings with nano-functionalized siliceous filler

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Abstract

In environmental engineering, biodeterioration is defined as any change made by an organism on a material. These changes can be caused by the mere presence of the organism as well as the result of its metabolic activity and can affect both the appearance and the structure of the materials, as well as potentially damaging to human health. One of the main alternatives to avoid it is the use of coatings with protective characteristics conferred by antimicrobial additives. Nanoparticles are promising to be used as antimicrobial additives, especially if they are obtained by green synthesis, due to be a low cost and eco-friendly methodology. However, the nanoparticles are colored and their addition causes changes in the color of the coatings. The subsequently change of color could be considered a useful visual indicator of the loss efficiency of this kind of functional coatings. This effect can be maintained and even increase over time, due to the fact that the nanoparticles are very reactive and tend to aggregate, losing the properties conferred by their nanometric size and shape. These changes in the properties of the coatings would be related to a decrease in their bioactivity. It also has an negative effect on the ornamental, artistic or functional value that conferred the original color to the painted material.

The objective of this work is to evaluate the effectiveness of the addition of Ag nanoparticles in a natural siliceous base material to prevent the change of color of the coating. The adsorptive capacity of Ag^+ ions of the siliceous material (SM) was evaluated. To functionalize the SM, it was first activated with an alkaline solution then two strategies were used: the direct addition of silver nitrate 10^{-2}M solution (SMAg) and the addition of silver complexed with ammonium (SMAgC). Afterwards, silver was reduced using the aqueous plant extract of *Senna occidentalis*. At the same time, the green synthesis of free nanoparticles (AgNps) was carried out using the same silver nitrate solution and the plant extract as a reducing agent. The obtained products were incorporated into a waterborne acrylic paint and applied on slides. The painted glasses were subjected to a natural aging process, exposed to natural light from behind a window. During this time the color was measured by the CIELab system with a colorimeter.

Statistical analysis of the color data showed from 24 hours the effectiveness of the functionalized materials to decrease the color change. This data is consistent with the highest antimicrobial activity of the paints with less color variation. The color variation in the control paints was slight. In the alternative paints with SMAg and AgNps was big and very big according to the colorimeter method by Teichmann. However, with the addition of SMAgC, the color change was barely evident. The color variation over time highlighted the effectiveness of the SMAgC to prevent the color change by approximately six months.

Keywords: avoid color changes, antimicrobial coatings, nano-functionalized siliceous

Common patterns of color change related to sex, season and latitude in small mammals museum specimens

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Abstract

In a recent study, we addressed the Intra-specific pelage color variation in a South American small rodent species (*Akodon budini*, Rodentia: Sigmodontinae). We studied the variation related to sex and season but not to latitude, because that species of rodent has a latitudinally (and longitudinally and altitudinally) very restricted area of distribution. At that moment, we hypothesized that pelage color would be more homogeneous in males than in females, but the results did not directly confirm our hypothesis, so we showed the complexity of the studied pattern and we speculated about a possible interpretation of the observed data. Regarding season, we hypothesized that pelage color would be darker in winter than in summer, the latter being orange, and the results clearly confirmed our hypothesis. In that study, we concluded that the studied variables should be considered when studying the coloration of specimens for characterization, identification, and discrimination of different taxonomic units based on color.

The main goal of the present study was to analyze objectively measured color data from a taxonomically wider sample of mammal species, to identify, if any, common patterns of color changes in the pelage of specimens of small rodents, in relation to a biological (specifically, sex) and some environmental variables (specifically, those related to season and latitude, longitude and altitude).

The studied sample includes several rodents species housed in the Mammals Collection of the Field Museum (Chicago, USA) and of the Smithsonian National Museum of Natural History (Washington, DC, USA). We measured the pelage color by taking five measurements on each one of three points over the dorsal and over the ventral surfaces of more than 250 specimens, using two different instruments: an Ocean Optics USB2000+ and an X-Rite eXact spectrophotometer. We used Principal Component Analysis to describe the association between the color variables, sex, season and latitude, and each one of the observations. We then used general linear models of Analysis of Variance to examine relationships between color data, sex, season, and latitude. We analyzed each instrument data set separately.

