AIC 2010, Color and Food
From the Farm to the Table

Interim Meeting of the
International Color Association
Mar del Plata, Argentina
October 12-15, 2010

Book of Abstracts

edited by José Luis Caivano - August 2010

AIC 2010 "Color and Food: From the Farm to the Table" is organized by the Argentine Color Group (GAC, Grupo Argentino del Color)
and the National University of Mar del Plata (FAUD-UNMdP), on behalf of the International Color Association (AIC, Association Internationale de la Couleur)
Hotel Provincial, Mar del Plata, Argentina, 12-15 October 2010

Program outline (the detailed program will be published later)
oral papers (20 minutes); keynote lectures (40 minutes)

TUESDAY, October 12			WEDNESDAY, October 13		THURSDAY, October 14		FRIDAY, October 15	
			Opening session		**Oral session**		**Oral session**	
		8:40	opening ceremony		8:40	oral paper 33	8:40	oral paper 51
		9:00	**OPENING LECTURE: John Hutchings** (40')		9:00	oral paper 34	9:00	oral paper 52
					9:20	oral paper 35	9:20	oral paper 53
		9:40	oral paper 1		9:40	oral paper 36	9:40	oral paper 54
10:00		10.00	oral paper 2		10:00	oral paper 37	10:00	oral paper 55
to	AIC executive committee meeting	10:20	coffee break, posters (30')		10:20	coffee, posters (30')	10:20	coffee, posters (30')
16:00	pre-congress seminar / tutorial: D. Bardier: ¿Qué nos da hoy el color? De la física a la sociedad (in Spanish)		**Oral session**	**Oral session**		**Oral session**		**Oral session**
		10:50	oral paper 3	oral paper 8	10:50	oral paper 38	10:50	oral paper 56
		11:10	oral paper 4	oral paper 9	11:10	oral paper 39	11:10	oral paper 57
		11:30	oral paper 5	oral paper 10	11:30	oral paper 40	11:30	oral paper 58
		11:50	oral paper 6	oral paper 11	11:50	**KEYNOTE LECTURE: Angel Negueruela** (40')	11:50	**KEYNOTE LECTURE: V. M. Schindler** (40')
		12:10	oral paper 7	oral paper 12				
		12:30	lunch (1 h.)		12:30	lunch (1 h.)	12:30	lunch (1 h.)
		13:30	commercial exhibition (1 h.)		13:30	commercial exhib. (1 h.) lecture L.Schmid, Osram	13:30	commercial exhib. (1 h.)
			Oral session	**Oral session**		**Oral session**		**Oral session**
		14:30	oral paper 13	oral paper 18	14:30	oral paper 41	14:30	oral paper 59
		14:50	oral paper 14	oral paper 19	14:50	oral paper 42	14:50	oral paper 60
		15:10	oral paper 15	oral paper 20	15:10	oral paper 43	15:10	oral paper 61
		15:30	oral paper 16	oral paper 21	15:30	oral paper 44	15:30	oral paper 62
		15:50	oral paper 17	oral paper 22	15:50	oral paper 45	15:50	oral paper 63
16:00	registration and posters hanging	16:10	coffee break, posters (30')		16:10	coffee, posters (30')	16:10	coffee, posters (30')
to			**Oral session**	**Oral session**		**Oral session**		**Closing session**
18:00		16:40	oral paper 23	oral paper 28	16:40	oral paper 46	16:40	**CLOSING LECTURE: Daniel Lozano** (40')
		17:00	oral paper 24	oral paper 29	17:00	oral paper 47		
		17:20	oral paper 25	oral paper 30	17:20	oral paper 48	17:20	closing remarks: study groups reports final open discussion presentation of next meetings
		17:40	oral paper 26	oral paper 31	17:40	oral paper 49		
		18:00	oral paper 27	oral paper 32	18:00	oral paper 50		
18:20	opening of the meeting artistic exhibition opens artistic performance reception cocktail	18:20 to 19:00	posters session	study group meetings	18:20 to 19:00	posters session	study group meeting	19:00 city tour / dinner / party (included in full registration)

112 posters exhibited all 3 days: October 13-15
Commercial exhibition open all 3 days: October 13-15
Optional tours or excursions after the meeting: Saturday, October 16 in the afternoon

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AIC 2010 "COLOR AND FOOD: FROM THE FARM TO THE TABLE"
BOOK OF ABSTRACTS

Abstracts include: invited lectures, oral papers, posters.
The type of presentation is indicated in each abstract.

Abstracts are arranged alphabetically by first author last name.
To find a specific author, see the author index, p. 207.
To know the date and hour of a presentation, see the detailed program.

All the abstracts included in this book and presented in the congress have been reviewed by the members of the Scientific and Papers Committee.

LANGUAGES

The following languages will be accepted for presentation in the congress (with the specified condition for oral papers*):

For invited lectures and oral papers:
English (AIC official language)
French*, German* (AIC official languages), Spanish* (local language)
Note*: The use of French, German, or Spanish will be allowed provided an English translation is projected synchronized with the speech by the authors.
If the presenting author uses English, there is no need of translation.

For posters: English

INVITED LECTURES

John B. Hutchings (UK):
Food, expectations, colour and appearance

Roberto Daniel Lozano (Argentina):
Colour and visual appearance in foods

Angel I. Negueruela (Spain):
Is the colour measured in food the colour that we see?

Verena M. Schindler, Annie Mollard-Desfour, Svetlana Krylosova (France):
From red bordeaux to absinthe green, from hot chocolate to capuccino: Beverages, their referential colour terms and reflections on cultural differences.

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pre-congress seminars / cursos pre-congreso:
Dardo Bardier: ¿Qué nos da hoy el color? Desde la física a la sociedad (en castellano)
Lindsay MacDonald: Introduction to colour measurement (in English)
see the programs / ver programas: http://www.aic2010.org

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Abstracts

VISUAL AND TASTE SYNESTHESIA: PERCEPTIVE EXPERIENCES OF COLOR IN A SHOPPING

Poster presentation

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The present work is part of the CAID Project "Poetics of design: Inquiries about the aesthetic dimension of visual communications produced at Santa Fe city", hosted in the Facultad de Arquitectura, Diseño y Urbanismo, of Universidad Nacional del Litoral. We propose to take the photographic representations of food exposed at a shopping's food place as our object of study. The purpose of this work is to study the role of color in the process of stereotypation in visual representations of food present at this place. The stereotypation will be studied front a triadic point of view (of logic-semiotic ground); according to this, stereotypation can be separated in three aspects: perceptive (related to visual identification), representative (related to visual languages and technical resources), valorative (related to meanings attributed to the object of stereotypation). In this sense, the work pretends to analyze the function of color in the perceptive aspect (how to collaborate to a better identification of the dishes components), the representative aspect (as the result of visual codifications and technical mechanisms of reproduction and circulation), and the valorative aspect (as attraction or refusal of images, as information about food and, finally, as a part of the persuasive process), in the construction of stereotype that we call "representation of the ornamental food". The work allows to study the general problem of stereotypation, as a procedure of selection, fixing and control of meaning, and the stereotypation in the chromatic choice, its technical materialization and interpretation. Finally, we will compare the chromatic stereotypation of those photos with similar operations recognized in the rest of the place where photos are exposed, what will allow to analyze similarities and differences between communications that promote different products.

COLOR DETERMINATION IN DEHYDRATED FRUITS: IMAGE ANALYSIS AND PHOTOCOLORIMETRY

Oral paper

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Color is a property that determines food quality and consumer acceptance. Dehydrated fruits are considered to be highly stable. However, they are prone to suffer discoloration during storage. Many natural pigments are unstable in dried media, and also brown pigments can be formed. These color changes cause deleterious changes in food appearance and organoleptic quality, and may be an indication of the decreased nutritional and functional properties of foods. Food discoloration can occur homogeneously, but most of the times heterogeneous distribution of color is observed.

The objective of this work was to evaluate the kinetics of colour changes in different dehydrated fruits as a function of relative humidity, especially considering heterogeneous discoloration.

Color changes of freeze-dryed apple, pear, melon and strawberry slices were determined using a computer vision system and a photocolorimeter. Color images were taken in a standardized grey box using a D65 illuminant, and converted to the CIELAB coordinates L^*, a^*, b^*. The photocolorimeter measurements were performed at 2º observer and D65 illuminant.

Dehydrated fruits surface were stored at several relative humidities at 45 ºC and color evaluation was performed at selected times. Apple, pear and melon systems presented homogeneous color distribution. Due to browning during storage, a* and b* values increased in these systems and L* values decreased. Strawberry samples, on the other hand, presented an heterogeneous color distribution. Therefore, for the image analysis the slices were divided in 3 different zones according to their L* values and were classified as dark, intermediate and light areas. L* values decreased after humidification at 20 ºC and during storage at 45 ºC. In these samples the heat treatment caused anthocyanin pigment destruction, therefore a* values decreased in the dark and intermediate zones. The lighter areas did not show important changes in the a* values, being b* the less informative variable. The pixels proportion of light areas in the pictures was greater at low RH and short storage times. As increasing RH and storage time the pixels proportion of dark areas and the color distribution homogeneity increased.

Photocolorimetry is a simple and easy technique to evaluate color changes, but it shows a limitation for the analysis of small areas or of heterogeneous samples. Computer vision analysis is a useful tool to assess optical properties of fruits based on its simplicity, and also allows the analysis of heterogeneous materials.

TEMPERATURE ABUSES DURING LETTUCE POSHARVEST: IMPACT ON COLOR AND CHLOROPHYLL

Poster presentation

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The appearance of fresh vegetables strongly affects the purchase decision. Color is an appearance component and a transcendental property, since it impacts directly on consumer visual perception.

Lettuce is a highly perishable vegetable whose quality and shelf life are limited by the temperature. High temperature is recurrent during transport from farm towards distribution centers. The first hours after harvest are crucial because quality losses at these earlier stages can not be recovered. The objective was to describe chlorophyll and color changes during lettuce exposure to three isothermal conditions during the first 24 hours after harvest. For this purpose, heads of butterhead lettuce (*Lactuca sativa* var. 'Lores') were harvested at optimal maturity and were stored during 24 hours in environmental chambers at 0-2 ºC (optimal), 10-12 ºC (abusive refrigeration) or 20-22 °C (warm room), maintaining the relative humidity levels in 97-99%. Parameters were measured in three different lettuce sections: external (outer and older leaves), middle (mid leaves) and internal (inner leaves), to evaluate the colorlability of lettuce related to leaf age. Correlations between greenness indices were investigated in each section.

The chlorophyll (C) content was determined following the methodology described by Moreira et al. (2003). Color was measured using a Minolta colorimeter, by L^* (lightness), a^* (redness/greenness parameter) and b^* (blueness/yellowness parameter) chromaticity co-ordinates of the CIELAB scale.

Leaf age had a significant effect on the initial values of greenness indices. Older and senescent leaves (external section) showed higher C and lower L^*, a^* *and* b^* values, than younger leaves (internal section) characterized by a clearest color.

Each lettuce section showed a particular C behavior during 24 h. While the external section exhibited C degradation at any assayed temperature (more pronounced at higher temperatures), the middle and internal sections showed no C changes.

Significant increases in a^* were observed in the three sections and the three temperatures. The highest increment was observed in inner leaves at 20-22 ºC. Increases of a^* are usually associated with chlorophyll degradation. However, decreases in C were not detected in internal section while changes in a^* parameter were detected. This fact could be associated with highest susceptibility of these leaves to browning. No changes were registered in b^* or L^* values as time advanced at any temperature and section. A high correlation ($R^2 = 0{,}93$) was found between chlorophyll content and a^* in external section at the three assayed temperatures.

The knowledge of the effect of leaf age and temperature on the evolution of color quality indices is of fundamental importance for producers because they can take decisions based on this differential behavior related to the degree of tissue development.

ROLE OF COLOUR EDIBLE FILMS AGAINST PHOTO-OXIDATION OF SALMON OIL: STUDY OF PHYSICO-CHEMICAL PROPERTIES OF FILM

Oral paper

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Environmental pollution and the safety of processed foods have been at the forefront of research concerns in recent years. Research has focused on edible films and on the use of several additives into edible food packaging. The use of bio-active compounds like flavonoids having combined properties as antimicrobial, antioxidant and anticarcinogen into edible food packaging is an innovation. As opposed to mixing these compounds directly with food, their incorporation into film would localize functional effect at the food surface. A perfect packaging should have an ability to protect food from temperature, light, humidity, oxygen, enzymes, micro-organisms, etc. So, keeping in view these factors to be controlled, in the first phase of this study, edible films of Hydroxypropyl methyl cellulose (HPMC) with different edible colours as light filtering additives were tested for their ability to avoid photo-oxidation in salmon oil. Chemical parameter of oil quality such as fat oxidation was monitored by gas chromatography (GC). Optical density (OD) was measured by UV/ visible spectrophotometer at 233 nm. The results showed that HPMC films with suitable edible colours act as adequate light barrier to avoid the light-oxidation of salmon oil during extended storage. HPMC films containing white, red and yellow edible colours show good control of oil photo-oxidation almost similar to the control samples stored in darkness. Oil samples treated with blue and green edible films show gradual increase in oxidation with increasing time of light exposure. Oxidation behavior of samples treated with blue and green films was almost similar to the samples treated with transparent films.

In the second phase, the physico-chemical properties (oxygen permeability, water permeability, and mechanical behavior, thermal and optical properties) of the films coloured with flavonoids and edible colours were determined to understand the impact of the composition of the film and the nature of the color molecules. The objective was to adjust the oxygen permeability, water permeability, anti-oxidant and anti-microbial ability of the film by incorporating reactive molecules such as flavonoids and optimize the storage of oil by incorporating both the color phenomena and composition of the film.

"IN THE GREEN MARKET…": FROM THE POETIC EVOCATION TO THE RECOVERY OF MUNICIPAL MARKETS IN LATIN AMERICA

Poster presentation

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At the turn of the 20th century Argentina received European immigrants who settled mainly in agricultural colonies. The province of Santa Fe and its capital city played a central role in that context. At that time an overseas port was inaugurated, and the railways facilitated the transport of goods and passengers who came from the new colonies in the "pampa gringa". This new situation had an impact on consumer habits, and municipal markets replaced the old forms of trade. In the city of Santa Fe, the *Central*, *Norte* and *Sur* markets were built.

Not only are municipal markets important for their role as centres of commercial activity, but also because they are spaces for cultural exchange and social cohesion, which turns their survival, strengthening and modernization into major issues. However, population growth and changes in the economy and in consumer habits have eventually led to the closing or relocation of those public spaces. *Mercado Norte*, for instance, closed down in 2007.

The Government of the city of Santa Fe is currently developing a project to reactivate *Mercado Norte*, funded by the European Union, and operating within a network of municipal markets (Red de Mercados Municipales), through which *Mercado Norte* has become partners with *Mercado Puerto* in Valparaiso, Chile.

The purpose of the present work is to study the visual identity of the different markets listed on the World Union of Wholesale Markets (WUWM) website, focusing on the use of colour in the design of their websites as well as on the types of images they use. The aim is to contribute, by surveying antecedents, to the work being carried out by the City Council, with a view to designing the system of visual identity when *Mercado Norte* reopens in 2010.

CROSS-SECTIONAL COLOR EVALUATION IN BORAGE STEMS

Poster presentation

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One of the reasons for the increase of the consumption of vegetable products has been the development of ready-to-eat or "IVeme gamme" products. Processing of these products includes the following stages: washing, cutting and packaging. Chilling (in general below 4 ºC) is absolutely necessary as well as long term-refrigerated storage. Thus, it is possible to obtain products with better sensory and with much longer shelf life than fresh products. The "IVeme gamme" of vegetables are not ready-to-eat; it is necessary to cook them before eating.

Borage (*Borago officinalis*) is a very popular vegetable in the Ebro valley (Spain) owing to its gastronomic and nutritional qualities, but its market is not as widespread as should be expected. This vegetable is commercially available lightly processed, cut and packaged in expanded polystyrene trays covered with stretch PVC films.

In the cutting's stage, the products will develop colour alterations. The browning reaction is due to the polyphenol oxidase (PPO) enzymatic action. PPO is one of the most important enzymes in minimally processed vegetables. Its reactions can change flavour, texture and nutritional value besides colour, one of the sensory characteristics most valued by consumers.

In this work, we have studied the cut from two different knifes, ceramic and special steel knife for vegetables. We have used digital analysis of the image to determinate the total area and the browning area. We have prepared twenty borage stems for each knife to conform a lot, we scanned the lot and with the software Matrox 8.0 the samples of each batch were analyzed in triplicate. We have determined the percentage of browning area with respect to the total area of the cut from each batch to compare the knife.

As results from this study we could say that the mean life of borage is bigger if ceramic knife is used to cut than if special steel knife for vegetables is used, because it produce less percentage of browning area with respect to the total area, and this cut produce less damage in the cut area than the special steel knife for vegetables.

CHROMATIC INTERACTION BETWEEN FOOD AND NON-FOOD PRODUCTS

Poster presentation

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Among the visual elements that comprise product packaging and labeling, the application of color in these depends upon various factors. The commercialization of product packaging and consequent search for competitiveness in the industry has led to numerous studies aimed at recognizing and evaluating consumer conduct (Gao and Xin 2006). As a result, in recent years coding systems have been created to identify different product groups such as wine, crackers, milk products, meats, spices, etc. For non-food products, such as those for cleaning, personal hygiene and household, coding systems have also been developed. In most cases these color coding systems require raw materials or related elements in their confection (Kim 2006).

These product groups, with precise pre-determined limits, tend to present interactions within themselves. For example, the same general groups of food products, crackers or potato chips, are commonly flavored with similar ingredients such as vegetable products or meat-based flavorings. Quite common in the market these types of products, in addition to being considered references for raw materials, are also considered references for food products, which are associated with a wide variety of aspects. Among these are the following: food as a vital and necessary element, food as essential for maintaining health, the dynamic aspects of food, food as related to body esthetics such as weight maintenance and skin quality, food as reflected in cultural identity, regional identity or modern identity.

The objective of this paper, given the described context, is to analyze the possible chromatic alternatives and the factors that come into play in cases in which the product areas pertain to more than one group. Such would be the case of a food product group interacting with non-food products; for example, hygiene products or cosmetic products. In this case, care for the body in both the exterior and interior aspects, is related to its color representation through multiple variables of association. Therefore in many cases, existing coding systems are therefore limited and insufficient due to this multiplicity. A revision of the same, along with a re-examination of variables that this new relation proposes is necessary, as well as determining criteria for the decision regarding illumination, chromatic and saturation values.

References

Gao, Xiao-Ping, and Xin. 2006. *Color Research and Application* 31 (5): 411-417.
Kim, Young-In. 2006. *Color Research and Application* 31 (4): 341-348.

APPLICATION OF EDIBLE COATINGS AND HEAT MILD SHOCKS IMPROVED THE COLOR OF MINIMALLY PROCESSED BROCCOLI (*Brassica oleracea* l.) DURING REFRIGERATED STORAGE

Poster presentation

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Color is one of the most important quality attributes of broccoli. Yellowing due to senescence of broccoli florets is the main external quality problem. The effects of edible coatings and heat mild shocks on color aspects of refrigerated broccoli as well as the kinetics models of broccoli color changes during storage were studied.

Minimally processed broccoli was coated with either chitosan or Carboxymethyl-cellulose combined or not with the application of a heat mild shock previous to coating for 90 s at 50 ºC. Product was packaged in polymeric film bags and stored at 5 ºC for 18 days. Superficial color (L^*, a^*, b^*, Hue angle (Hº), total color difference (TCD)), total chlorophyll content (TC) and sensorial color were evaluated during storage.

Edible coatings exhibited a beneficial impact on the color aspects of broccoli by presenting higher retention of parameter b^*, slowing down the yellowing and the decline in sensory quality. The application of a heat mild shock had a remarkable influence in delaying yellowing. Moreover, the combination of a heat mild shock and edible coating offer several advantages on broccoli, mainly in the retention of total chlorophyll reducing the florets yellowing. The nonlinear regression analysis showed that the rate constants of color parameters b^* and TCD followed a first order reaction and a polynomial model was suitable for the changes of a^* and Hº value. The TC evolution during storage for all samples (coated and uncoated combined or not with a previous thermal treatment) followed a first order kinetics profile. The observed results demonstrated that there was a correlation between measured color parameter a^* with chlorophyll content in stored broccoli.

The results showed that the application of chitosan coating effectively maintained the color attributes and extended the shelf life of minimally processed broccoli. Moreover, chitosan coating combined with a heat mild shock showed the best performance for long-term refrigerated storage of minimally processed broccoli.

FOOD, COLORS AND URBAN PLACES

Oral paper

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Preliminary considerations

The clear trend towards a global city, a virtual city of flows and *no-places* invites us to observe carefully the image of the urban man and his insertion in the present urban condition. In this way some issues are developed: the perception of urban environments, the chromatic treatment of its components and the resulting importance of color in the promotion of city and urban life experience.

We witness a rapid change of urban territories and places as a consequence of great technological revolutions which have brought about the prevalence of flows over places. In view of the miracles of the virtual and the numeric revolution, the idea of *the end of territories and places* has been divinized. But in fact, what is happening is exactly the contrary, that is to say: a re-configuration of the city and the rescue of urban places.

Color and the return to urban places

We move from the first paradox of the urban, a limited space that allows unlimited practices, to a second paradox: an unlimited space, the virtual one, which permits limited and segmented practices. Within the context of this urban condition which the human condition is not exempt from, different sociologists propose the return to the heideggerian place. In that context, the expressive power of color, being polysemic and multi-sensorial, becomes a powerful communication tool: its versatility is related to the manifestation of its variables and its capacity to assimilate into certain impressions verified by other senses: hearing, taste, touch, smell. Color is also connected with feelings and states of mind in which it seems to provide expressive-symbolic summaries in the chromatic synesthesias and in visual appearance signs, such as reflection, brightness, opacity, translucence and other ones referred by the cesias.

Urban place and food street markets

The multiplicity of opportunities to express the language of color by means of the street exhibition of food for sale allows the construction of that urban place, a field that Heidegger stated as fundamental to the intrinsic definition of man and his life environment. It is necessary to re-conquer the meaning of the local opposed to the global, of the lived through reality to the virtual one that neutralizes it. When the missions of orientation and sense of place occur in the urban space, the city takes on unique and memorable features which consolidate its identity and patrimonial value and support the urban condition understood as a social practice, as the ideal kind of urban experience.

If globalization establishes its *no-places*, the language of color and the conducts it promotes can possibly take up the challenge.

THE COLOR IN GASTRONOMIC STORES AS A GENERATOR OF SYSTEMS OF PLACES. STUDY CASE CORDOBA CITY

Poster presentation

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"The city is an act of nature", as Lewis Mumford says in his book *The culture of the cities*, but he even goes further when he states that it is also a conscious work of art and contains within its communal framework, many simpler and more personal works of art. The mind acquires shape in the city and, in turn, the urban forms determine the mind". "Together with the language, it is the man´s greatest work of art." It is not coincidence that Mumford compares the city with the language as the two most important works of man, since in both cases the language is the sensitive expression of the thought with which they were created.

The biggest concentration of the culture in community, forced man to move away the fundamental raw materials production centers to satisfy basic physiological food necessities. Since the food is produced in the farm, as raw material, until it reaches our tables in thousands varied ways, a series of processes of transformation about them are shot including the places where they are marketed. It is in this last instance, the one of the cafeterias and restaurants where the resources of figurative expression take a maximum degree when they try to attract the viewer´s attention and send a precise and tempting message.

Society meets its needs, adapts and adopts new habits, open new channels of communication to express an idea; it makes the most of the resources which through syntactic and semantic codes enable the answer to new behaviors. Thus, color plays an essential role in the recognition of the areas for food consumption and in some cases they go to the extreme to mean a whole area within the city.

Such is the case of Cordoba city in General Paz and Alta Cordoba neighborhoods where this phenomenon has taken place through the renewed value of old houses from the beginning of the 20th century, preferably as the "chorizo houses" with the concept that the restaurant brings the family together as a house that opens its doors.

Besides, in these interventions, color has a key role, since it itself, as a powerful generator of emotions and feelings attracts and carries out the environment impression and the of the character expression of the area, which encourages ownership and identity of itself.

Other areas of the city, in which gastronomy places have been located, are those near main streets and routes, such as Rafael Nuñez, Colon and Hipólito Irigoyen avenues, and surrounding areas. These areas are attractor's poles of our city and gastronomic landmarks within the system of places of the same city.

URBAN IMAGE AND COLOR IN FOOD INDUSTRY ARCHITECTURE

Oral paper

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In the last decades, cities have experienced changes in their urban landscape due to local and global events. In this context, the image of the city of Córdoba reflects these changes in some sectors which show alterations in their aspect, in the urban fabric and culture.

The present urban transformations represent new conditions, both material and contextual ones. The contemporary urban life proposes behaviors and the uses of spaces with new meanings; however, the urban experience still keeps its essence since it is basically a combination of physical and mental events, of material and imaginary ones.

The urban public space, where every inhabitant has a dialectic exchange with the environment, offers and provokes perceptions and stimuli; in turn, these start sensations, enjoyment, meanings, associations, analogies and images that the urban inhabitant keeps in his cultural-historical memory and fixes at an ideological level. In this multi-dimensional experience, the expression of urban facades or building enclosures which work as elements of communication and developers of representations, become a special non-verbal language of the city.

The present urban architecture responds to new economic and socio-cultural demands and reflects different conditions to actively participate in the city. Commercial architecture at various levels and specially the food industry architecture, by means of its language, convey messages to attract and catch the attention of the urban inhabitant. If we consider that every architectural phenomenon leaves an imprint as a witness and reflection of certain time, place and society, the role of color can be researched in this kind of architecture that at present struggles between local identity and the typical innovation of new determining factors. The approach to study this phenomenon is a complex task; however, it is possible to research the contact points derived from the global as well as the special features that come from local or regional contexts.

Taking into account that the components of the urban language bring about different answers in the urban environments, this communication will put emphasis on the language of color since it significantly qualifies the expression and communication of commercial food industry facades. In many cases, the strength of these messages is based on the optical contrasts, the chromatic synesthesias, the cesias and other signs of chromatic language which stimulate the sensorial experience of the city conditioned by new demands and meanings.

Presenting author: Darío Suárez

APPLICATION OF HYPERSPECTRAL IMAGING FOR PREDICTION OF TABLE GRAPES QUALITY INDICES

Oral paper

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Table grape is one of the most important crops in the world. According to several researches, consumer preference is well related with soluble solids concentration, titratable acidity, and their ratio in table grapes. Since physico-chemical analyses are both time-consuming and destructive, the possibility of applying the hyperspectral imaging technique for prediction of some physico-chemical indices of table grapes was checked. Seven cultivars were considered: the white *Italia*, *Baresana*, and *Pizzuttella* grapes, the red *Red Globe* and *Michele Palieri* grapes, the seedless *Crimson* and *Thompson*. For each cultivar, a suitable number of berries were randomly picked from 5 stalks at least. Each berry was acquired using a hyperspectral imaging system including a VIS/NIR irradiation system, a spectrograph composed by a prism-grating-prism (PGP) system, and a monochromatic camera. The PGP disperses the incoming line of light reflected from the sample (called line of view) in an array with a spatial axis *x* and a spectral axis *I* and projected on the camera CCD (Charge-Coupled Device) sensor. This system allows the acquisition of the spectral components of the line of view from 400 nm to 1000 nm with 5 nm resolution. Immediately after image acquisition, the same berries were subjected to the determination of pH, total acidity, and soluble solids according to the traditional methods. The hyperspectral data were processed by an algorithm coded in MATLAB® and the mean reflectance spectra of each berry was calculated. A Partial Least Squares Regression (PLSR) model was implemented in order to find correlation between spectra information and each of the considered quality indices. The Predicted REsidual Sums of Squares (P.RE.S.S.) statistic was used to establish the optimal number of latent variables to be used in the model. Good correlations were found between each of the quality indices detected by traditional methods and the spectra information. In particular coefficient of determination (R^2) values equal to 0.89, 0.90 and 0.91 were obtained for total acidity, soluble solids, and pH, respectively. The Root Mean Squared Error (RMSE) values were 0.25, 0.25, and 0.24, respectively.

RELATIONSHIP BETWEEN MINERAL CONTENT AND COLOUR IN HONEYS FROM TWO ECOLOGICAL REGIONS IN ARGENTINA

Poster presentation

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Mineral content of honeys is largely variable and several authors indicate that dark honeys contain higher mineral matter than light ones. Electrical conductivity is highly correlated to ash content and is commonly used to estimate honey mineral content.

Minerals are transported by the sap to the nectaries, thus the mineral composition of floral honey depends on botanical and geographical origin; some trace elements could come from environmental pollution. Raw honey colour, according to Eva Crane (1990), is related to mineral content and many other components which are largely unknown. The presence of polyphenolic compounds and a high content of amino acids are also reported in dark honeys. Some factors that damage honeys also darken it, mainly the heat treatments.

In order to relate the content of several minerals to honey colour, a set of 30 honey samples, 15 from the Southern Pampas region and 15 from the Caldenal region (Argentina) were studied.

The colour values were assessed by a Pfund grader and presented a wide range (16 to 109 mm Pfund), while electrical conductivity was measured on dry matter basis and ranged from 0.13 to 0.90 mS cm^{-1}. Nine minerals were identified and quantified: Ca, Mg, Na, K, Zn, Cu, Fe, P and S by using inductively coupled plasma - atomic emission spectrometry (ICP-AES). In accordance with many other authors, Potassium was the most abundant mineral in all samples. For the same colour range, samples from the Caldenal region contains higher levels of K. Botanical origin of the honeys was confirmed by melissopalynological analysis. Most of the dark honeys (> 50 mm Pfund) contain over 75% of *Condalia microphylla* pollen.

Considering all samples, the correlation between colour and K content was the highest ($r = 0.916$). A high correlation between colour and conductivity ($r = 0.895$) was also found. The reduction of dimensionality of data matrix with Principal Component Analysis (PCA) shows a direct relationship between colour, conductivity, K, Ca and Cu.

It is remarkable that there is no correlation between colour and conductivity in light honeys (below 50 mm Pfund) independently of their geographical and botanical origin, while there is a close relationship in dark honeys, suggesting that some components of honey other than the total mineral content, affect the colour of light honeys.

Reference

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FOOD COLOR CHANGE ENTERTAINMENT: COLOR APPEARANCE CHANGE OF FOOD BY CHANGING SPECTRAL DISTRIBUTION OF WHITE ILLUMINATION

Poster presentation

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In general, good color rendition is favorable feature of illumination and color appearance change of the object under illumination should be avoided. As an illumination of food, we select a high color rendering light source to keep natural appearance of foods or a light which makes foods look more delicious and fresher than usual. If we change our point of view, color change of the things is very attractive as in the case of blinking neon signs. Color change of the object in color spotlight is not so amazing, but if the color of the object changes in the white light we would be surprised and stare into the object. So if we can change color appearance of the food at will under white illumination it will be good and mysterious performance for the restaurant patrons.

In this study we prepare some fruits and vegetables and studied change of color appearance of them under the various white lights with different spectral distributions. Each of 78 white lights is consisted of three peaks within the wavelength from 410 nm to 670nm with 10 nm increments and each peak values are controlled to make white lights. As a result we could observe various change of color appearance of those fruits and vegetables while the background color is consistently white. Tomato, for example, changes its color appearance within tomato red, vermilion, strawberry, cochineal red and chocolate, and spinach changes its color appearance within yellowish green, green, bluish green and greenish gray. In principle, we realize various color change using food with different pigmento.

If we illuminate basket of fruit or some dishes with white lights and change their spectral distribution in certain time sequence with rhythm, we can see fascinating color change of each fruits and meals with stable white background that we are not able to see under the usual situation. We would like to propose this method as an amusing entertainment of dinner.

LEGAL VALUE OF COLOR AND FORM IN THE "SMALL PRINT"

Poster presentation

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In packaging and food documents there are almost always parts written with the so-called "small print", especially parts where the ingredients, which include the dyes used, are declared. Not only are small, but they are designed in such a way that cannot be read: its thickness, spaces, its forms, its colours, its contrasts with the background make biologically impossible to understand at a glance. It is common to invest a great effort in propaganda which is intended to advertise the product and can be read easily and clearly. It is also usual to perform similar effort so that the list of ingredients of the product cannot be read. Today are increasingly better knowledge about human perceptual limitations and it is possible to quantify key variables that allow or not, to read a text. This allows to legally define the set of constraints on the right to be able to read a text preventive, under normal conditions of reading, as is traditionally referred to as "small print", and that is obviously not only small size. This study identifies several features of the letters that go against its own objective to be read. Achieved with either of them would lose all value in favor of who wrote it, but it can continue be taken in favour of the recipient reader. Is possible to define a few fonts, their minimum size types and minimum contrast with the background, beyond which should be required a larger size to be read. This would simplify the basis for a possible international rule. Legal norms should respect human standard capabilities to ensure compliance. It should be considered as not written anything that is written in a humanly illegible way, humanly unreadable letter and impediments to the reading of preventive texts should be punishable. Especially be inadmissible letters in a color on the same color or similar brightness as the background, when do not reach the proper contrast between letters and background.

BICENTENARY: THE COLOUR IN N.O.A.'S (ARGENTINIAN NORTH-WESTERN) ABORIGINAL CULTURAL POTTERY

Oral paper

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This project consist in anlysing the colour of the first utensils made in native pottery. Since the earlier formative period, pre-Columbian pottery was conceived as utilitarian, but mainly as funeral apparel. Once a person died it was customary to include offerings of his belongings in this burial; things he had used in his daily life, like glasses, plates, brotthes, jars and jugs which held food and drinks. We will talk about these primitive ceramics made with local earth and elements taken from nature, like clay with impurities and, in some case, with the addition of certain antiplasties. These elements gave birth to the first pottery of pre-Columbian aboriginal cultures.

The first utensils were monochromatic and of rough aspect and, as time went by and deeper knowledge and better handling of the elements were introduced, new colours as well as combinations appeared; the colours of the earth and certain minerals provided by Nature.

An analysis of the evolution of colour and different shades resulting from these utilitarian pottery which was used to store food in agricultural cultures will be made.

The composition of the past and clay contamination as colour modifiers will be taken into account. We will carry out an analysis of the alteration of the colour depending on the temperature of the exposition of the pieces cooked in hearths or community ovens. We will consider the atmosphere the pieces were exposed to as a colour modifyer. We will analyze the benefits of the new methods, techniques, inconography and commercialization in pottery manufacture with the arrival of the Incas to our Calchaqui valleys.

Lastly, we will anlyze the impact of the Spanish colonization as the cause of extinction of the production which survived at the time and the reason why the skill falls into female pot marker's hands.

PACKAGING DESIGN FOR FOOD: TEACHING COLOR AND CESIA IN DESIGNERS' EDUCATION

Poster presentation

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The characteristic of global production and distribution model, in which several food products are produced nationally but often targeted to global markets, requires a higher preparation of designers, as they have to work for a much more informed and prepared audience. In this context, package design has become a complex field in which concur diverse abilities and knowledge, considering it as the creation of visual codes with strong semantic value.

Within this field, color and cesia play a fundamental role, as highly pregnant variables for visual communication. Though, design professionals must be adequately formed to be able to develop and articulate specific knowledge in order to deliver an appropriate answer for a competitive package.

This work is presented within the frame of the project "Design, development and production of didactic material for teaching color and cesia", in which the authors aim to revise the main aspects involved in the comprehension of these visual phenomena in order to elaborate diverse materials for both theoretical and experimental support in courses related to design education, specially in the Faculty of Architecture, Design and Urbanism of Buenos Aires University.

The project starts from the hypothesis that a greater systematization of specific knowledge, associated with proper didactic tools introduced in workshop dynamics and curricular activities could improve the learning opportunities, the incorporation and adoption of more sophisticated methods and concepts in the management of color and cesia variables, elements of highly importance for designed object's performance.

In this opportunity, we will present preliminary results of the project, focusing particularly in those aspects related with packaging design for food, and including among other contents: a) compilation and analysis of curricular contents in subjects as morphology, technology, design, etc.; b) interviews with head professors and teachers directly involved in color and cesia lessons; c) observation of theoretical classes and practical applications developed within these courses.

As it was defined on main project, we will take as work field both Graphic and Industrial Design careers of the Faculty of Architecture, Design and Urbanism of Buenos Aires University. Nevertheless, it is expected that the final results could be useful broader, including not only the remaining careers of our Faculty but also other institutions.

EFFECT OF HYDROTHERMAL CONDITIONS ON TRANSLUCENCE OF MILLED RICE

Poster presentation

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The objective of the present work was to determine the effect of hydrothermal process of rough rice on the translucence of milled rice grains. The relationships between translucence and the following quality indexes: degree of gelatinization and head rice yield were also determined.

The experiences were performed according to a factorial design that involved three factors: temperature, cooking time and tempering time between hydration and cooking stages. Rice grain reached the saturation humidity (43%) during hydration. The tempering was performed at ambient temperature; several values of tempering time were tested in the range of 0 to 24 hours. The equilibrated rice was cooked using water vapor at 85 ºC (90 - 180 minutes) or 95 ºC (45 - 75 minutes) to assure the gelatinization of grain. The processed rice was dehydrated up to 13% (dry basis) moisture content and it was dehulled and milled in a laboratory mill being the degree of milling of 11%.

The translucence of milled rice was determined with a colourimeter recording the change of the *x*-chromatic variable ($\Box x$) in contrast to black and white bottom. To obtain the translucence index the difference between $\Box x$ of rice sample and opaque control sample was related to difference among $\Box x$ of translucent and opaque rice control samples. As consequence, the translucence index was zero for non-treated rice and it was one for parboiled rice. Head rice yield was determined in a laboratory rice mill and gelatinization was evaluated by means of differential calorimetry (DSC). The conditions of hydrothermal process significantly affected the translucence of milled rice. The values of translucence index resulted between 0.05 and 0.98. The translucence index was correlated with head rice yield ($r = 0.76$), an important commercial quality parameter for rice grain. Besides a nonlinear relationships among translucence index and degree of gelatinization was found.

The significance of these results lies in the possibility to quantitatively assess the translucence of rice and also the fact of having mathematical expressions that connect this index with other quality parameters characteristic of parboiled rice.

COMMUNICATING THROUGH COLOR AND HEALTH

Poster presentation

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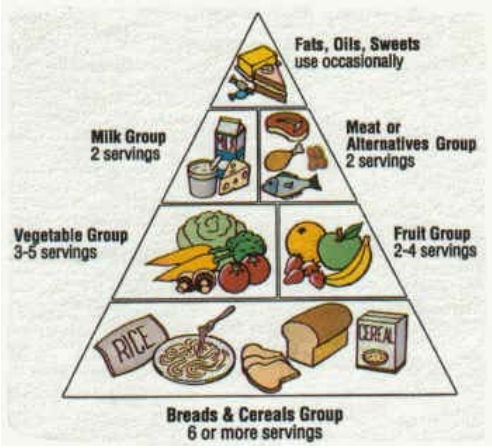
Nutrition is a substantial process for all human beings as it provides all the necessary elements inherent to a healthy life. The rate of absorption of nutrients depends on the freshness and color of the food. According to its origin, food can be classified into three groups:

- Vegetal origin: including vegetables, fruits and cereals.
- Animal origin: including meat, milk, and eggs.
- Mineral origin: including water and mineral salts.

Each one of these categories of food provides our organism with substances that are essential for its functioning and development. These substances include the following:

- Hydro-carbons (bread, flour, sugar and pasta), which are high in energy.
- Proteins (meat, eggs, dairy and legumes), which are necessary for the formation and growth of tissue.
- Lipids (fat and oil), which are energy producers.
- Water and mineral salts, which balance the functions of the organism.
- Vitamins, which are essential substances for the organism's good health.

A good nutrition should be balanced and complete; i.e. all the above mentioned groups must be present to cover the needs of the individual. To be healthy, people need to ingest different kinds of foods and liquids. The pyramid of basic nutrients provides a visual representation of the quality and quantity of nutrients that are needed for a daily balanced intake.



Let's give special attention to vitamins

A vitamin is an organic compound required as a nutrient by an organism. Vitamins promote health and are essential for the normal growth and development of a multicellular organism. Let's take a look at the most important vitamins:

Vitamin A: Vitamin A is a fat-soluble pale yellow unsaturated alcohol derived from carotene. It helps form and maintain healthy teeth, skin, mucous membranes, skeletal and soft tissue, sight and reproduction. One of the earliest and specific manifestation of

vitamin A deficiency is impaired vision, particularly in reduced light-night blindness. Vitamin A deficiency can also lead to dry skin, impaired immunity and dryness of the conjunctiva as the normal lacrimal and mucus secreting epithelium is replaced by a keratinized epithelium, an important source of child blindness in developing countries. Vitamin A can be found in carotenes, present in many vegetables such as carrot, pumpkin, spinach, kale and sweet potato.

Vitamin B1: Thiamine or thiamin is a colorless crystalline substance that is important in carbohydrate metabolism. Yeast and pork are the most highly concentrated sources of thiamine. Some other foods rich in thiamine are liver, heart and kidneys, eggs, green leaf vegetables, whole grains, oatmeal, nuts and legumes.

Vitamin C: The richest natural sources of vitamin C are fruits and vegetables such as citrics, strawberries, grapefruit, pineapple, guava, broccoli, Brussels sprouts, tomato, spinach, kale, green pepper, cabbage and turnip.