This study shows a number of relationships and associations between individual pelage color variation and a biological (specifically, sex) and some environmental variables (specifically, those related to season and latitude, longitude and altitude) that are common to a number of rodent species specimens. As might be expected, the situation is complex and deserves to be analyzed with care, although some interesting common patterns emerge. We discuss the individual relationship and association of each significant variable on the pelage color and we also discuss the interactions between the variables involved.

Keywords: Biology, color data, colorimetry, objective measurements, pelage color

Determination of a digital camera quantum efficiency from a single image

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Abstract

Digital cameras are used in many fields such as biology, medicine, chemistry, geology, etc. Color is often an essential property of an imaged object, but the recorded RGB triples depend not only on reflectivity of the object, but also on illumination and camera characteristics. Images of the same scene but differently illuminated and/or acquired by different cameras are difficult or sometimes impossible to compare colorimetrically. Color camera properties depend on its sensor sensitivity and a color filter array, most often arranged in a Bayer pattern. These properties are described in terms of quantum efficiency (QE) and comprise of three curves extending over visible part of the spectrum. The classical technique for determination of QE curves is a laborious task requiring controlled environment and specialized equipment. However, even this procedure suffers from subjectivity. Several approaches have been proposed to simplify the calibration procedure, for example, utilizing images of differently colored patches such as the Gretag-Macbeth chart, with known reflection spectrum for each patch. Reconstruction of QE curves form such images was shown to be ill-posed, needs an imposition of various *ad hoc* conditions, and output is highly sensitive to noise in input data. This paper demonstrates the reasons for a lack of stability in these approaches and proposes a technique that guarantees stability of QE reconstruction from a single image, even in the presence of substantial noise.

The equations describing the color formation process in a digital camera contain integrals that depend on reflectivity, illumination, and QE of a camera –all are functions of the wavelength. Sampling spectral quantities at chosen resolution transforms integrals in sums, and recovery of QE curves involves inversion of some matrix with number of columns equal to required number of discrete points in QE curves and number of rows –to number of reflectance spectra. The latter is arbitrary, and thus inversion usually is a pseudo-inversion that finds a solution in a least squares sense. Stability of inversion depends on a matrix condition number, and we show that any choice of patches from the Gretag-Macbeth chart or any subset of Munsell chips leads to significantly high condition number. Thus, any noise in input data leads to practically useless solutions (in the absence of imposed *ad hoc* conditions).

We propose to replace reflected light with the transmitted one. Ultra-narrow band pass interference filters cut narrow spectra from light emitted by a set of broadband LEDs. We show that depending on filters' properties, with the current state of technology, the condition number of the matrix that needs to be inverted for QE curves recovery can be decreased almost to a theoretical minimum. In this case, accuracy of recovered curves is limited only by the noise in the input data and accuracy of measurements of filters' properties. The design of a device that realizes the ideas mentioned above is proposed. Once such a device is built and calibrated, the process of colorimetric camera calibration will consist of acquisition of a single image and its processing.

Color vision and psychophysics

Experimental consideration on the effect of ipRGC for color reproduction on display device

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Abstract

At the beginning of the twenty-first century, intrinsically photoreceptive retinal ganglion cells (ipRGCs) —a new photoreceptor different from cones and rods— was discovered on the inner surface of the mammalian retina. In previous studies, ipRGC were thought to affect non-image-forming functions such as regulation of circadian rhythm and the pupil light reflex. However, increasing research has reported that ipRGCs influence visual perception such as brightness perception. In conventional displays, color reproduction has been performed colorimetrically based on the perception amount of the LMS cone at the photopic vision. If ipRGCs influence color perception, in addition to the amount perceived by the LMS cone, it is also necessary to consider the effect of ipRGC on color reproduction of display devices. In this study, we aim to experimentally verify the effect of ipRGC on color reproduction of a display device.