Vitamin D: Vitamin D is essential for the development of normal bone integrity and promotes the absorption of calcium and phosphorous. Natural sources of vitamin D include eggs, liver, tuna and milk fortified with vitamin D. Vitamin D is also naturally produced by the human body when exposed to direct sunlight.

CULTURE, FOOD AND WINE: A SENSUAL TRILOGY OF COLOR

Oral paper

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"*Only when combined in perfect balance: the culture, food and wine yield the range and quality of good taste."*

In this way, this paper attempts to uncover the characteristics of different cultures from opposite points of our planet, which we believe are of importance concerning the theme: Latin America with Mexico and Argentina at the top, Southern Europe Mediterranean culture where Spain, Italy, France and Greece are pioneers in the field, and the eastern culture, China, Japan, etc.

Each culture, with its landscape, climate and architecture features give rise to a cuisine, with all the charm of the kitchen with traditional flavors and colors of each area. In the history of each place is a different way of cooking, with dishes that best define the people and its people. These meals always accompanied by wine culture that runs through different climates and landscapes looking ancestrally privileged places for production.

The importance of wine is very large because, since history has shown, in all civilizations, that wine has been a food and a companion of all cultures and the best events.

"Right now, the wine is central to the traditions and dietary habits, and plays a very important component of healthy diets in the world."

In looking for the exquisite wine is consumed in search of a food supplement or an event you want to share.

The wine is quite a habit that has not ceased to exist and that is always present. In his election is sought harmony of flavors, in combination with the cooking (special dishes). As this search to harmonize flavors, it is also essential to note the harmony of colors and textures:

Flavors: heavy - intermediate - soft

Colors: dark - intermediate - clear

The marriage between wine and food, is a very extensive, and is an area where it is very difficult to develop rules that work for the generality of cases. The reason is very simple, there are thousands of different wines, and the same goes with food. Besides, each individual has their own senses and tastes which are different among all people. Try here for an analysis of cultures named to the top with their characteristics of natural and artificial landscape, relative to typical food and wines in accordance with them, emphasizing the pursuit of harmonious flavors and colors, elements that give rise to this AIC Meeting 2010.

THE LAST SUPPER OF LEONARDO DA VINCI. ANALYSIS AND INTERPRETATION

Oral paper

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This study on the Last Supper by Leonardo da Vinci provides a summary of the causes of deterioration of its pigments, a summary of its latest restoration, the description of its current state and the chromatic analysis and composition of the painting.

More than 500 years after its completion, a lot of this Renaissance masterpiece has been lost forever. Despite this, the Last Supper by Leonardo da Vinci is still under study and worship and still arises controversy among historians and critics.

At the same time of the Last Supper, Leonardo was also doing the monumental equestrian sculpture for Francesco Sforza, father of Ludovico Sforza, the governor of Milan; another great work of art that would have a more tragic end that the Last Supper, since the plaster model was destroyed and today there are not more than a few preparatory sketches.

Apart from that Leonardo had also been commissioned to organize parties and banquets at the court of Ludovico, which the most famous was called The Paradise's Feast.

The show date and time chosen by the astrologer of the court, required the participation of hundreds of designers, painters, actors and workers.

The celebration began with a dance and costume parade continued with a banquet for which Leonardo himself wrote and designed the menu and the kitchen itself, with ovens and cleaning systems.

Based on the last restoration of the work, carried out by Dr. Brambilla, it is known that Leonardo tested for this painting a variety of pigments and binding experiments.

The colors that have survived until today are not the same as 500 years ago, as the work has suffered successive restorations and repaintings in the course of time, certainly have lost many of its physical and visual properties.

There have been written records of the realization of the painting by Leonardo himself and by his contemporaries too. There is a record by the convent prior accusing Leonardo and his assistants not to terminate the work and to empty the warehouses and cellars of the convent in search of food appropriate for the subject.

Finally Leonardo's choice for food was arranged on the tablecloth by other austere: eels, bread, oranges and wine, all painted in warm, neutral tones.

As in all the plastic work of Leonardo, there is nothing by chance in the composition, and the way all its elements are interrelated.

We can also find some riddles hidden in this composition, some have already been revealed and some are still darkened.

EVALUATION OF COLOR CHANGES (INSTRUMENTAL AND SENSORIAL) OF COMMERCIAL PASTEURIZED JUICES OF CRANBERRY (*ARANDANO*), ELDERBERRY (*SAUCO*) AND BLACKCURRANT (*CASSIS*) – FROM EL BOLSÓN, RÍO NEGRO - DURING ACCELERATED STORAGE AT 40 ºC

Poster presentation

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Sensory attributes are one of the most important quality characteristics for consumer acceptance of foods. In the case of red fruit-based products such as sauces or juices, attractive color is a factor that plays a vital role in the choice of a product, and should remain relatively constant throughout the shelf life of the product. However, during storage, chemical and physical agents could lead to deteriorative color changes. As an example, anthocyanin pigments, which are primarily associated to red colour in berries, are very sensitive to discoloration.

In this work color changes of pasteurized juices of cranberry, elderberry and blackcurrant (produced and bottled in El Bolson, Rio Negro, Argentina) were evaluated during storage for a period of four months at 40 ºC.

The color of juices was analyzed using a Minolta Spectro photometer CM-600d (Konica Minolta Sensing Inc., Japan) using the illuminant D65 and an observer angle of 2º (CIE 1931 Standard Observer). CIELAB parameters were L* for lightness, a* for redness, and b* for yellowness. With these, calculations of C^*_{ab} for chroma, h_{ab} for hue angle, and ΔE^*_{ab} for total color change were made. Color measurement was made by duplicate on 0.4 g of sample in white containers of 3 cm diameter.

Triangle Test (ASTM 1977) was performed to evaluate differences in sensory attributes (color, viscosity, flavor) between samples during the storage period. Evaluation was performed in duplicate by a panel of 15 assessors (students and staff from Facultad de Ciencias Agrarias, Pontificia Universidad Católica, Argentina).

Color parameters a*, b*, L*, C^*_{ab} and h_{ab} changed during storage and the relative intensity of the changes were characteristic of each fruit. The parameter a* decreased significantly in cranberry and elderberry, while it remained relatively constant for blackcurrant. The parameter h_{ab} increase significantly during the first 50 days of storage in the case of cranberry ($p < 0.001$) and blackcurrant ($p < 0.01$), and remained stable for elderberry.

Through the ASTM Test Triangle, the panel described a change in color of all the juices from the initial red to a more brownish color, being more marked for the cranberry. In elderberry juice changes were described as a darker red. This agreed with the decrease in the parameter a* measured instrumentally.

Overall, the changes observed during storage can be useful for determining the shelf life of these products.

COLOR AND FEEDING, A COMPROMISE BETWEEN NECESSITY AND DESIRE: BIOLOGICAL AND CULTURAL SEMIOTIC PROCESSES

Oral paper

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Food, and everything around the act of eating, configure one of the most elaborate, culturalized and codified kind of semiosis, with a long history in mankind. And the visual sense, particularly color vision, plays a key role in this semiosis, perhaps even more important than the senses of taste and smell, because while these are anchored exclusively in food itself, vision and color are present both in food and in all the complex network of relationships that have feeding as it axis.

Feeding involves a complex set of semiotic processes: physiosemiosis, biosemiosis, and cognitive semiosis, three stages that appear recursively in a chain of events in which color works as a sign. In physiosemiosis, radiation interacts with foodstuff, producing physical and chemical processes that determine the material characteristics of food. In biosemiosis, living beings interact with foodstuff, reacting primarily to their sensorial aspects, basically seeing it. In cognitive semiosis, food is recognized, categorized and evaluated by its sensorial aspects, and more elaborate signs are created from this.

All the processes implicated in biosemiosis and cognitive semiosis are shared both by human beings and other animal species. One difference, however, is the nature of the biological processes, because different species have dissimilar kinds of vision systems, reacting to radiation reflected or transmitted by foodstuff by seeing color in a different way. Another difference is the nature of the cognitive processes, because species use different kind of languages or sign systems and have singular cognitive competences, with which they categorize the external world and communicate their experiences and knowledge mainly in a intra-specific way. All this results in the fact that color, as a useful sign for finding and selecting food, works differently for every species. But let's concentrate on human semiosis.

Within the field of anthroposemiosis, that is, semiotic processes confined to human beings, the representation of food is a highly relevant issue. Intentionality and the weight of culture, with its codified meanings, cross all stages, covering with their influence and transforming the basic act of feeding (a biological need) into a very complex and sophisticated semiotic process that have countless particularities along the history of human culture. But color is important from the most basic stages, not only in the sophisticated forms of cultural codification of food and eating in nowadays.

The aim of this paper is to present a survey with historical and semiotic insights, trying to cast light on some of the following questions, and asking for the role of color in them: When the act of eating is transformed from the satisfaction of a basic necessity into a cultural, and even aesthetic, ceremony? When food and the act of eating starts to be represented, and how color has been represented in these images? When colorants start to be used in order to enhance the visual aspect of food? When design starts to be applied on food presentation in the plate and on the table? And how color combination and color harmony has been used for this?

COLOR STRATEGIES FOR FOOD PACKAGING: SYSTEMATIC COMPILATION AND ANALYSIS OF CHROMATIC PALETTES OF OLIVE OIL'S PACKAGE

Oral paper

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The present work represents the initial stage of an exploratory research project on the field of packaging design for food. This project aim to analyze chromatic strategies used on different packed products segments, understanding as segment each one of the groups –milky, canned, oils, etc.– in which the diverse food products are gathered and sold on retail.

Our work is based on the hypothesis that for the different food products exist certain chromatic conventions and codes, born from consumption traditions and habits. Our research will try to make visible the strategies of adhesion or transgression to these codes, implemented by the companies in their attempt to establish a position on consumer's mindset.

Considering this aim, a theoretical framework is built on the crossroad of three fields: human vision, as the mechanism which allows the subject to have a perception of products; morphology, as the taxonomic dimension of different formal aspects of product; and semiotics, as the combination of perception with socio-cultural values.

Our analysis is carried out through a methodology that combines different levels of information: on the one hand, the systematic collection of colors and color-combinations present on packages which are distributed in local market; and on the other hand, a semantic analysis of package's elements, both structural (bottles, caps, cans, etc.) and graphics (typography, miscellaneous, illustrations, etc.).

To compile the necessary information for this analysis, a photographic register of package's fronts is made, in order to reproduce as far as we can, the average visual conditions –lightning, scale, position, etc.– in which the product meets the consumer on retail.

This methodology attempts to set an information basis which could be useful for building hypothesis about potential relation between morphologic choices –form, color, cesia, texture– and underlying socio-cultural codes on the analyzed segment.

In this occasion, we will present the methodology developed to compile the information and some initial results of the analysis of olive oil segment.

THE BUYING BEHAVIOURS OF THE CHILDREN TO THE PACKAGING COLORS

Oral paper

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This article presents a qualitative study about children and their buying behaviours to different kinds of packaging colors. Two categories of children were tested. The first refers to children aged 6-8 years old and the second refers to children aged 9-11 years old. The study was carried out the colors of the packaging of chocolate.

The first objective of this study was to discover that witch semiotics logic the children attribute a color to a flavor. The semiotics logic will be of 4 types: symbolic, metonymic, metaphoric or identifying. For example, in France, the red can be a symbol for the black chocolate and the blue is symbolic of milk chocolate. On the other hand, the white is metonymic of milk chocolate. The first question is as follows: which type of color is logical for a child to associate to a flavor?

What is the reasoning of children to associate a color to a flavor? The second objective of this study was to discover if a child prefers and chooses a packaging functions of his preferred color or functions of his logical color?

The last objective of this study is to discover if a child prefers a packaging of chocolate (flavor preferred / color less preferred) or on the contrary (flavor less preferred / color preferred)?

We will see that the responses of these questions depend on gender and age to the child. Girls and boys have not the same buying behavior to different kinds of packaging colors.

Presenting author: Marina Cavassilas

CORRELATION BETWEEN PALATABILITY AND COLOR HARMONY OF CHINESE FOOD

Oral paper

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Together with scent and taste, color has been considered as one of the vital ingredients of gourmet Chinese cooking. Although this statement can be found in virtually all Chinese cookbooks, it is not an easy task to establish the empirical link between the preference of food and its color arrangement. In this study a color information visualization tool was developed for summarizing color contents of food images. For a given image, color pixels of like hues were sorted into hue-specific accumulators, the cumulated count of each hue was then represented by the size of a corresponding rectangular patch comprising of the same number of pixels, finally by arranging the rectangles of various sizes on the image canvas, a Mondrian of hue distribution can be obtained. Such a Mondrian has been proven elsewhere to be an effective way of summarizing color information in a digital image. A total of 100 pictures of a good variety of Chinese cuisine served in restaurants were obtained. Each one was taken under standardized lighting condition, and was transformed into a Mondrian representation (the number of hue categories was set to eight). Thirty raters were recruited for giving their ratings on (1) the preference to a dish before tasting (visual appeal judgment); (2) the preference to a dish after tasting (palatability judgment); (3) the preference to the Mondiran, i.e. the color selection and arrangement, of a dish (color harmony judgment). The three types of judgments were conducted in blocks, while the order of blocks and within block trials was randomized. In palatability judgment trials, there was an inter-trial interval no less than three minutes. The results show significant correlations between all possible pairings of judgments. While it is not surprising that visual appeal correlates with palatability, we find it intriguing that color harmony alone can predict palatability of food well.

THE USE OF BLUE IN FOOD AND FOOD PACKAGING

Poster presentation

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The colour of food is a particularly emotive topic. Published work has explored various effects of colour. For example, beverages have been found to be more thirst-quenching when consumed from cool-coloured (blue or green) glasses than warm-coloured (red or yellow) ones. There is some evidence that the colour blue acts as an appetite depressant; perhaps this is because there are very few naturally blue foodstuffs and so we have not developed the responses to that colour that we have with other colour such as blue. The colour of food is a critical factor in our desire to consume and our satisfaction during consumption. Some oranges in Florida have green skins even when the fruit is ripe. The skins need to be injected with an orange food colour if intended for normal consumption to make them acceptable to consumers. Generally, it would seem that consumers prefer "naturally" coloured produce than produce free of preservatives and additives.

Advertisers are aware of the functional properties of colour and design products and product packaging accordingly. Thus, for example, coffee is predominantly sold in brown and red packaging. The functional properties of colour can be conveniently separated into three categories: psychological, aesthetic and visual effects. Psychological effects include the typical associations of colours (such as green with nature; white with purity). Aesthetic effects include the harmonious use of colour. For example, certain colour combinations can appear harmonious (colours with a similar hue or with similar vividness) or disharmonious (colours that clash).

This work will review the frequency and use of blue in foodstuffs and in food packaging. An experimental study of the use of blue in food packaging will be described.

TASTE ICONS

Oral paper

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With the theoretical contribution of the science of semiotics –the science of all the languages–, this article intends to study the iconic resources used by the photographer with special interest in gastronomic photography. Those resources are supposed to be responsible for the synesthetic suggestion effect that those images cause on a receptor, to the point of arousing the appetite sometimes even more intensely than a real dish. The gastronomic photography, as a sign itself –a sign being "something which stands for another thing to a mind" (Peirce MS 380)–, can heighten the senses, causing physiological reactions (biophysical, sensorineural, behavioral and so) on the interpreter, without which there can be no communication, just like salivation or to create the particular flavor of the food imaginatively, accordingly to its previous signic repertoire of tastes.

Based on Charles Sanders Peirce's theory of signs, especially on its iconic-sign concept –which always refers to its object by means of its predicate–, we can understand the color as a qualisign, a quality that is a sign –which by not representing anything, is able to represent anything that resembles it– therefore, the chromatic effects of the gastronomic photography present a great suggestive power, which can, in their turn, create possibilities able to insinuate delights, trigger and even intensify psychophysical effects, like arousing the appetite. The colors themselves don't represent anything, but they suggest, they invite to interpretations by their purely qualitative characteristics, with no direct connection with things that are external to it, they are pure possibilities, pure icons, whose object can be just a Firstness –the mode of being of that which is without reference to any subject or object– and those qualitative possibilities will be highlighted on the present article.

OF IMAGINARY AND FANTASIES/PHANTASMS – A CRITICAL VIEW OF THE RELATIONSHIP BETWEEN COLOUR AND FOOD

Poster presentation

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Facts and figures on hunger and poverty across the world are alarming. Today every four seconds a person dies from hunger-related causes. Poverty, poor water and sanitation, climate changes and profit-based monoculture policies, as well as civil conflicts and war increase the risk of hunger, disease and early death. Colour and food is not a priority for those people and countries that suffer from famine. Therefore this paper intends to discuss the topic "colour and food" from a critical point of view.

In industrialized countries a significant trend is to denaturalise alimentary products, and colour standardization is the rule. Is it cynicism, scientific naivety or commercialism that aims to produce "desirable" fruits and vegetables that over time maintain a monochromatic and unvarying colour appearance?

A typical example is the tomato. Once upon a time it was a wild, small, hairy, green and bitter fruit. Already cultivated by indigenous Americans, it was first recorded in Italy in 1544 when the Italian herbalist Matthioli wrote about a tomato that was around the size of a fist and a bright yellow colour. This is why he called it the "golden apple" (*pomo d'oro*). By the 1600s high society people called it the "love apple" not only because of its red colour but also this nickname was inspired by the tomato's reputation of being an aphrodisiac. During the 1800s the tomato was eaten across Europe and in the 1830s-1840s it became popular in North America leading to a "tomato mania". However, as mechanization has increasingly taken over cultivation methods, colour, shape and size differences have disappeared. Today the ripening process is eradicated from the consumer's view and a well-defined perennial permanent-red haunts the fantasies of business-oriented practices. Another telling example includes eggs. Those purchased in grocery stores are delivered by hen factories and are uniformly white or beige, while those that come from the farm often vary in size and colour.

More and more high protein alimentary paste products are being invented by product engineers. Low in cost, they are manufactured by turning different fresh products into flour or powder. The final products are processed to become the same colour. This visually neutral aspect has also been developed for astronauts' food. Colour is no longer evidence of the ripening process, but is rather an abstraction. This is also true for fresh products. The red tomato has become the genetic mask of a 21st century prototype; an industrial icon with no content; a signified without signifier; a pure mental concept recognizable and accepted by global markets; and a visually perfect appearance with no taste.

The aim of this paper is therefore to inquiry into colour variegation of fresh food and its respective industrially processed products. In particular tomatoes and eggs and their different industrialized products will be considered. Thereby a synthesising colour palette will be presented with conclusive background remarks on how innovative technologies and scientific research have been changing the notion and colour of food in the last decades.

THE CONTROL OF ANIMAL STRESS AND WELFARE WITH MEASUREMENTS OF VARIATION OF THE SKIN COLOR: A NEW FIELD OF APPLICATIONS OF COLORIMETRY IN APPLIED PSYCHOLOGY

Oral paper

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The main objective of this study was to bring new perspectives for colorimetry applications and stress control. The color changes of epithelial tissue in critical situations (yellowness or paleness) are signals of physiological responses to stress, which has common aspects with the health of the humans and the animals. The management of color skin oscillations in function of stress and environmental conditions is presented as new chromatic approach to the control of animal welfare, and quality of the food derivates of animals' products. Stress is an unavoidable consequence in breeding and transference of cattle for slaughter, in this process fear is a powerful stressor (Sacks 2006), with adverse consequences in the quality of raw meat, such as: color, pH, muscle contraction and discharges of hormones. The control of the levels of animals stress is a challenge, because the biochemical control and diagnoses of stress involves the determination of cortical levels - which is even more problematic outside the laboratory setting. Conceição (2009), in his doctoral thesis at the University of São Paulo, found significant differences in skin color variances measured before and after exposure to stress in the context of high performance sports. The discussions of the study were based on locus of control; coping stress strategies; auto-perception of stress in the List of Stress Symptoms (Vasconcellos 1985); and, skin color differences evaluated with the apparatus Minolta Chromameter CR 410. The results showed yellowness and/or paleness of skin associated with stress symptoms as measureable variables. In the present study, discussions of skin color variances (ΔE*ab) considered the differences in the CIELAB space and CIEDE2000 color difference formula recommended by Commission Internationale de l'Eclairage (CIE). The influences of stress on the alterations of skin color in humans and animals are the consequences of reciprocal regulatory mechanisms between sensory perception and neurohumoral responses of the autonomic system to environmental threatening (stressors), which are determiner of the vasoconstriction of blood flow in responses to feelings of fear, pain, fatigue, among other symptoms of stress. Based on the research preliminary results, emerge new directions to studies in psychology, stress management and applications of colorimetry. The harmful effects of stress in animals could be minimized by the control of skin color alterations during breeding and slaughtering, which is also associated with the reduction of diseases and reproductive problems. The improvement of the animal stress management may help bridge non-tariff barriers in food international trade meat products derivates.

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HOME SWEET HOME: IS THE GINGERBREAD HOUSE IN PALERMO VIEJO?