In the experiment, perceptual color matching of the color patch and the display was performed under 6000K LED illumination. The display used a high-brightness liquid crystal display (SHARP PN-A601) to control the influence of the rod. The color patch used the X-Rite ColorChecker. Seven colors with comparatively high reproducibility from 24 colors were used as color stimuli (stimulation size 3.4°) in this experiment. The reproduction accuracy with CIE Delta E color difference was 1.5 on average. The color matching results for 10 subjects was CIE Delta E color difference of 9.5 on average, resulting in perceptual results that were largely out of colorimetric color reproduction. This result shows that the current colorimetric color reproduction of the display is insufficient, suggesting that ipRGC may affect color reproduction of the display.

Since ipRGC is a ganglion cell, we assumed that ipRGC acted after absorbing the tristimulus values. We derived a correction formula for CIE XYZ obtained by correcting each value of CIE XYZ with ipRGC absorption rate by regression. The ipRGC absorption rate was obtained from the spectral sensitivity of ipRGC and spectral distribution of the measured display. The CIE Delta E color difference after color matching was 9.5 on average; after applying the proposed correction formula, the color difference improved to 3.4. This result suggests that by using the color difference based on the corrected tristimulus values, it becomes possible to display color that stays perceptually faithful to the real object on the display device.

Keywords: ipRGC, color reproduction, color perception, display

Do color matching functions explain individual differences in color appearance?

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Abstract

It is well known that there exist individual differences in color appearance. In order to evaluate such individual differences, it is required to evaluate them quantitatively. Color matching functions (CMFs), which indicate the intensities of three primaries necessary to match reference light, is known that there are certain amounts of differences among observers. Moreover, it is reported that CMFs differ in shorter wavelength region depending on the method adopted to measure. In order to clarify whether CMFs are appropriate index to describe quantitatively individual differences in color appearance, we measured CMFs of an observer with two methods, maximum saturation method (MSM) and Maxwell's matching method (MMM). Then we conducted metameric color matching experiments on them.

We built a compact system to measure CMFs. In this apparatus, we could measure CMFs with MSM and MMM. In the former method, the monochromatic light was exposed to the observer as the reference light, while the latter method presented white as the reference. Observers were asked to match the appearance of the test light, which composed of the mixture of three primaries, to the reference light.

In metameric color matching experiments, we changed the saturation of the reference light. In some experimental conditions LCD display was used to present the reference stimulus, while in other conditions, programable light source (Onelight) was used to present reference stimuli. Observers were asked to control the intensities of three LED primaries, R (626 nm), G(524 nm) and B(472 nm).

After metameric matching experiment was completed, we measured the spectral distributions of the test and reference stimuli, which were matched in color appearance, and calculated tri-stimulus values with three different CMFs, CIE CMF1931(Standard Observer), CMFs with MSM, and CMFs with MMM, and compared the residual color differences which were obtained by Euclidian distance between the test and the reference color.

It turned out that the residual color differences decreased by introducing individual CMFs. However, the amount of the color differences depended on the saturation of the stimuli: the color differences were smaller in CMFs obtained with MMM for less saturated stimuli than CMFs with MSM. When the stimuli were more saturated, on the other hand, color differences were smaller for the tri-stimulus values obtained with MSM.

Our results indicate the possibility that individual color matching functions can explain the individual differences in color appearance. If we would like to compensate individual differences in color appearance, we need to measure color matching functions of users. In that case, easy and precise method to measure color matching functions will be required.

Keywords: color vision, color matching functions, metameric color matching, individual difference

A framework and methodology for spectral color vision deficiency imaging

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Abstract

Millions of people worldwide are affected by some form of color vision deficiency (CVD) due to the lack of or anomaly in one or more cones in their vision system. Unlike people with normal color vision, people with CVD cannot see the world in full color. Because of this, they can miss contrast and some of the features in a photographic image. Depending on the type and number of defective cones, color vision deficiency has been categorized into various types such as protanopes, deuteranopes, tritanopes, etc.