Poster presentation

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The Gingerbread House from the fairytale Hansel & Gretel, by The Brothers Grimm, serves as our starting point –it represents our more basic needs and desires presented in the most delicious and seductive way, as Bruno Bettelheim described in the book *The Uses of enchantment*. We first ask: what are the colors of such a longed-for and symbolic object? By studying illustrations of this enchanted house, we determine a palette of fantasy, seduction and edible architecture.

We then turn from fantasy to reality, to the colorful neighborhood of Palermo Viejo, in what the locals once referred to as the grizzled city of Buenos Aires. After Argentina's 2001 economic crisis, Palermo Viejo responded by transforming itself from a residential neighborhood to one much fancier and commercial, brimming with designer shops and restaurants. A significant change of color accompanied this change of use; building facades became brighter, more colorful, resulting in a very attractive destination, akin to the gingerbread house in the middle of the forest.

We have two different journeys –the metaphor of the gingerbread house and Palermo Viejo's contemporary history– linked by the concept of attractiveness through color. I would like to compare these two palettes, that of the gingerbread house, and that of the facades found in Palermo Viejo in 2009. By doing so, we can determine whether they share enough in common that we can begin speaking about a "palette of attraction".

The two palettes are built on the NCS system, in the case of the gingerbread house, by digitizing book illustrations and giving a corresponding code of the colors in NCS, and in the case of Palermo Viejo, through field research applying the methods of J.P. Lenclos, comparing building colors to color samples.

Are the colors of Palermo Viejo a reverberation of our greedy childhood fantasies? Are they simply the most attractive colors in every culture? Do they also correspond to the most attractive colors of real food? Could there be cause and effect at play, with the palette of children's book illustrations affecting how we perceive the attractiveness of colors as adults? The comparison of the two palettes raises questions for further research.

THE DAILY QUOTES THAT TRANSFORMS THE CITY INTO A FESTIVAL OF COLOURS: RIVER MARKET, VALDIVIA

Oral paper

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The city of Valdivia, surrounded by rivers and wetlands, was founded by the Spanish Pedro de Valdivia in 1544 on the banks of Calle-Calle River; elected as a privileged place for the construction and maintenance of ships, it was a deep and quiet influx stewardship of the open ocean, allowing the city supply and trade with foreign ships of deep draft, as well as with local producers.

According to the chronicle account of the time, the natives who inhabited the area came in large crowds in their canoes to offer their goods and the trade was on the edge that corresponds to the market today in the city river. This market, whose origins are as old as the founding of the city, has undergone several renovations derived from some disasters (earthquakes, fires), and other improvements; the latest being the construction of permanent canvas roofs. In 2007, to protect it from real estate interests, it is declared typical zone. Despite the clear limitations of the current construction, aesthetic value associated with the exhibitions does not stand in the way of human intervention in nature heritage buildings; lying it in the practices of the immediate environment.

The main trade held here is food from the earth (vegetables, fruits, flowers, cheeses, honey) and sea (fish and seafood).

The river market is for the inhabitants of the city, not just a place to buy, but a daily ritual, which celebrates diversity in an intercultural and interspecies landscape, where stand-holders and buyers are located next to sea lions, cormorants, gulls, terns and pelicans in an urban festival of colors starting with the installation of stands on an empty floor at dawn; having its most intense moments at noon; a festival of colors, textures, smells, sounds and flavors; people walking and shopping, tourists, the remains of vegetables on the floor and lots of parked cars.

By mid-afternoon, the city staff, provided with hoses, cleans floors and the remains of mesons, again leaving the area empty and gray waiting for the next day as a blank paper, the daily pulse calling hundreds of Valdivia inhabitants to this place and giving identity to its people for centuries.

This paper investigates the origin of these local products which have been maintained over time (colors that are kept) and the importance of color in the urban phenomenon that daily transforms this place.

NON-DESTRUCTIVE ASSESSMENT OF WATER AND PIGMENTS IN LEAVES FROM THE REMISSION FUNCTION USING THE KUBELKA-MUNK THEORY

Poster presentation

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Correlations between light reflectance of leaves and their pigments content are relevant in developing analytical non-destructive methods that allow remote sensing of vegetation. In the present work, the applicability of the Kubelka-Munk theory and the Pile of Plates model in plant leaves was confirmed and it was further used to elaborate a methodology for the determination of pigments and water from reflectance measurements.

Several leaves from different species: *Hedera helix*, *Liquidambar styraciflua*, *Populus alba*, *Rosa sp*., *Gardenia jasminoides*, *Schefflera arboricola*, *Aloysia triphylla* and *Ficus benjamina* were selected. Chlorophyll-a and chlorophyll-b were quantitatively determined in the leaves by solvent extraction and subsequent spectrophotometric determination. On the other hand, reflectance and transmittance spectra were recorded for the studied species in the UV-visible range and in the near infra-red region. The remission function, a quantity proportional to the chromophore concentration in solid samples, was calculated from reflectance measurements using the Kubelka-Munk theory. Optical parameters of leaves such as the light absorption (k) and the light scattering (s) coefficients were also estimated from transmittance and reflectance data using the Pile of Plates model.

Linear correlations were found for: a) the remission function at both 550 nm and 700 nm and the chlorophylls content and b) the absorption coefficients at both 550 nm and 700 nm and the chlorophylls content. The scattering coefficient did not show any net tendency with the pigment concentration. The best correlation was that obtained between F(R) at 700 nm and the chlorophylls content. The results were not improved by taking into account the scattering coefficient into calculations.

A linear correlation for the water content was additionally found when representing water concentration in mmol per square centimeter as a function of the Remission function in the near infrared, specifically at 1456 nm.

The correlations developed in this study allow the direct determination of chlorophylls and water in intact leaves by measuring reflectance spectra in UV-visible and NIR regions.

SENSING CHLOROPHYLL AND ANTHOCYANIN CONCENTRATIONS IN LEAVES WITH SPATIAL RESOLUTION FROM DIGITAL IMAGE

Poster presentation

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The aim of the present study is to develop a methodology to infer pigments concentration in leaves (spatially resolved) from a digital image of the material.

Uniformly coloured leaves of different species were selected. Reflectance spectra of these leaves were then obtained from 300 to 700 nm, using a spectrophotometer equipped with an integrating sphere. Barium sulphate was used as 100% reflectance (white reference). Seven reflectance spectra were averaged for each species and the resultant spectrum was used for further derivation of colour coordinates (R, G and B). The selected species were: *Hedera helix, Liquidambar styraciflua, Populus alba, Rosa sp., Gardenia jasminoides, Schefflera arboricola, Aloysia triphylla* and *Ficus benjamina*. On these leaves, chlorophyll-a, chlorophyll-b, carotenoids and anthocyanins were determined by extraction and posterior spectrophotometric measurement.

From the reflectance spectra of uniformly coloured leaves, and taking into account a standard illuminant, the RGB coordinates were calculated. Then, correlations between the colour coordinates and the pigment concentration in mmol/cm^2 were obtained.

Values for the R component decreased non-linearly as chlorophyll concentration declined. Values for G component decreased linearly with chlorophyll content. Values for the B component, on the other hand resulted insensitive to chlorophyll concentration. An excellent correlation was finally found for the sum of R and G with the chlorophyll content and between the ratio R/G and the proportion anthocyanins/chlorophyll. No correlation was found for carotenoids.

On the other hand, images from heterogeneously coloured leaves (*Liquidambar styraciflua*, *Ligustrum vulgare* and *Schefflera arboricola*) were captured using a commercial scanner (HP-DeskJet F380 de Hewlett-Packard). The scanned images in TIFF format (Tagged Image File Format) with a resolution of 300 ppp and a depth of 24 bits were digitally processed using the ERDAS IMAGINE 8.4 program. Using this software the TIFF images were imported to IMG format and they were subsequently separated in R, G and B bands.

Using the correlations between the colour coordinates (R, G and B) and pigments concentration, deducted for homogeneous leaves, the concentration of pigments per pixel in heterogeneous leaves were estimated.

RABBIT MEAT HAMBURGERS: COLOR DIFFERENCES DUE TO INDUSTRIAL OR ORGANIC REARING SYSTEM

Poster presentation

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The aim of this work was to study the influence of rearing system ('I'industrial or 'O'organic), and the conservation (frozen/chilled) on the color of rabbit burgers, fresh or preserved 8 days, both raw and cooked. The meat of 40 NZxCalifornia rabbits bred in organic or industrial system was used. Twenty-four hours post slaughter the rabbits were pulped by hand and the meat was homogenized. From the 'mix' of 'O' or 'I' meat there were produced burgers of 50 g (6 burgers/trat.) that were arranged on individual trays covered with plastic film wrap or vacuum packed (Multivac) and were analyzed the next day (4 °C ± 1) or were kept for 8 days refrigerated or frozen (-17 ºC ± 1). The burgers were cooked in double contact grill to reach 71 ºC ± 1 ºC in the center of the sample. The color was analyzed (Minolta CR300, Illuminant D65, geometry 0°, aperture 8 mm, dull; L*: lightness; coordinate a*: -a/+a green-red, coordinate b*: -b/+b blue-yellow and estimated the Chroma (C^*_{ab}:$\sqrt{(a^{*2}+b^{*2})}$) on raw meat (after 40' of 'blooming' in the case of vacuum-packed burgers) and cooked meat; sensory evaluation was conducted by a trained panel of 8 assessors (10 cm non-structured linear scale). Statistical analysis of data was performed using ProcMixed,SAS and the averages compared by Tukey test.

In general, treatment ('I' *vs* 'O') and shelf-life (1-8 d) were significant ($p < 0.01$) for all variables analyzed and was high the frequency of 'Trat.xTime' interactions. There were no differences due to preservation or the packaging except for a* and b* of raw burgers; the parameter a* was stable or tended to increase while b* tended to decrease in the raw vacuum packed burgers.

The 'I'/'O'origin determined differences in all parameters except for b* and C^*_{ab} of cooked hamburgers. The 'O' burgers were less luminous (L*: 54.2 and 68.1 for raw and cooked burgers) and more 'red' (a*: 12.6 and 6.97 for raw and cooked burgers) than 'I' burgers (L*: 64.4 and 69.4, a*: 7.62 and 5.45 for raw and cooked burgers, $p < 0.001$) and only for raw hamburgers, showed a lower value of b* (8.28 and 13.3 for 'O' and 'I', $p < 0.001$) and C^*_{ab} (15.1 and 15.8 for 'O' and 'I', p: 0.0774). From a sensory standpoint, 'O' burgers showed higher overall color and surface brightness but less color uniformity ($p < 0.01$).

The shelf-life influenced all parameters examined and showed interaction with treatment with the exception of cooked b* and C^*_{ab}. The sensory analysis of chilled burgers showed that while the Gobal color decreased in 'I' burgers with storage time, increased in the 'O' burgers ($p < 0.01$). The surface brightness decreased in both 'I' and 'O' burgers while the uniformity of color did not change in the 'I' and decreased in the 'O' burgers evaluated after 8 days of preparation.

We conclude that the origin of meat and shelf-life significantly influence the colorimetric parameters of rabbit hamburgers while the packaging and preservation are not significant.

USE OF COLOR IN THE PROMOTION OF CONSUMPTION OF FRUITS AND VEGETABLES: THE EXPERIENCE IN CHILE "5 A DAY"

Oral paper

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"5 a day" is an international movement that promotes the consumption of fruits and vegetables in the world and is present in over 40 countries on 5 continents. Its name is based on the minimum daily ration of fruits and vegetables recommended by the scientific and medical communities in a healthy diet. This program exists in Chile since 2006, implemented by the "Corporation 5 a day",[1] having an exemplary impact in Latin America.

The paper described here is the presentation of the research, conclusions and recommendations by the use of color in the "5 a day" Chilean program, based on observations and analysis of the color scheme proposed by the program. The analysis used perceptual aspects of color and different graphics and digital parts that are used to promote publications, educational materials, recipe books and other products.

Since the campaigns of "5 a day" is based on the relationship between a group of fruits and vegetables and their natural colors. Sorting them for their recommendation of daily consumption in 5 groups and associating them with a different color. The research intends to explore the chromatic and sensory relationships between color, taste, texture and smell of a fruit or vegetable. Also inquire the symbolic and significant associations between the color assigned to the classification and the concept that is transmitted to consumers.

During the investigation, sensitive color observations were made, that decode the chromatic proposal raised by the program. Identifying certain stimuli that cause sensory and psychological associations with the colors, their relevance and the degree to which they affect consumer perception. It seeks to demonstrate through empirical evidence that the colors provide more than just visual information to recognize their expressive and communicative functions.

The research is raised from the point of view of the designer, who works with food engineers and nutritionists, through a collaborative work, providing an appropriate chromatic language that contributes to the success of the program.

[1] The Corporation "5 a day" is a nonprofit organization founded by the Instituto de Nutrición y Tecnología de los Alimentos (INTA), Facultades de Ciencias Agronómicas de la Universidad de Chile, Pontificia Universidad Católica, Pontificia Universidad Católica de Valparaíso and Universidad Mayor. And representatives of the private sector as the Asociación Gremial de Supermercados de Chile, Asociación de Exportadores de Chile, Central de Abastecimiento Lo Valledor, Comité de Hortalizas de Chile, Federación Nacional de Productores de Frutas de Chile and Sociedad Nacional de Agricultura. And the continued support of government agencies such as Ministerios de Salud and Agricultura, and international organizations such as World Health Organization, Pan American Health Organization, United Nations Development Program, and Food and Agriculture Organization of the United Nations.

FOOD PACKAGE CHROMATIC DESIGN: AN ANALYSIS FROM THE POINT OF VIEW OF VISUAL PERCEPTION

Oral paper

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The purpose of this paper is to present an application of Visual Perception Model Sens-Org-Int to a chromatic analysis of food packages. Sens-Org-Int Model was devised by the present author, published and awarded in IVLA's (International Visual Literacy Association) 2007 *Book of selected readings*. The model differentiates the three processes that occur in human perception: sensory impressions, organizing processes, and interpretive processes of visual perception.

Theories about perception tend to emphasize the role of either sensory data or knowledge in the process. Some theorists have adopted a *data-driven* or *bottom-up* stance, or synthetic approach, according to which perception is direct: visual data are immediately structured in the optical array prior to any selectivity on the part of the perceiver proposed by Hering (1850), Gestalt theories, and Gibson (1979). Others adopt a constructivist, top-down or analytical approach emphasizing the importance of prior knowledge and hypotheses, argued by Berkeley (1709), Helmholtz (1925), and Bruce, Green & Georgeson (2003).

Sens-Org-Int Model was devised in an attempt to differentiate which principles or laws of design and art are common to all human beings with normal eyesight from the concepts that are not common to everyone. Those that are not common therefore are learned or otherwise acquired. Therefore, this model unites the synthetic and the analytical approaches to psychology as well as neuroscientific inputs (Chalupa & Werner 2004; Knoblauch & Shevell 2004; Pinna & Spillman 2001; Shimojo, Kamitani & Nishida 2001; Spillman & Levine 1971; Zeki 2000) on how the brain works, and relates them to classical art and design principles.

This theoretical model is now put into practice, in an attempt to analyze food packages. This paper, thus, shows the results of such analysis conveying some important information on food package chromatic design. Examples of many packages shall be shown to illustrate the concepts discussed. Results include reasons on why some chromatic packages work better than others.

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COLOURS SEEN THROUGH TRANSPARENT OBJECTS

Oral paper

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Foods and drinks can be transparent or translucent, but not always they appear such. As regard to this phenomenon, we distinguish two aspects: first the determination of the chromatic characteristics of the colour of the object (its colour and its density), and secondly how the transparent object modifies the colours of things seen through it. In this research we deal with this latter problem, which is a case of colour constancy: how much a surface colour appears constant despite the modifications introduced by a coloured filter in front of it.

Our hypothesis is that, contrary to what found by D'Zmura et al. (2000), and on the basis of previous works (Masin 1998), colour constancy of objects completely covered by transparent objects is quite low. To study this effect we simulated in a computer controlled monitor a coloured transparent veil completely covering a chromatic Mondrian and protruding from it over either a white or a black background. The veil was perceived at a certain distance in front of the mondrian by means of a simulated stereoscopic vision. The Mondrian consisted of nine nearly square regions of different chromatic and achromatic colours, always presented in random order. It appeared behind and covered by the filter because of the stratification in depth; the reduction colours (Katz 1935) were computed according to one of the most widely accepted models of phenomenal transparency (partitive mixtures: Metelli 1974, Da Pos 1989, D'Zmura et al. 2000). The filter could have one of the four unique hues, at high or low saturation, and could be very or little transparent. The task of four observers was to reproduce the Mondrian seen through the filter with its original colours (as if it were observed without the filter), the hypothesis being that the observer could perceive the original colours through the filter. The adjustabile Mondrian was perceived in front of a local background of the same colour of the filter so to keep the same contrast relationships with the background as the filtered Mondrian, but seen in plain air.

Constancy is perfect if the colours of the covered Mondrian are correctly reproduced, constancy is null if the reproduced colours only match the reduction colours (the colours presented in the screen and perceived without the effect of the context). Results show little constancy, and the reproduced colours lie midway between the original and the reduction colours; higher transparency, lower saturation, and blue filters favour colour constancy.

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ARCHITECTURE AND GASTRONOMY, COLOUR AND FOOD

Poster presentation

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In the mouth of the current architects proliferate the analogies between the culinary and architectural facts, recognizing that building and cooking are two activities essentially human, indispensable to the survival and welfare from the origin. In this way are related the sensitivity required by the act of cooking and enjoy a well prepared meal and enjoy the material and spatial qualities of a building.

Eating is one of the more subtle acts for human beings, and for enjoy this experience fully you must have architecture and the interior design of the local are in harmony, which emphasize that gastronomic experience.

We know that cuisine, culinary arts, respond to the "bastard" senses, largely marginalized by sensualist hierarchies of the ancient, advocating the metaphorical subtlety of the view and the intellectual and mental acuity of the ear above animality of taste and smell roughness. But as well as the architecture is the art of the view and ear music, cooking is the art of taste and smell, without forgetting the importance of touch in the preparation of dishes.

So we maintain without mistaken as well as food there is something more protein, minerals and vitamins, Gastronomic Architecture also has something more than walls, ceilings and floors, and both the *colour* and the *forms*.

Color is essential in determining the nature of space, depending on what they pretend to project it. The most common use of intense colours is not a fad; it is that the public in general "dares" to apply more vivid colors. In society this root is a culture in which the Interior already does not arise as something permanent that not "tire" and has lasted many years. On the contrary, culture change and constant renewal facilitates the fact "launch to play" with colors more daring to spaces whose durability was raised in an intentionally ephemeral way.

The gourmet "boom" is one of the reasons for this need because, to the growing supply proposals seek to differentiate not only by the type of food, but of all conceptual elements, where the interior architecture is essential.

Gradually begins to consolidate our culture of a spirit that tends to revalue the enjoyment of which commonly described as simple pleasures alluding to a desire to recover the purity in our sensual experiences to strengthen them. The color is part of it.

FROM ARCIMBOLDO TO MONDONGO: FOOD AND COLOR IN PAINTING

Oral paper

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Food represents one of the ways in which a vital activity shared by all animal species (feeding) is processed and culturally codified, becoming a ritual, and exceeding the status of natural satisfaction. The own sensualities, the communicational interchanges and the aesthetic values acquire meaning in front of food, all this being integrated in cultural expressions, particularly philosophical and artistic ones.

For instance, *The Banquet* of Plato is not ingenuous in taking the rituals of shared food as a frame for deep thoughts about beauty, power, love, and the human soul. And the *Last Supper* by Leonardo Da Vinci expresses in a pictorial way the integration of shared food to a religious fact.

But other modes of expression have been proposed through food, which are interesting because food becomes the matter by means of which reality is represented. We take two cases located in two different historical times: the case of Arcimboldo in the 16th Century and the Mondongo Group in the 21st Century.

Arcimboldo paints sculptural images created with different food stuff making their parts, and keeping the referential colors of the food. Fruits, vegetables, meats, and other elements build creatively the figures of human faces, meaning perhaps that we are constituted by the food we ingest.

In Spanish, the word "mondongo" (the trip) refers to an organ cut of the cow from the abdominal zone, with which people cook a food that has the same name, and this word, because of its sonorous inflexion, has connotations related with the abdominal zone as a sign of sensuality.

Among its notable pictorial modes of artistic creation, the Mondongo Group makes concrete color images with different amazing materials, including food. Especially interesting are the faces created with colored cookies and candies.

In the paper I will present the different meanings of these particular modes of expression, relating and differentiating the ideas that these two authors bring into play in their works of art.

CULINARY EXPRESSIVENESS IN NATIONAL HOLIDAYS

Oral paper

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Taking a pragmatic approach to the feasts prepared in Frida Kahlo and Diego Rivera's home in Coyoacan during the 1940's, allows for the appreciation of the colors and flavors of Mexican cuisine.

The expressive intentionality of the three colors of the Mexican flag –green, white, and red– reflected the nationalist character of the hosts and their guests. The renowned painters used paper flags and tri-colored shawls for the decoration of their house, as well as in the preparation of the elaborate meals for the celebration of the National Holidays during September.

This statement and redundancy of the colors of the flag could be appreciated in the different meals prepared in Frida's cuisine: three colored rice, chili strips with cream and tomato, the Poblano chili in walnut sauce, fresh fruit water consisting of green lime, white horchata, and red jamaica which are representative of the variety of vegetables, fruits, and flowers that are still grown and consumed in the country.

Cooking for the eyes, permits the association of these colors with the different textures and the appearance of the dishes placed in artisanal tableware, with a wide range of smell and taste sensations that determine the strong social and aesthetic codes of this strong culture. The analogies that these colors represent may seem somewhat artificial, however, its meaning denotes the national essence present in the flag of independent Mexico since 1821.

COLOUR DESIGN OF FOODSTUFFS IN TURKISH BAAZAR AND CUISINE

Oral paper

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Colour provides both visual and psychological information. Although colours can have different meanings in different cultures, sometimes colours convey universal truths. When food is in question; colour gives information about its ripeness, freshness or appropriateness for consumption. Additionally, when foods are presented together, they create remarkable colour combinations. In both aspects; colours and compositions are expected to have positive effects on appetite and taste.

Turkish cuisine embodies 5,000 years of culture. Throughout the history, the land of Turkey hosted so many cultures, Hittite Empire, Assyrian Empire, Babylonian Empire, Persian Empire, Macedonian Empire, Roman Empire, Byzantine Empire, Seljuk Empire, Mongol Empire, and Ottoman Empire, over the years. For this reason, Turkish cuisine has not only richness in food products, such as fruits, vegetables, dry legumes, spices and nuts, but also richness in traditional and cultural meals. The presentations of food products in Turkish cuisine and in their cultural nourishment are notable in two different settings. The first one is bazaars, displays and market halls where shopping for cuisine is done commonly and the second one is the dinning table where various traditional meals are served together.

Even though, the number of modern supermarkets has been increasing as a result of globalisation, Turkish people have preferred to do shopping from bazaars, displays and market halls. In these places, the great majority of vendors are producers, middlemen and resellers. Even they have a practice on, at most, primary education, they pay particular attention to colour design and composition in a remarkable level when presenting their foodstuffs. Likewise, it can be seen that kind of concern on the dinning tables of ordinary people, as well. Colour harmony appears as a criterion for the finishing touches on the meals. This approach can not be clarified by any kinds of instructions and it has been transferred from seniors to juniors in cuisine and bazaars as a manner and a cultural heritage.

The scope of this paper is to trace this manner and heritage. In the study, colour and colour design of foodstuffs in Turkish bazaar and cuisine has been taken up with its both symbolic and formal aesthetic attributes. Accordingly, intuitive and cultural approaches of colour design and colour harmony during displaying and serving the foodstuff have been recorded, classified and examine the theoretical justifications of such attitudes.

YOUNG ARTISTS FROM ROSARIO. A CURRENT LOOK ON COLOUR IN THE VISUAL ARTS

Poster presentation

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Our aim is to select meaningful works of contemporary visual artists from Rosario, who through their own artistic resources, inquire into food and hunger.

For this dissertation, I will discuss the works of the following artists. *Graciela Sacco*, a neo-conceptual artist who works on the bi-dimensional and three-dimensional levels of blueprints. *Nicola Constantino*, who questions the perverted aspect of beauty in her items of clothing made of silicon skins. *Mabel Temporelli*, who centres her work on the feminine world, made up of everyday rituals. And *Claudia Raimundo*, whose interactive and perfomatic actions are food centred.

Today's art has lost the strict limit of each of its particular areas. However, no matter how blurred these limits can be, we can still differentiate a painting, from a sculpture from a photograph.

The artistic productions have become interdisciplinary, collective and ephemeral. There are no limits or restrictions to materialize an idea, since a work of art can interact with the real space in an installation, an action or an urban intervention

FOOD'S DOMESTIC ENVIROMENT, ITS EVOLUTION AND TRENDS

Poster presentation

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Since the beginning of mankind, spaces related with dealing with food such as collecting, preparation, and eating spaces, have been changing, always related, some way or another, with nature.

The first nomads, had nature as their environment: mountains, valleys, rivers, oceans. When they needed shelter, these constructions were made of natural materials, such as stone, leather and vegetation.

Colour came to life when man evolved from eating raw food to cooking it with fire. It's around this element that most of their significant gatherings took place (rituals, feasting, etc.).

With civilization, as buildings became solid structures, heat-resistant surfaces and easy-cleaning materials became part of meal's preparation, creating spaces with different colours, all related to nature: black, brown, red, brick-red.

Colours in eating and cooking environments change during centuries 16 to 19. Surfaces that allow easy cleaning and maintenance, such as ceramics, were preferred over other materials, traditionally used. White and blue establish and are actually used.

Colour explosion occurs in the 20th century. From then on, fashion dictates what used to be the result of eating and cooking function. Both activities either remain tightly bond, or develop on independent spaces, depending on the socioeconomic and cultural context.

Last century is when colour institutes all around the world begin their work, orientating and directing us. Colour and trend in two centuries of Argentinean history. Nowaday's forecasts, where are we headed?

MATRIX INFLUENCE ON COLOR PERCEPTION: A STUDY OF CORNFLAKE PROCESSING STAGES

Oral paper

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Of all visual food aspects, the effect of color is the most obvious and well-studied. However, food appearance results from the complex interaction of several basic sensory attributes such as color, opacity, gloss and visual structure and texture. The perceived color would thus depend not only on the spectral reflectance characteristics, but also on the spatial distribution of light. In this work, changes on color perception are analyzed in relation to physical changes occurring in the food matrix during processing. Breakfast cereals are interesting models for analyzing these aspects since, besides brown pigments generated by the Maillard reaction during cereal processing, many opacity and gloss transformations occur. Cornflakes production involves the milling of corn kernels to remove germ and bran for obtaining grits, steam cooking, lamination to obtain the flake shape and toasting under hot air current. The samples studied in present work were derived from each one of those stages. Color was measured by a calibrated computer vision system and expressed in CIELAB color system. Sample microstructure was analyzed by environmental scanning electron microscopy. Several markers of the Maillard reaction occurring during processing were measured: surface fluorescence, carboxymethyl-lysine and furfurals. After protease treatment brown compounds were determined trough browning index of extracts (BrI).

After cooking process L^* and b^* values decreased and a^* values increased as a consequence of brown pigment development. At the same time, starch gelatinization made the matrix more homogeneous and sample opacity decreased. During lamination the matrix was compressed under high pressure producing an important change on sample shape and thickness. At this stage L^* and b^* values increased. Toasting process produced sudden water evaporation due high temperatures used and generated bubbles in the sample matrix. This effect produced light dispersion changing sample appearance, opacity increased compared to laminated grits and L^* values increased. The hue angle (h_{ab}) decreased after cooking and then increased in lamination and toasting steps. Maillard reaction markers changed according to thermal treatments, since its major changes were observed after cooking and toasting. Fluorescence changes were mainly produced during cooking. Color changes were affected not only by pigment formation but also by microstructural changes. These changes involve the destruction or generation of interfaces and thus affect the way in which light interact with the sample matrix. This effect made color perception and brown pigment development not to behave in parallel. In this way, an integral approach that takes into account color, pigment concentration as well as microstructural and physical changes is important in order to understand visual color perception of laminated cornflakes samples.

ORANGE JUICE COLOR: VISUAL EVALUATION AND CONSUMER PREFERENCE

Poster presentation

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The relevance of colour as a sensory quality attribute which influences the consumer preference has been demonstrated in several studies (Meléndez-Martínez, Vicario and Heredia 2003). The objective of this study was to determine the colour attributes (lightness, chroma and hue) quantified by trained assessors and the colour preferences evaluated by consumers, in orange juices from different varieties.

Orange juices were obtained from nine orange varieties. The samples were evaluated by image analysis and the chromatic parameters were calculated (DigiEye System) (Luo, Cui and Li 2001). Those juices, which ΔE^*_{ab} exceeded the threshold for visual discrimination were selected for the visual test (Melgosa et al. 2001). The trained panel consisted of eighteen panellists, with normal colour vision and experience in both visual assessments of colour and tristimulus colorimetry concepts. All of them were asked to classify the samples in increasing order of hue (yellowish-reddish), chroma (dull-vividness) and lightness (clear-dark). They were also asked to score the colorimetric parameters on a continuous scale of 10 cm, anchored at the ends. Analysis of variance (ANOVA) ($p < 0.05$) and Page test were used for the statistical analyses. Results showed that judges were able to order the orange juices correctly based on hue and lightness, but only 17% of them ordered the samples properly according to chroma. This may be due to the low chroma differences among samples ΔC^*_{ab} (1.03-2.77). In accordance to this, significant score differences ($p < 0.05$) were found for hue and lightness, but not for chroma.

The consumer panel consisted of 111 panelists (78 female, 33 male) recruited among students and staff at the University of Seville. They were grouped in six categories based on gender (male and female) and age (less than 20 years old, 20-29 years old, and over 30 years old). The consumers were asked to order the samples according to their colour preferences. Ranking data were analyzed by Friedman test). A significant preference ($p < 0.05$) was observed for the sample with intermediate hue and lightness values (Valencia Midnight), while the least preferred was the variety with the lowest value for lightness and the higher hue value (the most yellowish) (Navel Foyos). No significant differences were found based on gender and age, however, it was observed that male consumer group had higher preference for the most reddish variety (Rhode Late).

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RELATIONSHIP BETWEEN SENSORY ANALYSIS AND THE INSTRUMENTAL COLOUR AND VISUAL TEXTURE ASSESSMENT OF DEEP-FRIED BREADED VEAL

Oral paper

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The new technology of colour calibrated digital analysis appears to be very suitable for performing a rapid and simultaneous specification of both colour and appearance aspects of food. It is possible to specify colour and appearance attributes in one measurement process by using this technology.

The aim of this study has been focused on two main objectives: (a) to determine the equivalence between sensory evaluation of the appearance of deep-fried breaded veal (DFBV) performed on the real product as well as on a photograph of the same product, (b) to analyze the relationship between sensory analysis and "instrumental colour and visual texture assessment" of DFBV.

For the study, a panel of 8 assessors was screened and trained in descriptive analysis (DA) following the guidelines of the ISO 8586-1 Standard. DFBV were prepared from 5 mm thick Semitendinosus bovine meat, dipped in reconstituted egg powder and covered with bread crumbs. The process of dipping in egg and covering with bread crumbs was performed once or twice (1-dip and 2-dips). Cooking was in sunflower oil at 180 °C at two different times. Thus there were two processing factors: number of dips and cooking time. Digital photographs of the samples were taken with a digital camera (Sony DSC-W55) under controlled illuminating conditions (a closed illumination cabinet with a D65 emulator illuminant). The trained panel developed descriptors covering colour, gloss and visual texture, and appropriate references were developed to standardize and calibrate the panel's evaluations. Once training was completed, real samples of DFBV were measured in triplicate. In separate sessions digital photographs of the same samples were measured, also in triplicate. Regression analysis and general Procrustes analysis were used to compare the assessments of the real samples and their photographs. Similarities and differences in both evaluation methodologies will be discussed.

On the other hand, the digital images were processed by CromaLab® software in order to have detailed colour characteristics of each DFBV sample. Based on these data, it can be observed that, as expected, the cooking time induces a descent of the lightness (average of L*) while the number of dips increased it. Taking into account the chromatic heterogeneity (percentages of number of pixels with different hue or lightness ranges) determined by digital image analysis, a clear dependence between the cooking time and the number of "dark" pixels (L* < 50) was found. These data were in accordance with the sensory analysis results.

CHANGES IN COLOR AND ANTHOCYANIN CONTENT OF DIFFERENT DRIED PRODUCTS BASED ON SWEET CHERRIES

Poster presentation

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It is widely known that quality properties of fruits can be affected by drying processing. The objective of this work was to analyze the effect of different pretreatments and dehydration methods on color and anthocyanin content of two products obtained from sweet cherries (Lapins *var*.). Fruits were cut in halves and in eighth pieces in order to obtain different dried product geometries: discs and dices. Sucrose infusion (SI) and blanching (B) were applied prior to drying. Dehydration was performed by freeze-drying (FD, 48 h, condenser temperature: -84 ºC, vacuum: 0.04 mbar) and by air drying (AD, 24 h, air temperature: 60 °C, 10% RH). Color was measured by photocolorimetry (2° observer, C illuminant, CIELAB color space). Measurements were performed on skin and pulp in discs and in pull in the case of dices. Global color change (ΔE^*_{ab}) and hue angle (h_{ab}) were analyzed in comparison to fresh fruit. Total anthocyanin content (T Acy) was determined using the pH-differential method, and Acy degradation index (ADI) was calculated.

The applied pretreatments and drying methods caused different effects on color and anthocyanin retention when compared to the fresh fruit. The SI pretreatment in discs caused the greatest ΔE^*_{ab} (> L*, < a*) on skin, due to diffusion of pigments into the solution during osmosis, to the addition of bisulphite to the system and to the presence of sugar crystals on fruit surface. On the pulp, air-drying caused a darkening of discs (L* decrease), because of browning reactions. In the case of cherry dices not significant differences were observed between ΔE^*_{ab} values of samples ($p < 0.05$). Both products, discs and dices, exhibited in general an increase in h values upon dehydration, in agreement with Acy pigment decrease. For a certain pretreatment, FD samples showed a greater Acy retention than the respective AD samples. Moreover, AD-SI samples presented the highest ADI values. Fruit cut in small pieces allowed obtaining a better quality product (color and anthocyanin content) than processing it in halves. Overall, the SI pretreatment caused an important decrease in anthocyanin pigments retention and a clearer appearance. Therefore, this procedure should be carefully performed in berries in order to keep the nutritional quality of the product.

THE PSYCHOLOGY OF COLOR: A RELEVANT INSTRUMENT IN MARKETING AND DESIGN

Oral paper

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The aim of this work is firstly to attempt to conceive and examine the alterations in appearance resulting from chromatic effects, which the expressions of colour give rise to in the human psyche. Secondly, it is aimed at revealing and presenting the emotional value in the decisive and strict aspects as a relevant instrument in marketing and design, taking into account the chromatic value of foods, their packaging and the environment where they are exhibited, as a factor of unity.

Colour is critical to its attraction, and it must direct the reactions of people, becoming a protagonist of consideration when it comes to the success or failure in selling a product on the market.

In spite of personal preferences regarding colour –which may appear very subjective to conjecture accurately–, designers have to try to limit the consumers' associations through reduced groups, interviews, consultation with colour forecast groups on market research, advertising and all the specialities which cordon off the launching of a packaging item with foods.

Brand and product constitute an indivisible whole, connected to the term "idea". This concept is linked to a strategy adopted by companies regarding a specific market, responding also to the general idea that companies have about consumers.

These analysis and revelations enable the understanding of the differentiation of food products on the market, making use of the phenomenology of colour, when colour receives a signification or attribution of sense and enhancement through dissimilar associations with a translucent language.

"The emotional values caused by colours lead us to realize that colour does not exist on its own but it is always an aspect of the object –in this case food and its packaging–, considering also the environment of its exhibition. The chromatic effects that colour objects cause on the human psyche are a relevant instrument in marketing and design".

COLOUR REFERENCES FOR ESTIMATING ACTUAL CONDITIONS OF FOOD MATERIAL AND COOKED MEAT

Poster presentation

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Colour is one of the major factors along with gloss, texture and flavor influencing our food tasting perception. Colour information is also important for checking the freshness of vegetables and for knowing the degree to which meat has been cooked.

In this study, we conducted two measurements in order to clarify the actual conditions of the colour of food ingredients and cooked meats. According to the results of these measurements, we made two colour charts as an index to be used as reference in food preparation and cooking.

For the measurement of the colour of food ingredients, we measured the luminance and chromaticities of 101 food materials (54 vegetables, 7 kinds of fruit, 16 kinds of fish, 11 kinds of meat, 5 kinds of cheese, and 8 others) which were used in four Cooking classes of the Department of Food Science and Nutrition, at Doshisha Women's College of Liberal Arts, with colour luminance meter (Konica Minolta CS-100A). We also measured them under the lighting condition of 400-500 lx on the worktop with 6500 K fluorescent lamps in the cooking class room. The results showed that the values of the chromaticity were from $x = 0.30$ to $x = 0.50$, and from $y = 0.30$ to $y = 0.55$. We transformed these values of luminance and chromaticities into the Munsell value, and extracted 9 colours; 7.5GY 4/4, 5GY 5/6, 5GY 7/4, 10Y 4/3, 5Y 6/4, 2.5Y 8/12, 10YR 6/8, 7.5R 4/9 and 2.5R 4/4 and made a colour chart of these 9 colour chips for a reference in food preparation.

For the measurement of the colour of a cooked meat, we baked a hamburger steak in an oven, and we measured the luminance and chromaticities of the hamburger steaks at 9 stages during the cooking process with two-dimensional luminance colorimeter (Konica Minolta CA-2000) under the lighting condition of 1000 lx on the worktop with D_{65} lamps. We transformed their values into the Munsell value, and extracted 9 colours; 7.5YR 5/6, 7.5YR 5/4, 10YR 6/4, 5YR 4/4, 7.5YR 4/5, 10YR 5/4, 5YR 3/4, 7.5YR 4/3 and 7.5YR 4/4, which were observed in middle and late stages of the cooking process.

Finally, we made a colour chart consisting of these 9 colour chips for a reference for cooked meat. The colour chart enables us to estimate actual conditions of food materials and cooked meat easily and quantitatively.

FROM GARDEN CONSCIOUS TO COLOR CONSCIOUS: THE RISE OF THE SUBURBAN FOOD GARDEN

Oral paper

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As we go forward into these times of scientific and technological innovations a unique phenomenon is co-occurring. The self-motivated gardener is popularizing the organic food garden without its past patriotic service or hobby status. This renewal brings food gardening into the present as a solution for several current concerns and mainstream needs. For some it even answers an inner calling to the rhythms of nature.

Three demographics where food gardening is practiced, rural, urban, and suburban, are explored. We find the suburban location the youngest with the most potential for affecting behavioral change. The "socially correct" organic methodology advances ideas in maintenance and sustainability for growing and harvesting food requiring a certain consciousness by the suburban gardener. It transforms this residential area in character and aesthetics giving rise to color awareness.

An influence on the organic lifestyle are the beliefs of Biodynamics, a super organic application steeped in spiritual science that leads to a deeper understanding of the eco-system. As a mindset develops in the practitioner he aligns to the dynamic forces that govern plant growth and color cognition. We realize a blending of the old gardening ways with the new by the commercial introduction of artificial plastic and tweaked traditional palettes. As evidence the organic food garden has gained acceptance we point to the extensive media attention given to its cultural relevance. This spotlight also has an entertainment quality shaping public mood and opinion towards color. The imagination envisions opportunities to design and market to the consumer persuaded by their connection to the earth.

Overall this work observes three historical time periods of the food garden demonstrating its evolving economic role and social importance to better understand our interest in a personal food source that reflects a progressive color story underpinning organic gardening and changing attitudes.

COLOR CALIBRATION VIA NATURAL FOOD COLORS

Oral paper

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Color image calibration is usually done with the aid of a color chart such as the Macbeth ColorChecker containing a set of carefully produced color patches. However, in many consumer applications, such as Internet shopping for which the correct reproduction of color can be very important, most users will not have a color chart readily available, and probably are not interested in purchasing one in any case. We propose using the colors of the fleshy interior parts of oranges, lemons and limes, along with cooked egg white as a means of creating a simple color 'chart'. A sample of oranges, lemons and limes from North America and Australia has shown their color to be quite consistent, and therefore potentially suitable as a set of reference colors for color image calibration. Figure 1 shows one of the images used in measuring the colors of the fruits and vegetables. In the case of Internet sales, a seller photographing color-sensitive merchandise, such as clothing, could simply include one or two of these foods in each picture. This would provide an immediate point of reference for the purchaser as to whether or not the image colors are correct. Clearly, if the food colors do not look right, neither will the clothing when it is delivered.

The simplest form of color correction, namely white-point adjustment, can be done based on only a single known color, usually white, in an image (Lee 2005). However, there are two problems with this approach. The first is that most white objects are not pure white in the sense that they have a completely uniform reflectance spectrum, and furthermore many, such as paper, have fluorescent optical brighteners in them. The second problem is that with a single white object only a 3x3 diagonal matrix von-Kries-type color adjustment is possible because there are only 3 knowns, namely the RGB of the white patch. With 3 or more known colors, it is possible to solve for all 9 components of a 3x3 linear transformation matrix, or the 6 parameters of a diagonal-offset model (Finlayson, Hordley, Xu 2005). Depending on the number and variety of the colors, it is also possible to solve for non-linear terms that help account for differences in the gamma, brightness and contrast settings of the display.