Several methods and techniques, called daltonization, have been proposed [1-5], which aim at recoloring (modifying the color of) a photographic image in order to increase the color contrast and bring back the missing features, thus improving the accessibility of the images in terms of retrieving information content for color deficient people. Almost all these daltonization methods generate simulated images using color vision deficiency models that are based on the trichromatic color imaging. As color imaging has several limitations such as environment dependency, suffers from metamerism, and limited to visual spectrum, the generated images are far from perfect. Moreover, as most of the color vision deficiency models are general models, they may not reflect the perceptual capabilities of an individual with specific color vision deficiency.

Since spectral imaging mitigates the limitations of the trichromatic color imaging, and with the availability of fast, simple, and inexpensive multispectral imaging technologies, an accurate simulated color vision deficiency image can be generated for a given type of color vision deficiency using a spectral image [6]. We call this method of generating a CVD image from a spectral image as spectral color vision deficiency imaging.

In this paper, a framework and methodology for spectral color vision deficiency imaging, which can acquire an accurate personalized CVD image of a scene real-time under an uncontrolled illumination condition, will be presented.

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Keywords: *color vision deficiency (CVD), color blindness, simulation, spectral CVD imaging, framework*

Influence of the color of lighting on taste threshold

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Abstract

We assess the flavor of food not only based on taste, but with all of our senses based on color, smell, texture and sound. Maga reported that the color green decreased the threshold sensitivity of tasting sweetness and increased the threshold sensitivity to tasting sourness and the color red increased the threshold sensitivity to tasting bitterness. Maga also reported that color did not significantly affect the threshold sensitivity to saltiness. Jin et al. reported that lighting was an important factor affecting taste sensation. However, there are few research reports on the relationship between environmental color and taste sensation.

Therefore, in this study, we aimed to clarify the influence of the color of lighting on taste threshold sensitivity. In this experiment, red, green and blue colored lighting were used. The illuminance of the table surface was set to 200 lx. Three kinds of taste solutions (sweet, salty and sour) were prepared at nine different concentration levels. The experiment was basically conducted once a day. However, when multiple experiments were conducted on the same day, we set an interval of more than 1 hour between experiments. To assess taste threshold, subjects tasted a taste solution at a specific concentration and were asked to select how the solution tasted from four choices of "sweet", "salty", "sour" and "I don't know". The subjects were eight males in their twenties, all of whom reported having normal color vision.

The taste threshold obtained in this experiment was normalized. Normalization was performed based on the average taste threshold of all colors of lighting for each subject. In the case of sweet, the threshold was high under red lighting and low under green lighting. In the case of salty, no effect of lighting color was observed. In the case of sour, the threshold was high under green light and low under blue light. A similar trend in taste threshold by color was observed between this study and a previous study on different colored taste solutions. It is thought that similar taste threshold changes may occur between the case of different colors of lighting and different colors of taste solution.

Keywords: *taste threshold, color of lighting, colored taste solution*

Colour to sound translations and world perceivability

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Abstract

With this research, we propose a colour-to-sound scale which is based upon patterns found by collecting data from psychophysical experiments. This scale is intended to allow people with vision deficiencies enjoy a richer impression of a visual landscape.

In the first phase participants were asked to map a hue to an attribute of sound (pitch). This research phase led to the creation of a web site which provided further testing materials for remote and crowdsourced colour-to-sound studies, allowing the participants to compare different colour attributes (Hue, Lightness, Chroma, or HSL) with different sound parameters (Pitch, Timbre, Loudness). The crowd-sourced data collection is providing the data for a representation of visual reality and colour to sound mapping.

In previous work on colour scales used by sensory devices which employ auditory substitution for visually impaired people, the scales used in the sensory devices were often not justified and the colour-to-sound scales have few common points. A notable finding in previous work is that a warm-cold scale can be applied both to hue and to sound frequency.