Of the fruits and vegetables shown in Figure 1, the carrots are the least stable in terms of color. Oranges are quite stable, but lack significant reflectance in the blue portion of the spectrum, which makes them less useful for color calibration. Overall, limes are the most stable in terms of their color and reflect significantly across the whole spectrum.

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Figure 1.

NONENZYMATIC BROWNING IN DEHYDRATED FOOD LIPOSOMES

Poster presentation

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Microencapsulation of food ingredients is a very valuable technique in order to improve delivery, stability and controlled release of many beneficial food components. Liposomes are common microencapsulation systems, composed by phospholipids. Many functional phospholipids contain amino groups, making them reactive in the browning development. The most studied browning reaction involves sugars and proteins. The nonenzymatic browning involving phospholipid components has been less explored. The objective of this work was to analyze color changes in dehydrated liposome model systems containing soy lecithin, as a source of phospholipids, considering different drying methods and storage conditions.

Model systems contained soy lecithin liposomes (prepared by sonication or extrusion) in phosphate buffer pH 6, with the addition of either glucose or glycine or both reagents. Each liposome system was dehydrated by two different drying techniques: freeze-drying or spray-drying. The samples were then humidified at different relative humidites (RH). Afterwards, the samples were stored at the temperatures 45 and 60 ºC. Color was measured using a photocolorimeter, using the CIELAB color space, 2º observer and D65 illuminant.

During storage, L* values decreased while a* and b* values increase in all the analyzed systems. These color changes and the chromatic displacement in the CIELAB color space were characteristic of non-enzymatic browning reactions. The changes were more pronounced at 60 ºC than at 45 ºC and at the higher RH analyzed. No significant differences of color changes between were observed in samples dehydrated by the two drying methods employed.

Many dehydrated foods and ingredient formulations, especially liposomes contain lipidic compounds like phospholipids that can participate in non-enzymatic browning reactions causing color changes that might be deteriorative. Therefore, it is important to analyze the conditions for the occurrence of such reactions. This work shows that both freeze-dried and spray-dried food model systems containing soy lecithin liposomes can develop browning even in mild storage conditions.

COLOUR OF HONEYS FROM THE SOUTH-WESTERN PAMPAS REGION: RELATIONSHIPS BETWEEN PFUND COLOR SCALE AND CIELAB TRISTIMULUS METHOD

Poster presentation

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The international market usually classifies honey according to the Pfund colour scale. The Pfund grader gives a measure (mm) of the point along a calibrated amber glass prism where the liquid honey sample placed in a glass cuvette shaped trough matches the prism. However, this device has some limitations (greenish and reddish hues, lack of data from manufacturers, etc.). Other methods successfully tested provide more information of honey colour, such as the CIELAB tristimulus method. In order to find a relationship between both methods, 50 honey samples were selected as representative from the south-western Pampas region (Argentina).

The colour was assessed by a Pfund grader and by a Hunterlab colorimeter, using an optical glass cuvette (1 × 5 × 5 cm). Samples were slightly heated (40 ºC) and centrifuged in order to eliminate bubbles. D65 standard illuminant and CIE 1964 standard observer (10º visual field) were used in the calculus. The honeys ranged between 4 and 85 mm Pfund. Chroma (C^*_{ab}) values ranged between 14.32 and 82.18 CIELAB units, Lightness (L*) between 73.59 and 91.17 CIELAB units, and h_{ab} between 82.94º and 101.07º.

Different mathematical algorithms were tested in order to find the possibility of predicting the Pfund colour of honeys based on tristimulus colorimetry variables. Simple and multiple correlation models were applied including scalar (L* a* b*) or angular (L* C^*_{ab} h_{ab}) CIELAB variables, and good correlations were found.

Multivariate analysis shows a direct relationship between Pfund colour and C^*_{ab} (R^2=0.89) and both variables inversely related to L* and h_{ab}. Multiple linear regression analysis indicates that colour according to the Pfund scale can be estimated accurately on the basis of CIELAB values: mm Pfund = 0.840 C^*_{ab} – 1.026 h_{ab} – 0.631 L* + 155.89 (R^2 = 0.91; $F_{3,46}$ = 152.55; P < 0.0001).

Observers usually interpret the Pfund colour index as the "total colour" of honeys by comparison with a standard coloured glass prism. In order to find a simpler equation, we have defined the total colour (E) as the CIELAB colour difference (ΔE^*_{ab}) between the honey and the white reference. Taking this parameter into account it has been obtained a slight improvement of the linear correlation coefficients. Moreover, the correlation reached higher values (R = 0.98) when a non linear quadratic polynomial regression is used. This allows us to calculate the Pfund index (which is widely used at industrial field) by means of objective instrumental colorimetric measurements, without involving visual comparisons.

COLOR STUDY IN STORAGE OF LYOPHILIZED CARROT SYSTEMS

Oral paper

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Foods from fruit and vegetables provide not only water, fiber, vitamins and minerals, but phytochemicals. There is evidence that the benefits of phytochemicals may be even greater, because the oxidative stress induced by free radicals is involved in the etiology of a wide range of chronic diseases. Hence, the need of antioxidants consumption.

It is therefore proposed as an objective of this work, to study the stability of β-carotene in its natural matrix, encapsulated with different molecular weight maltodextrins. Freeze-dried systems were stored in atmospheres of different water activity. The effects of storage stability and wall materials in carotenoides degradation kinetics were investigated. Encapsulation process followed by freeze-drying was evaluated by spectrophotometric quantification and analysis of color.

The source choice of β-carotene, carrots, has responded not only to the excellent composition of raw materials, but high vegetables availability throughout the year. In freeze-dried carrots systems, the color study through the relation b * / a * was useful, while the luminosity is highly dependent on the systems composition and it is heavily influenced by the presence of water. The presence of maltose or maltodextrins, generates much less change in color. The worst storage situation corresponds to the highest water activity, 0.75. The preservative effect of maltodextrin systems was evident, and even more in the final condition of the encapsulated carrot. The best effect was provided by the MD150 maltodextrin.

Both the optical and electronic microscopy have proven excellent tools to verify the excellent coverage of maltodextrins.

The gained knowledge of the deterioration phenomena of carotenoid pigments in their natural matrix, can be implemented on the development of functional foods, beneficial to the population health.

Presenting author: Alicia Gallo

COLOR-COPIGMENTATION STUDY IN BLENDING WINES

Poster presentation

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Industrial evaluation of color differences research has improved in the last years. Many records on colorimetry application in different fields of industry are known. However there is very little previous information about the application of the color differences to the study of the copigmentation phenomenon. Thus, a study on the copigmentation evolution in wines from different varieties is proposed, realizing a chromatic interpretation of the above mentioned effect.

The spectrophotometric measurement of real and diluted samples wines has been performed. Colorimetric measurement of tempranillo [T] and graciano [G] monovarietal wines, [M] wine (vinification with both tempranillo and Graciano grapes), and [W] wine (blend of [T] and [G] wines) have been made by spectrophotometric determination. Significant differences ($p < 0.05$) were found between [T], [G], [M] and [W] wines. In final stages, where wines were stable, [T] showed lower chroma (C^*_{ab}) values than [G], which means lesser colour intensity. Higher lightness (L*) and hue angle (h_{ab}) values were found in [T]. Indicating [G] led to quite darker and more colourfulness wines. [W] and [M] had a similar behaviour to [T]. They showed significantly lower a* and C^*_{ab} values than [G]. However there is difference between [M] and [W] for h_{ab} y b* parameters.

ΔE^*_{ab} corresponding to [T], [G], [M] and [W] were calculated to evaluate colorimetric difference among the studied wines. The colour difference value ΔE^*_{ab} was in the range between 1.16 and 6.12. ΔE^*_{ab} found between [T] and [G], [T] and [M], [G] and [M], [G] and [W], and [M] and [W]. So, blending wines [W] are similar to [T], however blending grapes have different colour of [T], [G] and [W].

$(\Delta E^*_{ab})_{r\text{-}c}$ between pairs of wines (real/calculated) were 4.09-30.00 CIELAB units. $(\Delta E^*_{ab})_{r\text{-}c}$ was 13.58 in the initial stages, in which the copigmentation phenomenon is more present, and 9.27 in the final stages. The evaluation of this parameter allows us to know if changes of color owed to the copigmentation are visually relevant.

[M] had higher copigmentation values in the initial stages ($(\Delta E^*_{ab})_{r\text{-}c}$=14.44). [G] and [T] had less copigmentation values ($(\Delta E^*_{ab})_{r\text{-}c}$=12.76 and $(\Delta E^*_{ab})_{r\text{-}c}$=13.46 respectively).

ΔE^*_{ab} between 5-12 stages (final stages) were calculated to prove the stabilization wines. [W] is the most stable, however [M] has a similar behaviour to [G]. So, vinification with blending grapes has going to less stable wines than vinification with blending wines. More stable wines were obtained when 20% of [G] wine was added to [T] basic wine. After [W] wine, [T] had the most stable color (ΔE^*_{ab}=12.70), this correspond to higher copigmentation values in the initial stages ($(\Delta E^*_{ab})_{r\text{-}c}$=13.46). [G] had the lost copigmentation values in the initial stages ($(\Delta E^*_{ab})_{r\text{-}c}$=12.76) and color differences higher in the final stages (ΔE^*_{ab}=16.84).

OPTIMIZATION OF SENSORY ANALYTIC METHODOLOGIES APPLIED TO HETEROGENEOUS VEGETABLES

Poster presentation

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The objectives were: (a) to develop a methodology that allowed obtaining statistically reliable data for sensory evaluation of the appearance of heterogeneous foods like broccoli; and (b) to compare appearance quality evaluation of broccoli using trays of the real product versus digital photographs of the trays.

A panel of 8 assessors was screened and trained in descriptive analysis (DA) following the guidelines of the ISO 8586 – 1 Standard. Broccoli samples with different storage times (0, 4, 6, 11 and 26 days at 10 ºC) were used for appearance evaluation. Samples were presented in trays that contained approximately 300 g of broccoli. The assessors evaluated the broccoli appearance using four descriptors: dark green, green, yellow and brown colour. Each colour was evaluated using a 0-100 scale; where 0 = absence of the colour and 100 = all of the broccoli with the colour. Measurements were by duplicate in different sessions. A month after having used the DA, the same panel was trained in sensory quality methodology (QM). The panel used a 6-point degree of quality scale, with 6 corresponding to fresh broccoli and 1 to a completely spoiled broccoli. Each point on the scale responded to a description obtained by consensus. As soon as the real trays had been evaluated, their photographs were taken under the same standardized lighting as used by assessors to evaluate the real trays. A week after having evaluated the real trays, the same 8 assessors measured the appearance quality of the digital photographs on PC monitors, using the QM. Assessors were not aware of any relationship between the real trays and the corresponding photographs. Measurements were by duplicate.

DA method showed high dispersions between assesors' duplicates on the same samples and the average scores were not always correlated with storage time. Assessors' duplicate scores on the same samples for the QM showed low dispersions and the average scores were highly correlated with storage time. Analysis of variance showed that there were no significant differences between evaluations of the real tray and the corresponding photograph. As an example, for 11 days storage the quality averages for the real tray evaluation and the photograph evaluation were 2.2 and 2.4, respectively; standard error of the difference was 0.17.

The QM would be advantageous for the sensory evaluation of appearance of hetereogenous products such as broccoli and this method could be used with digital photographs instead of the real product. Both these applications make QM an interesting alternative for sensory evaluation of appearance.

DRINKS AND CONTAINERS: EXPERIENCE FOR COLOR APPEARANCE TEACHING

Oral paper

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A drink can have a certain color and look like it has another one, because of the influence of the container's color. The design decision of this appearance may favor or change the communication of the product quality and cause acceptance, indifference or reject in the consumer. We ask ourselves, to what extent the visual perception of the product can be intervened, without changing it chemically?

The color appearance, just like cesia, is not always a subject to study in depth in the projectual language teaching, but it is of great importance if we associate it to foodstuff launching, without ignoring other relevant aspects (form, size, graphic design, etc.).

The color appearance of a drink can be modified because of the influence of the container's color, and due to this from the syntactic, besides of the *juxtaposition*, the sustractive mix of colors must be studied, as a result of the articulation by *superposition* in combination with cesia.

This is an experimentation proposal to introduce the *color appearance* as an education subject to the 2nd year Industrial Design students in Mar del Plata.

The development of the subject counts with a descriptive moment, survey and case study, and another experimental moment with variables and invariables determination for the later analysis from the syntactic. It is proposed for the following years the possibility of going in depht from the semantic and pragmatic through opinion polls where the students can approach to the facts.

This work launched in advanced in the 2008 Argentine Color Congress, pretends to go in depth in the color and cesia teaching through the applied experimentation and favor the *color appearance in foodstuff study*.

THE COLOR OF BACCHUS

Poster presentation

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The wine has been present throughout the history of the humanity. It represents the Dionysian spirit of the celebration and pleasure, has been the elixir of the religious rites, balsam of miraculous medicines, romantic refuge of poets and artists, mandatory partner in any personal encounter, and lately also, a symbol of distinction and erudition.

The incorporation of wine as one of the primary exportation products from Argentina during the '90s was accompanied by a deep process of transformation in the national wine industry. The production diversified in order to achieve autochthonous and original products, along with the modernization of the technology to improve quality. The packaging and commercialization systems evolved to much more complex solutions oriented to the demanding and changing international market, although without neglecting the local presence. In particular, and this is the main topic of the present work, intensive use was made of visual communication to seduce the customer with a strategy that clearly segments the market in categories that reflect social and economical conditions of clients.

The central aim of this work is to explore the strategy of visual communication, and in particular, to analyze the role that color plays as the main referent of wine, in its extremely complex semantic plot.

Since advertising strategies extend the cosmetics of the packaging and their label, projecting itself to the massive means of communication that intent to reconstruct into the customer mind an image meticulously designed of the product, we must assume that the research domain is not restricted to the material object, but also, its compress the virtual presence in the campaign of visual contact of the graphical publicity, the televising publicity, and the presence in the different ways that the Internet owns.

In smaller degree, but equally important, it is the effect that has the increasing importance of the eno-gastronomical tourism, that incorporates to the strategy of the corporative image, the design of the spaces of reception of the visitors. Of this form, stays, warehouses, and vineyards, are redesigned to rescue the values of the local identity and the artisan tradition, the factories to show the technique the service of the quality, and the whole based on a fort respect by the environment. The exposed thing the complexity of the study subject is come off clearly, a product that appears to us with apparent triviality but that it reveals in his analysis an extraordinary wealth of uses and meaning turns that it into a true paradigm of communicational magic applied to the publicity.

NEW COLOR SCALE FOR VIRGIN OLIVE OILS

Poster presentation

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Currently the Spanish Association for Standardization and Certification (AENOR) recommends the Bromothymol Blue Method (BTB) as the official method for determination of virgin olive oil color. Because this visual method does not have very good properties, as have been reported, another color scale,, the Uniform Oil-Color Scale (UOCS), was proposed by our research team (*J. Am. Oil Chem. Soc.* 81: 323-329, 2004). It was elaborated from spectrophotometric measurements at 5 mm thickness, which values were referred to a 10 mm pathlength by means of the Lambert-Beer law. However we have found recently that Lambert-Beer law cannot be applied for accurate virgin olive oil color measurements (*J. Am. Oil Chem. Soc.* 85: 1063-1071, 2008).

The goal of this work is to report on a modified UOCS (M-UOCS), which having the same number of standards (60 standards) than the previous one, performs considerably better than UOCS and the old BTB scale.

To elaborate the M-UOCS we have used as reference a virgin olive oil dataset of 1700 samples measured at 5 mm thickness and extracted over four crop seasons in Spain. All the color measurements were made less than 1 hour after the extraction using a Hewlett-Packard 8452 UV-visible diode array spectrophotometer.

The new scale M-UOCS has been made up following regular rhombohedral lattice in the DIN99d color space. This lattice supposes Euclidean distances, thus the highly uniform color space DIN99d has been chosen. The new scale fills the color gamut of the measured oils. This lattice is a type of "closest packing," where each point of the lattice is surrounded by 12 equidistant nearest neighbors. Longtime ago this arrangement of colors was chosen by the Optical Society of America for its Uniform Color Scales.

To test M-UOCS we have computed the CIELAB color difference between each one of the 1700 oils in the dataset and its nearest standard. The results show that the mean CIELAB color difference for the M-UOCS is $\Delta E^*_{ab,10} = 2.86$ (SD=1.43), which appears as a good improvement in comparison with previous results: $\Delta E^*_{ab,10} = 3.99$ ($SD = 3.05$) for UOCS, and $\Delta E^*_{ab,10} = 8.17$ ($SD = 6.64$) for BTB. Also we have obtained that the percentage of oil samples classified using M-UOCS with a color difference lower than 7.0 CIELAB units is 98.6%, while this percentage was 59.1% for BTB and 93.2% for UOCS. Our current work tries to confirm the good results found for M-UOCS using a new dataset of commercial virgin olive oils from different countries.

SOME CONSIDERATIONS ABOUT LIGHT AND COLOUR IN THE GASTRONOMICAL PREMISES

Oral paper

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Nowadays eating out is rarely a formal occasion, but it is an event, a celebration much more relaxed and less inhibited than it implied before, these encounters take place in much more informal and relaxed places. That is why, going out has become a lifestyle, a way of entertainment as well as an activity. The restaurants/bars and bistros have replaced the bars, becoming the new meeting places for people. There is an extensive variety of them, from the traditional bar, the small cafe, the theme bars, half restaurant, half coffee, half museum, and half merchandising shop, and the great patios of food among others.

The common characteristic is the singularity of each one generated not only by the supply of meals, or the service but by the design of the space and its environment, in which light and colour play a decisive factor, these variables serve original spatial idea, with its own character, conferring identity to the place.

At present the concept in these gastronomical premises is the newness and the exclusive features (the difference). They, apart from having flamboyant facilities, must breathe, vibrate, in this point it is the magic of light and colour that generates surprise and sensations in the customers. Two tendencies are fundamental to create this differential answer: the subdivision and illumination. The subdivision, that is to say, that within a hall, spaces with different climates and levels are created to give privacy, by using furniture and an illumination design that suitably accompanies the creation of the different sectors and the illumination with its variety of effects, the colour of the walls as well as the furniture take part in general project of the premises proposing the customers a unique experience through them.

The design of the illumination must accompany the atmosphere of each area, for those reserved or more intimate an indirect illumination must be used, for the most social or opened areas, the illumination must be preferably surrounding and diffuse. The combination of these elements will depend on the type of establishment and the customers that it seeks to attract.

In conclusion, it is all about creating different situationswithin the premises in which it is possible to enjoy a good time. The most important thing is to know that we count on so valuable elements such as the light and the colour to create a gastronomical proposal that invites the customer to remain inside. And to come back again.

SPECTRAL REFLECTANCE ANALYSIS OF TOBACCO LEAVES AND FUNGUS INFECTION DETECTION

Poster presentation

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Optical properties of vegetable matter and associated analytical techniques such as VIS and NIR reflectance spectroscopy were used for several decades in the foodstuff industry (Cozzolino et al. 2003, Norris et al. 1976, Murray 1986). By means of these techniques, is possible to study and determine the plant pathology of crops: health or disease conditions, water stress, growth, etc. (Muhammed 2003, 2005), being a good alternative to traditional chemical or biological tests, generally very invasive and even destructive.

The organized array of reflectance in terms of wavelength, ranging generally from VIS to NIR, is called a "spectral signature" of the given specie. The spectral signature could be modifyed according to plant pathology condition of the sample under analysis, for example its health condition, the presence of diseases, plant growth or maturity, nutritional condition, moisture content, etc.

Tobacco is a crop of great socio-economical importance at the north-west region of Argentina. It can be affected by several pathogens in different stages of growing; among these pathogens, the fungus *Fusarium oxysporum* can make the plant to get withered (Ramallo et al. 2005), causing economical and agricultural damages (yield losses, increased chemical products to control the affection, environmental impact).

The aim of this work is to analyse and quantify the effect of the presence and development of the pathogen *Fusarium* on spectral signatures of Burley tobacco leaves, and to evaluate the potential of radiometric techniques as tools for diagnosis. Measurements of spectral reflectance were performed with Optronic OL 750 spectroradiometer, ranging from 310 nm to 1900 nm. The data correspond to two groups, control –healthy– and test –inoculated with fungus–, and would be taken at 1, 2, 3 and 4 weeks from inoculation.

The analysis of the obtained results by means of a Principal Component Analysis, using Stata 9 software, showed that spectral signatures of tobacco leaves are noticeably modified, in the visible region –associated to colour characteristics– as well as in the NIR region, when the fungus was present.