The first phase of our research reproduces a part of the Hamilton-Fletcher et al. experiment in which participants associated lower frequency sounds with blue hues and higher frequencies sounds with yellow hues based on pure tones. A total of 40 observers took part in our web-based experiment, in which data about pitch and the corresponding perceived HSL were collected. Participants were presented eighty pure sound samples (computer-generated sounds with only a fundamental frequency, to minimise influences of timbre on colour experiences). They were asked to choose a colour on a colour wheel that could represent the sound heard. They could only change the hue. The sound samples represented a natural minor scale (A4, B4, C5, D5, E5, F5, G5, A5) (as used by Hamilton-Fletcher et al.). The sound samples were presented in a list with random order. The participants were asked to assign colour to the specific sound sample ten times. The participants could answer partially to the test, and the total number of responses for a one note varied from 348 (note A5) to 357 (notes E5, F5).

The results showed a correlation between pitch and hue: the lower notes were perceived as more blueish while higher notes were perceived more as yellowish. The results are in line with those obtained by Hamilton-Fletcher et al.

In the second phase of the research (currently under way), we performed a 3-dimensional experiment in which participants built individual mappings. Colour vision deficiencies impair the ability of people to describe and enjoy the richness of the landscape. Vision sense might be transformed to sound experience thanks to which the landscape can be uniquely represented and potentially remembered. Colour and sound rely on different perceptual mechanisms, but sound shows properties that can be exploited to describe colour properties.

The results of this study forms the basis for further research which can improve the precision of auditory substitution devices for colour deficient people. However, the research in the perception of sound and colour combined with linguistics studies might also help to develop a unified colour-to-sound scale flexible enough to help communicate colour deficient person with another colour deficient person or non-colour deficient person.

Pupil role in color brightness perception in relation with "the dress" explanations

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Abstract

In vision science, pupil size measurement has become a useful technique to estimate physiological parameters that correlate with different percepts. Since 1920, many studies have focused on pointing out the way distinct factors affect pupil size, in order to figure out how the visual system processes the light falling onto the retina. Today we know that factors as retinal illuminance, accommodative state of the eye, various sensory and emotional conditions and individual's age, affect the pupil size to some extent. However, there are few articles informing research in reverse, that is, investigating how pupil size affects perception. Perhaps this is due to the fact that pupil size is determined mainly by the illumination level and that the entire pupil's reflex mechanism is controlled by the sympathetic and parasympathetic nerves, in an almost exclusively bottom up fashion. Or, on the other hand, this may be due to methodological issues.

New insights into the role of pupil size come from recent studies triggered since "the dress" image was scientifically considered by the vision community. Following these new outcomings, the aim of this work is to characterize the role of pupil size in the perceived brightness of colored patches in search of certain grouping in the data.

To perform this study, we use a self-luminous wall that was built by illuminating a large acrylic diffuser from the rear by a high power projector. Onto the center of this acrylic wall we displayed self-luminous circular stimuli of 10° field of view. Ten different hues at four different luminance values (1, 10, 50 and 80 cd/m²) have been used as test stimuli. One equal-energy white stimulus with a luminance of 40 cd/m² was added to be used as a reference. All the stimuli were characterized through a spectroradiometer. The background was maintained always black. Forty test stimuli were presented to each observer randomly, always alternating with the reference stimulus. The perceived brightness was evaluated with the magnitude estimation method, in which the observers must estimate the brightness of the test stimuli by assigning numerical values relative to the perceived brightness of the reference stimulus (that has preassigned a brightness value of 100). Pupil size was measured using an EyeTracker while each observer was doing the brightness estimation.

Our results and data analysis allow us to segregate two groups of observers: those who have a "big pupil" and perceive colors in a dimmer way and those who have a "small pupil" and perceive colors in a brighter way. Further analysis is needed to grasp these results in a family theoretical framework, for example, the Helmholtz-Kohlrausch (HK) effect.