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IMPORTANCE OF ANTHOCYANIC COPIGMENTATION ON THE COLOUR BEHAVIOUR OF RED WINE OBTAINED BY PREFERMENTATIVE COLD MACERATION

Poster presentation

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The phenolic compounds, mainly anthocyanins and their polymeric products are responsible for the colour of red wine; but colour expression of anthocyanic pigments also relies on copigmentation phenomena. Copigmentation reactions consist of non covalent molecular association between anthocyanins and other organic compounds such as flavonoids, alkaloids, amino acids, organic acids, nucleotides, polysaccharides, metals and anthocyanins themselves, generating changes or increments in the colour intensity. At the first steps of the winemaking process, the wine shows bluish hues and high intensity colour since monomeric anthocyanins are involved in copigmentation reactions. Nevertheless, the copigmentation complexes trend to disappear in the next few months of ageing due to the transformation into polymeric pigments. This conversion yields to the colour stabilization of wine which shows brownish hues and less intensity colour.

The objective of this study was to assess the influence of copigmentation evolution on the colour changes of red wines, specifically elaborated by prefermentative cold maceration. For this purpose, four separate vinifications were made from organic Syrah cv. grapes. The whole process consisted of two stages: 10 days of prefermentative cold maceration (5-8º C), followed by 14 days of traditional maceration (20-25 ºC). Colour changes as well as the contribution of copigmented anthocyanins and polymeric pigments to the total wine colour have been studied by tristimulus colorimetry.

The relative contribution of each group of pigments to the total colour of wines was different, which determined particular colorimetric changes of the wines studied. During the storage period (6 months), the contribution of the polymeric pigments increased in all wines; however, the contribution of copigmented anthocyanins was quite variable.

The colour differences due to the copigmentation were also determined. It was observed that the effect of this phenomenon on the colour of wines was always evident, showing ΔE^*_{ab} values upper than 3 CIELAB units. However, the colour of wines is not always influenced in the same way, varying according to the time of storage. At first stage of vinification, the contribution of copigmentation to the total colour of wines affected notably both the chroma and the hue. In contrast, at the end of the storage period, the copigmentation influenced mainly the lightness.

FOOD COLORING AND LIQUIDS - BASIC AND NATURAL COLORS

Poster presentation

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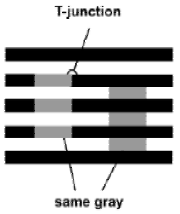
Humans constantly apply a bilateral system of color interpretation: that of light and pigment. Sandford&Gosti create installations and art works based on basic color primaries (RGB and RYB), observing the use of color pigments suspended in water and the duo refraction and reflection of light. The objective of these experiment / installations was to verify White's illusion –also known as the dungeon illusion– (White 2009, Bressan 2008 –colored versions–, 2001 –black and white version–, Munker 1970 –colored version) in a comparison between three natural liquid color contrasts and three basic color food coloring in water contrasts. The illusion involves changes in the lightness of a color test element that interrupts a dark or a light- bar of a dark-light square wave grating (White 2009). In Adelson's (2000) example, illustrated here, he points out that "the T-junctions give evidence that the rectangle should be grouped with the region touching its shorter sides, thus, if the gray rectangle is being compared to the black strips flanking it left and right, it should be seen as lighter, in accord with the illusion". In Experiment 1, we will use three different colors of natural food liquids: teas, wine, beer, or fruit juice, and in comparison in Experiment 2, we will use food coloring in water, using three basic colors (RGB and RYB), as we have in past installations –see image (Sandford&Gosti 2009). We propose a three dimensional structure, composed of piled glass jars containing the colored liquids. The transparency of the container allows for a complex pigment light interaction. When colored liquid is seen in a clear glass jar all four color aspects are activated: adaption, constancy, reflection and refraction. Typically illusion experiments have been visualized with pigments on paper. Will the use of colored liquids in a three dimensional structure create the same effect as White's illusion; the same lightness or color assimilation that is referred to as 'anchoring theory' or 'scission theory'?



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BASICS OF ELECTRODE POTENTIALS AND COLOR FOR REDOX INDICATORS APPLIED TO FOOD INDUSTRY

Poster presentation

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In order to establish the end of a chemical reaction or to test a particular reaction, a substance that changes its color is added to the system. This modification of color occurs at a fixed electrode potential under specific conditions. There are a lot of colorimetric-based commercialized tests applied to control the food quality. A good example of this is the oxygen detection, especially in modified atmosphere food packaging (MAP), in which the food package is flushed with a gas, such as carbon dioxide or nitrogen. The typical indicators are very easy to use and relatively cheap. The reagent is put in contact with the food sample; then its color is compared with a color scale that generally establishes three stages of quality: good, intermediate and poor. There are also colorimetric pH- monitoring test applied to check the rancidity of oils.

As the change of color is due to a reversible change between the oxidized and reduced forms of the reagent, the aim of this presentation is to display the theoretical basis of their behavior.

For an electrochemical system in equilibrium, a relationship is used between the electrode potential for the oxidation and reduction reactions and the concentration of the related species, applied in practical measurements. In the case of organic compounds that are no ionized, the concentration of the hydrogen ion is taken into account. For biological systems as they are mostly neutral (not acid, not basic systems), it is convenient to establish a concentration of the hydrogen ion of 10^{-7} g/l. In a practical determination, a small amount of the redox indicator is added to the system under analysis. Both systems reach the equilibrium point. In this moment, the color of the redox indicator is determined by its potential. Then, as the potential for the indicator in neutral solution is known, it is possible to establish the relation between the concentration of the reduced and oxidized forms through the developed color. Finally, the potential of the system under study can be calculated.

"MAN DOES NOT LIVE BY BREAD ALONE…" ATTRACTORS IN A PLATTER. ART AND PRODUCTION

Poster presentation

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As teachers and investigators, we have always focused our attention on contextual events, and we have taken care of curricular connections of inter-institutional investigations, inter-professorship, inter-professional and inter-community. Our first layout was to mark the networks that schematise itineraries and project encounters justified by the strategies –firstly, the strategic plan of UNLP (National University of La Plata), and secondly, the strategy of the professorship. Strategy 3 of the Strategic Plan of the UNLP, emphasises the role of the institution and confers the relation with the medium a status that appoints it to bigger and more responsible projections.

The aim of this reflexive frame is to take us to the centre of the document: colour and food, boarded with the contribution of a company from Patagonia, which produces *gourmet* products, Valleverde Alimentos SRL. We reflect on *borderline* aspects between art and psychology.

Food colours in nature allow us identification, and the new technologies have used palettes for the first time, artificial colours are both attractors and detractors before the dinner guests' diversity. Generalizations in post-modernity disappear. Food is eaten firstly with the eyes, and there arises the recognition of a language analogous to the colloquial. Deconstruction is immediate in food, speculative in the first place, then related to savour and lastly conceptual. Colour is the first stress –the attractor– probably the one that initiates the dialogue, the one that pre-announces pleasure. Savouring closes the circle of perception, goes beyond colour, sensations, aromas; it compromises all the senses. And this is the main topic of the congress, a *painted* issue to be discussed from a semiotic approach.

Semantics and syntax are aligned with the menu in hand. Nowadays, ceramic art is crossed over by different kinds of languages and multiple technical resources, prioritizing the work of art. The universe of the graphic discourse (vitrifiable serigraphy) and photography (photoceramics) interact as disciplines of transit and relationship. They are, not only production techniques, but also ways to see the world and represent it. We go through multiple chromatic alternatives in singular expressive works of art, in relation with the productive community in the field of visual communication. Technological and expressive alternatives are explored from the ceramic colour viewpoint, which is used under contemporary semantic criteria which, in turn, is crossed over by naturalistic, expressionist or fantastic aesthetics.

All this integrates a realization nucleus which is served on a platter for its immediate *delivery*. The *corpus of the delivery plates* offers a production of photographic images in black underglaze on colour-saturated surfaces which reminds us of pop art. The vitrifiable serigraphy magnifies itself, both in shape and colour, through the selection of features and tonal synthesis, now the representation has real sense, now the colour delimits its artifice. The media amplify the field, shorten distances, food is a show and we all participate in the *gourmet universe.*

MULTI-SENSORY CULINARY COLOURS: SHIFTING HUES FROM GREEN TO BLUE

Poster presentation

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Culturally, culinary colour codes evolve slowly over time. However, since the late 1990s colour has become an important creative means in the industrial food sector. In both the food and cosmetic industries, a frenetic competition has been pushing the boundaries beyond tolerance and acceptance. In order to attract, surprise and even shock the consumer with culinary colours of artificial excess, the market place is breaking taboos. Marketing designers are looking for exciting innovations, not only to sell specific products, but also to induce changes in the consumers mind. Since 1998, the *Comité français de la couleur* has been organizing special colour-and-food-related discovery walks in Paris, as well as multi-sensory culinary events inquiring into the relationship of the food industry, cosmetics, luxury, beauty and pleasure.

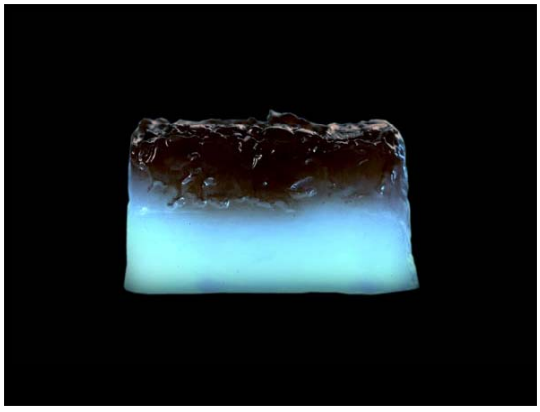
Both Paris-based associations, *ad chroma* and the *Comité français de la couleur*, are collaborating in the present project to reflect on the boundaries of colour concepts for food. In particular, vegetables, fruits, beverages and sweets ranging from green to blue are considered. First we inquire into how far the colour of a specific product can be shifted from a commonly known hue (e.g., green) to an artificial one (e.g., bluish green to blue), from a traditional to an exotic one. What is the threshold at which the product is still recognized and identified as being edible versus repulsive? Is the taste attributed to a product in coherence with its "natural" colour? Finally, this study will show how colour manipulation leads not only to a change of appearance, but also to an alteration of taste and sensation. Is food becoming more and more colourful? How do colour-manipulated foods change our look, taste, and habits? Will, for example, blue become a common food colour in the future?

The point of departure provides culinary designer Muriel Grosjean who has been working on "sensory design" (*design sensoriel*) by elaborating the visual, tactile, aromatic and sonic aspects of innovative creations, such as of chocolate bonbons, exclusive drinks and other delicacies. Her objectives include the perceptive quality of a product that aims to evoke exotic effects, to arouse sensual delight and to stimulate the consumer's fantasy.

In 1959 Fred Carlin founded the non-profit colour association *Comité français de la couleur* in order to address the textile industry and forecast colour trends by creating a colour palette once a year. Since 1963 this association is a member of *Intercolor*. Many other fields are included today such as cosmetics, leather, luxury, decoration, architecture and design. It organizes multi-sensory and pedagogical workshops, as well as colour events for a broad public audience.

ad chroma, a non-profit colour association founded in Paris in 2003, is concerned with the dynamic aspects of light, colour and material within our environments, intimate and public spaces. The objective is to identify converging interests in using colour and colour appearance as a trans-cultural language in research, practice and communication, via an open-minded and critical look.

Zalgue – Menthe à l'eau. Mint Water. Photo © Muriel Grosjean



Stratosphère – Menthe glaciale. Iced Mint. Photo © Muriel Grosjean.

Creation of sensory appetisers; the evocation of these appetisers may inspire cocktails, buffets and aperitifs. Creation and realization by Muriel Grosjean, 2006. Photo © Muriel Grosjean.

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COLOR MEASUREMENT OF "NOVA" MANDARINS SUBMITTED TO HEAT AND DEGREENING TREATMENTS DURING LONG STORAGE

Poster presentation

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The external color is one the most important quality factors of citrus fruit. Fruits reaching their internal maturity, but still maintaining its external green color, have to be degreened to become commercially apt. Therefore, the accurate measurement of color is vital in related research or in grading process of packinghouses. Low-temperature storage is the most important method to maintain the quality of fruits. However, some varieties can undergo –when exposed to temperatures below 12 °C– certain physiological disorders, known as chilling injury (CI), which cause significant deterioration of the overall quality. The development of CI symptoms can be reduced by the application of heat treatments prior to the storage at chilling temperatures. The objective of the present study was to investigate color attributes during the postharvest life of Nova mandarins subjected to long storage at low temperatures. For this purpose, Nova mandarins grown in Entre Rios (Argentina) were harvested and divided into four lots: one was incubated at 20-21 °C in a chamber for 48 h with ethylene 5 ppm (ethylene degreening, D); the second was incubated at 36 °C for 48 h (heat shock, HS), the third was first incubated at 20-21 °C for 48 h with ethylene 5 ppm, and then treated at 36 °C for 48 h (D+HS), and the fourth was used as a control (C). Fruit were stored for up to 60 days at 2 °C (chilling temperature). The evaluations were performed after treatment application, and periodically every 15 days under two conditions: immediately after cold withdrawal, and after 7 days at 20 °C to simulate commercial conditions. Color measurements (L^*, a^* and b^* parameters) were performed with a Minolta Chroma Meter. Average values were calculated for each fruit and converted into IC = (1000*a) / (L*b). Two-way analysis of variance was performed on data with treatment and time as factors. ANOVA and covariance analysis were applied by SPSS® (v 12.0 Illinois, USA).

No significant differences were found among treatments in IC after 60 days of storage. However, immediately after treatment application, fruit submitted to treatment D showed the highest ($p < 0.05$) IC value (16.6), and the decreasing order for the rest of treatments was HS+D > HS > C (12.7; 9.0; 7.0, respectively). In the samplings performed during the storage period, fruit submitted to D and HS+D treatments showed a clear tendency to render the highest values. When CI was analyzed after simulation of commercialization, IC values were higher than those corresponding to the other condition. IC behavior was similar to that found during the cold storage (D > HS+D > HS > C). Results show that the degreening treatment was effective in accelerating fruits color development. Otherwise, the effect of the heat treatments (previous to D or HS alone) was the delay of color development. Hence, the conclusion is that the degreening treatment *per se* is suitable for the attainment of the final color of citrus fruit.

BETWEEN MYSTERIOUS AND FORBIDDEN: "RED IN POMMEGRANATE AND APPLE"

Oral paper

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The color red is observed in many plants, flowers and fruit in nature. Among this variety, pomegranate and apple have especially drawn our attention for a semiotic analysis since both fruit have common characteristics as being names of places and representative of plenty.

The word "Nar" (Turkish equivalent of pomegranate) is identical with the district of Side. This particular town is named as pomegranate in ancient Anatolian languages symbolically represents the fertility of this fruit as a fruitful region. As for the word "Elma" (Turkish equivalent of apple), it is named after the place where apple first appeared; Alma-Ata in Kazakhstan. As the forbidden fruit of Adam and Eve, apple is considered a sign of reproduction in many beliefs.

The representation of these fruits in art is observed since early periods. They are reflected on Ancient Greek-Roman murals as popular subjects of humanity. The paintings defined as "nature morte / still life" have significance in European art. The arrangement of various fruit in a jar does not only associate the sophisticated eating tastes but also include further meanings. Especially in Dutch painting, these objects had become an excellent field of experimentation. In this way, the harmony as well as the conflict of colors was analyzed.

The still life paintings which particularly take food as their subjects are called "bodegón" in Spain. Still life paintings emerge as new forms in different movements in European painting. From their interpretation in Cubism to Chirico and Pop Art, it is possible to view this transformation.

Today, the traditional still life painting is considered an out-dated approach in terms of artistic development. Throughout the development of still life painting, the artist first acted as the imitator of nature, then the creator and finally the selector of the object.

With selections from the paintings and miniatures including apple and pomegranate figures used as visuals in accordance with the main theme of the conference, "from the farm to the table", a semiological analysis will be conducted.

Samples of recipes which employ pomegranate and apple in culinary art will also be presented and a workshop including the presentation and distribution of "Noah's Pudding" as a symbol of plenty will be conducted.

Presenting author: Deniz Özden

AKIDE: A SWEET AGREEMENT WITH THE JANISSARIES

Poster presentation

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Akide candy is a kind of sweet which Turks have enjoyed consuming since the Ottoman period. The candy was named with reference to the *Ulufe*[1] ceremonies in which the loyalty agreement (*Akit*)[2] of the Janissaries with the sultan was strengthened.

Every three months, a meal was served to the Janissaries in the palace garden when their salary was distributed. If the Janissaries were satisfied with the food and pay, akide candy was presented to high court officials as a symbol of loyalty to the sultan. The candy was cooked in the palace kitchen and was in the form of a coin. Later on, the candy was produced in different forms such as lumps, pebbles or rods, as well. Today, it is still a tradition to serve akide candy at religious gatherings held on the 40th and 52nd days following a death as well as on the anniversary of the funeral.

The taste and color of akide candy vary according to the wide range of flavors such as cinnamon, nuts, sesame, lemon, pineapple, rosewater, strawberry and orange. Therefore, the variety is frequently described as "a rainbow of colors, a smorgasbord of flavors and a cornucopia of shapes". Since they are traditionally displayed in huge glass jars, they also serve as window dressing in candy shops.

Within these contexts, the aim of this paper is to conduct a semiotic analysis of the "Akide" candy. The presentation will be supported by two as well as three-dimensional visual demonstrations of the candy.

[1] *Ulufe* is the salary paid to the Janissary Corps.
[2] *Akit* means agreement in Turkish, and the word *Akide* is derived from this root with the help of a suffix.

FEMININE NAMES ASSOCIATED WITH ROSE IN FOOD AND COLOR RELATIONSHIP

Oral paper

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Rose owns an interesting corpus of feminine names associated with food and color in Turkish. This domain which transfers food and beverage tradition from east to west, is the reflection of fragrance and color were a special cultural synthesis is created through women.

Food is based on the redolent petals of rose with its specific fragrance, the use of rosewater, and the attar of rose. This concept which embraces a large spectrum, mostly finds its colors in *Rosa damescena* Mill. [*Pink rose*, *Oil-bearing rose*] growing in Turkey. The flowers of *Pink rose* define the identity of *rose pink* in this color field.

The rose which is a part of the multicolor and well-sugared eastern haute cuisine was among the most apprecited flavors in Ottoman imperial cuisine. Rose culture which was initiated as a Court custom in Sultan´s orchard, includes the realization of rose products by queens or noble ladies. Soft drinks like rose sherbet and sorbets nearby rose sweets like *cüllâb*, *gülengübîn*, *gülbeşeker, gülşeker* were the production of the Palace. Unfortunately today we only have the colors of these forgotten flavors which many of them had been lost. The shades of sherbet influence the *rose color* field which brings out the abundance of pink in this geography as a cultural color. It is the most popular color in the world, and is also considered the most beloved for women.

All these specialties unify the concept of rose with *rose pink.* In addition, they come out as feminine names like *Gülgülü*, *Gülgûn,* and *Rengigül.* The names associated with rose have high rate of frequency and generate nearly a large group of 500 among Turkish names. They are not only derived from rose,they also can combine the verbs including the rose production as they found a beauty in them. They may be about flower picking like *Gülçin*, *Gülderen, Tazegül,* or, they can refer to scattering roses and sprinkling rosewater such as *Gülaver*, *Güleşan* and *Gülriz*. Those names, in each section of concepts of field, can form a whole of the real narrative. *Seringül, Tazegül, Seçgül* and *Tezgül* which are all about rose harvest, almost can be articulated linearly, to mean that rose harvest is done by handpicking only full-bloomed flowers one by one, in the very early hours of the morning. A reading respect to the terms of rose seems to underline the privelieged role of women within the universe of names about food and color.

APPLICATION OF NON-CONTACT DIGITAL IMAGING FOR "MEASURING THE UN-MEASURABLE"

Oral paper

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The visual attributes of food, its colour and overall appearance, is widely acknowledged as one of the most important factors influencing the consumer's purchasing decision. There is a direct correlation between the product's colour and appearance and the product's quality, maturity and the perception of it being "fit for purpose". This consumer perception clearly has a significant impact on how food produce and ingredients are quality controlled for colour throughout the supply chain.

As the retail sector becomes progressively more competitive, supply chains more complex and divergent the pressures of cost and time escalate, so the process of managing colour within the food sector has become increasingly challenging –it has never been more important to control colour from source to store.

Conventional spectrophotometers have, to date, seen reasonable uptake in the food manufacturing environment, as a first step toward improved accuracy and objectivity in colour quality control. However, these instruments have significant limitations in application, due to the extremely wide range of food produce, its general diversity in terms of irregular shape and form, inconsistent surface texture and appearance, multi-coloured nature and largely transient properties.