Improving the appearance of HDR images based on visual characteristics

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Abstract

The cityscape has mainly been considered about the daytime view, but nowadays urban activities are carried out day and night. Therefore, nighttime view is also considered as an important aspect to form a cityscape. The use of images has become commonplace in the formation and maintenance of cityscape. However, it is well known that the cityscape image acquired by the camera and human perception are different. This is because human vision understands scene information through non-linear processing such as chromatic adaptation and brightness adaptation. Furthermore, in both daytime urban landscape and nighttime urban landscape, there are areas where the contrast ratio is large. Because the dynamic range of the human visual system and color devices are different, high dynamic range (HDR) imaging is used to acquire images of such areas. However, since the dynamic range of a general display is 8 bits, it is necessary to finally perform tone mapping to a low dynamic range (LDR) image. Therefore, it is necessary to develop a method for reproducing the appearance of an HDR scene image taking visual characteristics into consideration.

In this research, we propose an image reproduction method based on visual characteristics using an image appearance model. The iCAM06 was adopted as a conventional method for the image appearance model. We proposed two kinds of tone compression methods and realized the gradation control of an HDR scene image by integrating into the conventional method. In the conventional method, tone compression is performed based on adaptation white and adaptation luminance, but it has been confirmed that the output image looks unnatural under some environment. Therefore, we propose a method of generating a luminance distribution image that reflects the features of a scene using the Guided filter and performing tone compression based on this luminance distribution image (Method 1). On the other hand, we also attempted a tone compression method based on a simple retinal response without using adaptive white and adaptive luminance (Method 2). In the experiment, tone mapping was performed on 48 HDR scene images by three methods (conventional method, method 1 and method 2). The reproducibility of method 1 or 2 was excellent in many images, and it was confirmed that the unnatural appearance was improved. Furthermore, the images carried out tone mapping were classified according to the brightness, such as daytime, nighttime, indoors, etc., and subjective evaluation experiments were performed on nine subjects. The evaluation results were particularly excellent in a scene including a strong light source or backlight according to either of the method 1 and the method 2. The results show the usefulness of the proposed method.

Keywords: high dynamic range image, tone compress, visual characteristic

Does melanopsin help to explain color constancy in natural environments?

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Abstract

Visual information is conveyed from the retina to the brain by the Magnocellular (MC), Parvocellular (PC) and Koniocellular (KC) pathways. The MC pathway codifies luminance information, while the PC pathway codifies "red-green opponency" and the KC pathway the "blue-yellow opponency". These pathways have been shaped by the natural environment during evolution. Natural image statistics are the most efficient representations of environments and they can predict how neural responses should vary to encode them. A visual attribute that allows us to keep a stable color perception of the visual environment disregarding changes in chromaticity of natural illuminations throughout the day is color constancy. On the other hand, the recently discovered melanopsin photopigment has shown a unique photon-counting capability that may modulate visual processing. If melanopsin is related with color constancy, the perceptual invariance with respect to the illuminant should be function of melanopsin excitation. The aim of this work was to assess whether melanopsin could help to achieve color constancy.

Data from hyperspectral natural images containing primordial foliage information and spectral reflectance information at each pixel (https://personalpages.manchester.ac.uk/staff/david.foster/), together with irradiance values of 21 daylight illuminants (Correlated Color Temperature: 3635K – 24770K) covering different phases of the day from moon light to sun light, were used to compute L-, M-, S-cone and melanopsin excitations for each pixel. Using D65 illuminant as a reference, the geometrical distance d in the cone chromaticity [L/(L+M) and S/(L+M)] was computed between daylight illuminants and the reference illuminant for each pixel in each image. Distance d data were correlated to melanopsin chromaticities [I/(L+M)] using different multiplicative coefficient for each cardinal axis.

For all of the scenes, higher correlated color temperature (CCT) values were negatively related to the coefficient of the melanopsin excitation in the L/(L+M) axis but positively related the coefficient of melanopsin excitation in the S/(L+M) axis.

Based on these analyses, to achieve color constancy, melanopsin contribution should affect in opposite ways the KC [corresponding to the S/(L+M) axis] and the PC [corresponding to the L/(L+M) axis] pathways, but the sign depends on the CCT of the illuminant. For example, for CCT values related to clear sky conditions, KC signals need a positive melanopsin contribution, and the PC pathway a negative contribution. Instead scenes under low CCT illuminants, such as those related with dawn and dusk, have worse constancy when melanopsin is considered.

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