Additional restrictions of traditional instruments allow only measurement of a limited area of the product offering an average of the colour of the selected area and crucially, this possibly isolated and potentially unrepresentative area does not correlate with the way the human eye sees colour.

Non-contact digital imaging technology, designed specifically to address such challenges, is now gaining increasing acceptance by food manufacturers and brand owners alike. Unique applications software together with uniform and controlled illumination in a totally enclosed cabinet, has been developed jointly with the Universities of Derby and Leeds and Lighting specialist, VeriVide, to provide the DigiEye system used by multiple international blue chip companies and food research organisations in food sectors and geographies around the world.

The DigiEye system has many diverse and proven applications from raw material to end product. Typical applications include the creation of highly accurate colour photographic standards and specification sheets, post harvest shelf life colour stability analysis, packaging quality control, plus instrumental measurement and assessment against established tolerances.

This non-contact and non-destructive colour measurement system, importantly measures colour in context, not in isolation –measurement of colour as seen by the consumer. The system offers significant and tangible benefits in terms of quality control and brand value over traditional instrumentation techniques, because of its scope, accuracy, repeatability and flexibility. This capability results in real cost, time and substantial production efficiencies not previously realized by either R&D or commercial enterprises in the food sector.

DISCRIMINATION OF FIVE STRAWBERRY VARIETIES BY SPECTRORADIOMETRY AND IMAGE ANALYSIS

Poster presentation

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When the sample present colour variations within it (this is the case of most of foods, including strawberries), important loss of colour information occurs when a colorimeter is used since it measures average colour. However, a digital imaging system records the colour at thousands or even millions of points in the sample (each pixel records a separate colour measurement) and also information about other appearance characteristics. This provides much more detailed information about the colour of the sample, giving the colour distribution within the sample.

The colour of ripe strawberries (*Fragaria* × *ananassa Duch*.) is furnished by anthocyanins, which are attributed diverse health benefits (antioxidant, anti-carcinogenic, anti-inflammatory, and anti-angiogenic properties). These pigments are mainly located in the peel, but also in the pulp.

In previous investigations we have stated that the colour of strawberries is conditioned by genetic and agronomic factors such as the type of soilless cultivation system, being possible to differentiate between varieties based on their anthocyanic content and their colour characteristics (Hernanz et al. 2008).

In the present work a thorough study of the colour of five strawberries cultivars (Aromas, Camarosa, Diamante, Medina and Ventana) grown in soilless systems (also known as hydroponics systems) have been carried out. The fruits were harvested at the same maturation level and the colour of the samples was measured within 24 hours of the harvest both by Spectroradiometry and Digital Image Analysis, techniques that mimic the operation of the human eye which has already proved successful in the objective assessment of the colour of diverse foodstuffs.

Multivariate statistical methods have been performed to find statistical differences based on the colour and the appearance of the samples which are able to discriminate among the different samples surveyed. In this sense, differences due to the cultivar were found especially when image analysis was applied since the presence of seeds on the external surface of the strawberries which can have different hues (from pale green to brown) induces important differences on the appearance of the fruit.

Reference

Hernanz D., A. F. Recamales, A. J. Meléndez-Martínez, M. L. González-Miret, F. J. Heredia. 2008. Multivariate statistical analysis of the color-anthocyanin relationships in different soilless-grown strawberry genotypes. *J. Agric. Food Chem.* 56: 2735-2741.

THE COLOUR OF THE TILES IN THE CENTRAL MARKET BUILDING OF VALENCIA (SPAIN)

Oral paper

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This communication shows the results of a research on the color of glazed ceramic tiles, applied in indoor and outdoor surfaces of one of the most distinctive modernist buildings of the city of Valencia (Spain), the Central Market (1914-1928). This building, used for trade of food, is located in the historical center area of the city and was designed by architects Alejandro Soler i March and Francisco Guardia i Vial. It is a great architectural space in which it takes place the ancient ceremony of the sale of foodstuffs, which is an experience for the senses, and thanks to colour, also a visual delight. The study analyzes the situation, distribution and composition of the ceramic pieces of the building, by its graphic lifting, and a typological, chromatic and computer aided analysis, obtaining a novel colour chart, with was never done before. The creation of this chart has been very useful for the restoration process which has recently been done.

It is noteworthy in this investigation, and as a result, the dominant colour in each of the central market areas, both on the exterior surfaces and inner spaces, as tiles represent a significant percentage of them. The study of chromatic parameters, graphic analysis of the ceramics, its compositions and location, has provided and extended the study of this ancient building and has served as a basis for its recently completed restoration, as mentioned before.

The location and morphological analysis of ornamental ceramic coatings, done in this research, has allowed the cataloguing of the iconology, which is very representative of the modernist language, chronological period when the market was built. It has also been observed the high ornamental value of the different market segments, attending to its compositional features and consistent with the functional zoning.

Presenting author: Ana Torres

WHITENESS, YELLOWNESS AND BROWNING IN FOOD COLORIMETRY – A CRITICAL REVIEW

Oral paper

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Whiteness is an important characteristic of many food products from milk and rice to surimi and pasta. In many cases whiteness is desirable, in others it is not. Deviation from whiteness may be perceived as yellowness or browning, and there are hundreds of articles (and some pages in a few textbooks) describing this phenomenon using whiteness, browning and –less frequently– yellowness indices.

In a review of over 200 articles published in over 30 journals dedicated to food science and technology we have found ample references to the application of these formulae, most of them related to the description of the change in some kind of technological or process parameter, rather than the perceptual change of the white, yellowish or brownish colour of the product.

The most frequently used *whiteness indices* are L*, often erroneously called "whiteness" (as opposed to lightness) and $WI = 100 - [(100 - L^*)^2 + (a^*)^2 + (b^*)^2]^{1/2}$ (or the equivalents with Hunter coordinates). In some publications the $WI = L^* - 3b^*$ formula is used, but to the current CIE whiteness formula we found reference only in one case. The reason for neglecting the only internationally recognised formula lies in the fact that natural or processed food products very rarely are white enough to fall within the limits of its validity.

For the characterisation of yellowness the b (b*) coordinate is used quite often. *Yellowness indices* are unduly neglected in the publications reviewed, they report only in a few cases the application of the YI according to ASTM E313 or the $YI = 142{,}86\ b^*/L^*$ formula according to Baixauli et al. (2002), although in many cases YI would be more appropriate than WI or a *browning index.*

Browning index in the literature may mean one of two things: a simple indicator of a chemical change (often characterised by the optical density at a given wavelength (420 nm) or the ratio of the reflectance at 570 nm and 650 nm; or the colour change due to oxidation of a freshly cut fruit or vegetable surface, during storage or drying, or the baking of bread. The simplest (and probably least adequate) indicator of the colour change is the L* coordinate (or 100-L* or 100/L*), excitation purity is often used following the suggestion of Buera et al. (1985), and the application of a Hunter Lab-based *browning index* has also been reported, following Palou et al. (1999).

We shall present case studies on the comparison of the various *whiteness, yellowness and browning indices* for such diverse products as milk, pasta, pears, surimi, onions and yoghurt.

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COLOR CHANGE WITH THICKNESS IN LIQUID FOODS: DICHROMISM

Poster presentation

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Some materials show the property of change in the color with the thickness, which has been called dichromatism (*J. Opt. Soc. Am. A* 26 (7): 1576-1581, 2009). Specifically, dichromatism is defined as a "phenomenon where the hue of the color in materials or solutions is dependent on both the concentration of the absorbing substance and the depth or thickness of the medium traversed. In most substances which are not dichromatic, the brightness and saturation of the color depend on their concentration and layer thickness" (http://en.wikipedia.org/wiki/Dichromatism). However, usually dichromatism refers to a form of colorblindness in which only two of the three fundamental colors can be distinguished due to a lack of one of the retinal cone pigments. Thus, we proposed the term 'dichromism' to refer to the phenomenon of change of hue with thickness or concentration, as a new form of chromism, similar to termochromism, .photochromism, electrochromism or solvatochromism.

Kreft and Kreft (*J. Opt. Soc. Am. A* 26, 2009) have proposed a method to quantify the dichromism in transparent materials by mean of a "dichromaticity index" (*DI*). This method assumes the validity of the Bouger-Lambert-Beer law and computes the absorption spectra of a transparent material at different thickness (or concentrations) from a measured absorption spectra at 10 mm of path length. The CIELAB coordinates are computed for each computed absorption spectra, and the thickness corresponds to the absorbance with the maximum CIELAB chroma (C^*_{ab}) is selected. The difference between the hue corresponding to the selected thickness and the hue corresponding to absorbance 4 times thinner/thicker (or more diluted/concentrated) is called "dichromaticity index" toward lighter DI_L and "dichromaticity index" toward darker DI_D, respectively. Be careful that the difference is just between the hues (in degrees), but the chroma is not taken into account in these indexes as in the case of the hue difference included in color difference formulas. This could lead to important hue differences with insignificant visual differences in case of low chroma.

We have applied this method to different liquid foods: extra-virgin olive oil (10 samples), the BTB scale for olive oils (60 samples), red wine (4 samples), "corozo" juice (4 samples) and blackberry juice (1 sample) measured at 5 mm path length with a spectrophotometer. The results show a DI_L and DI_D in the range 6.13º to 31.54º and 13.48º to 27.60º respectively, considering absolute values. These results state a certain dichromism in all the analyzed substances. However, a closer analysis of the results shows some inconsistencies in this method. In addition, the Bouger-Lambert-Beer law is not always valid, as has been recently reported in the case of olive oils (*J. Am. Oil Chem. Soc.* 85 (12): 1063-1071, 2008). Hence, further analysis of this method is claimed.

FOOD, EXPECTATIONS, COLOUR AND APPEARANCE

Keynote lecture

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Expectations drive our decisions, lives and actions. Our response to the environment may be actions of duty or pleasure, or engender the dread, excitement, or boredom that lies ahead. Interpretation of the scene governs whether or not we eat the food front of us, or whether or not we patronize a particular store or restaurant. The stimulus provided by the total appearance of the object, scene or event engenders expectations of the outcome of our involvement with that object, space or event.

Throughout the food supply chain expectations are at the heart of quality and price judgements. On entering a restaurant or pub we may subconsciously judge expectation qualities such as cleanliness, comfort, privacy and quality. A major part of these judgements are direct responses to the visual properties of the space.

An account will be given of expectations and how they arise. Examples will be given of expectations that occur throughout the industry, expectations associated with the food itself, with the food environment in the store and restaurant, with the food business façade, advertisement and packaging, as well as expectations we have of people we meet in the food industry.

A holistic approach is taken because total appearance images and expectations are critical in separate and interlinking ways to all aspects of food research, development, production, marketing, sales and preparation, as well as consumption. Above all, they are critical to each individual producer or customer whether they are in the field, kitchen, store, restaurant or pub. They are also critical to those in all areas of industry who contribute to the visual stimulus experienced by the customer. These include architects, store designers, and food producers, whether they be banquet chef or manufacturer, as well as those in advertising and packaging or having responsibility for training customer contact staff.

The focus will be on the food industry, but the philosophy, approach, and interpretation apply to all industries and service sectors that depend on a person's visual appraisal of an object, scene or situation.

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John B. Hutchings

John spent 30 years at the research laboratories of Unilever and during this time worked on the colour and appearance of a wide range of foods. He now acts as an advisor on colour and appearance science to Professor M. Ronnier Luo at the Department of Colour Science of the University of Leeds.

Current projects include fruit ripening studies, beer appearance, development of a colour order system based on biological colour changes and the compilation of a dictionary of colour word use in the English language. He has written two books: *Food Color and Appearance*, now in its second edition, and *Expectations and the Food Industry, the Impact of Color and Appearance*. Over the past twenty years studies have been extended to colour and appearance in folklore, anthropology, belief and custom, biological nature, architecture and design, archaeology, and ethics.

John is holder of the Deane B. Judd Medal of the International Colour Association, the Newton Medal of the Colour Group (GB) and is an honorary member of the Grupo Argentino del Color.

ILLUMINANT ESTIMATION UNDER MULTIPLE LIGHT SOURCES

Poster presentation

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Estimation of scene illumination from image data has important imaging applications, such as color image reproduction, color constancy, and automatic algorithms for image database applications. The scene illuminant estimation problem has a long history. Many algorithms were proposed for estimating the scene illuminant spectra from image data. However, most algorithms assumed uniform illumination from a single light source. Recently artificial light sources such as various fluorescent lights and light emitting diode (LED) have appeared in our daily life. Then a complex illumination environment is constructed by mixing these artificial and natural light sources.

The present paper proposes a method for estimating the scene illuminant spectral power distribution under a complex illumination environment with artificial and natural light sources.

A high-dimensional spectral imaging system for spectral imaging system is realized using a liquid-crystal tunable filter, a monochrome CCD scientific camera, and a personal computer. We represent illuminant spectra with 69-dimensional vectors, where the visible wavelength range [400-700nm] is sampled at equal intervals of 5nm and additionally sampled at eight wavelengths that correspond to the peaks of general fluorescent lights. We estimate the scene illuminant spectral power distribution from the captured 69-dimensional image data.

We note that gloss or specular highlight on object surfaces includes much information about scene illumination. The dichromatic reflection model suggests that light reflected from for inhomogeneous dielectric objects like plastic and paint is decomposed into two additive components; the specular reflection component and the diffuse reflection components. Then the specular reflection component can be used for illuminant estimation. We develop an algorithm for detecting highlight areas from the observed spectral image of a natural scene and estimating illuminant spectra for the respective areas.

Because of two-dimensionality of a reflective surface, the image data of the high light area are projected onto a two-dimensional space spanned by two-principal components. The pixel distribution (histogram) in this space is divided into two straight clusters. One cluster corresponds to highlight pixels by specular reflection, and another cluster corresponds to matte pixels by diffuse reflection. Therefore, the illuminant spectral power distribution can be estimated by extracting the principal-component vector of the highlight cluster and transforming it inversely into the high-dimensional spectral space.

When curved object surfaces are illuminated from several light sources in different directions, the illuminant spectrum estimated from each highlight area corresponds to each of the light sources. Moreover, if the illuminant includes spiky spectra from a fluorescent light, we can identify the fluorescent light source by using the wavelengths of the spike peaks.

The feasibility of the proposed method is evaluated in experiments using actual scenes containing dielectric objects under multiple artificial and daylight sources. The accuracy of the estimated illuminant spectra is demonstrated.

CHROMATIC EXPRESSIONS IN COMMERCIAL ARCHITECTURE: CORDOBA, ARGENTINA

Oral paper

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On behalf of the researches on the subject of color within the framework of the Institute of Color, Faculty of Architecture, Town Planning and Design, National University of Cordoba, Argentina, in this presentation we focus on color of the commercial architecture related to food, that is gastronomic architecture, in two traditional neighborhoods of the city of Cordoba, Argentina.

The emerging commercial architecture in General Paz and Nueva Cordoba neighborhoods, deserves a particular study from the sociological approach. It has created paradigmatic situations in the city within a few years due to the substantial increase of places for gastronomy. It should be noted that there are other equal growth areas, but we will address the study only on these two neighborhoods, because they are situated very near from the city center and are predominantly residential; trade in supplies and services activities work during the day; at night the movement gives way to restaurants, bars, pubs, and the whole gastronomic trade situation. This development is generating a very particular and highlighted renovation in the image of these two areas of the city townscape.

This renewed urban image is primarily characterized by the sudden installation of the gastronomic activity in old houses of the beginning of the 20th century, most located in corners, which according to the different design proposals; retrieve its interiority, revalued textures and colors of primitive materials structures. This, accompanying the gastronomic field that characterize these endeavors, Mediterranean, Mexican, Gourmet cuisine, defining chromatic interior spaces, with the use of vivid colors and textures either in architecture, in furniture, in tableware. At the same time, the chromatic expressions of the façades on sectors of blocks are bringing interesting identity architecture, setting a very special urban image.

In this work we will present a systematic survey of bars, pubs and restaurants with main emphasis on the use of color, trying to understand the information in a profiling, allowing subsequent advance on other emerging studies on chromatic expressions in commercial architecture.

"EL MERCADO SUR": ENHANCED CHROMATICITY, A TEACHING EXPERIENCE

Poster presentation

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As lecturers and students assistants of Urban Morphology –Morphology III– at the Faculty of Architecture, in the National University of Cordoba, Argentina, and within the framework of the research named "Educational practices of urban color. Case study: Morphology III, at the Faculty of Architecture, Town Planning and Design, in the National University of Cordoba", this work entails the use of color in urban areas.

Coinciding with the theme of the congress, and in the proposed topic "color & appearance", our assignment develops in the area of the *Mercado Sur*, a paradigmatic place within downtown Cordoba, Argentina.

This true exchange center, where thousands of people converge daily, has a dominant activity in the building itself, with stalls of fruits and vegetables, fresh meat, fish and food shops, supported by a wholesale commercial activity in the surroundings. All of this contributes to a particular environment and enriches the experiences of the local community and visitors.

The main objective of the workshop, which was held in Morphology III, was to test urban colors throughout the chromatic interpretation of the area, verifying the performance of color in different ways, in large as well as partial parts of the Market, contrasting various components of the urban language. The intention was to discover if the colors used at the *Mercado Sur* area, eventually contributed to build up a legible environmental image.

Based on a color setting intention, we worked with the students at different scales of approximation, expressing the chosen color arrangements through the use of the Natural Color System, in a format designed to be legible as well as systematic.

In the instance of recognizing the essence and atmosphere of the Market area, in order to generate new color palettes, in an exploratory practice, our research was based on the expressions of the main activities and ambiance created by the interaction of color in food –chromatic power– and the urban environment.

In this way, we intended to contribute to strengthen the readability and identity of this particular area of the city, through the recovery and recreation of colors that give meaning to the atmosphere of the urban place.

EVALUATION OF COMPRESSED IMAGES DISPLAYED ON LCD MONITOR (V): INTRODUCING A COEFFICIENT FOR MAXIMUM COLOR DIFFERENCE USED IN THE FORMULA OF UNDERESTIMATING EDGE COLOR DIFFERENCE

Poster presentation

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Although signal-to-noise ratios (SNR), such as peak signal-to-noise ratios (PSNR), are currently used for evaluating compressed image quality, it is well known that image impressions can be different for images with the same SNR. In response to this, we developed a new measure based on the color differences between corresponding pixels of original and compressed images displayed on a liquid crystal display (LCD) monitor. The new measure is a mean of modified color differences, $\Delta E_{00}' = \Delta E_{00} / (1+m)$, where CIEDE2000 color difference ΔE_{00} between corresponding pixels of the original and compressed images is utilized, and m is the maximum color difference between the pixel and its neighbors in the original image. Compressed images are produced from four SCID images using JPEG and HPK software products. Evaluation values of the new measure were calculated from the modified color difference. Subjective evaluations of similarity values were scored by comparing the original and compressed images. Using this method, a correlation coefficient between the objective evaluation values and subjective evaluation values was 0.74. A coefficient for maximum color difference m used in the formula was introduced for improvement of the formula. Correlation coefficients for variations of c values from 1/16 to 16 with step of 2. The highest correlation coefficient 0.95 was obtained for c = 1/8. Consequently a good measure for evaluation of compressed image, $\Delta E_{00}'' = \Delta E_{00} / (1+m/8)$, was developed.

COLOUR APPEARANCE IN LED LIGHTING

Poster presentation

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The development of white solid light emitters (white Light Emitting Diodes, LEDs) with improved light characteristics is helping to spread this new light technology in the domestic and commercial lighting fields. In order to obtain a shape similar to a conventional lamp (incandescent or halogen incandescent lamp), several individual LEDs are encapsulated together so that a non-specialist user can easily have access to this new technology. He only needs replacing the old lamp without the need of changes in the lighting device (luminaire).

The technology used for white light generation in low cost LEDs is based on short waves (violet – blue) emitter chips. This radiation is later changed to white light through a secondary emission of a thin phosphorous coat into the LED encapsulate. In general, the information about the light chromatic characteristics of commercial devices is scarce and it is strongly determined by the properties of the used phosphoric compound.

A study on LED reflector lamps designed for the direct replacement of halogen incandescent "dicroic" lamps is shown in the present paper.

The normal use of these lamps is in ornamental lighting and in many cases, the usual applications involve food lighting: bars, restaurants, home kitchens and supermarket stands.

The light emitted by samples commercially known as "warm light" lamps was spectrally measured in the visible region of the spectrum. In addition, the chromatic coordinates were obtained and compared with conventional lamps. On the other hand, a group of observers assessed subjectively the "appearance" of the LED light and illuminated objects. For that purpose, diverse kinds of food (green vegetables, red and yellow fruit, raw and cooked meat) were shown in three similar adjacent compartments designed as food displays. Two of them were illuminated by conventional lamps (incandescent and compact fluorescent lamps). LED reflector lamps were used for the third compartment. The three specimens were successively shown, verifying that illuminance and luminance levels were the same. Then, the observers answered questions, based on their perception, about subjective issues in food, such as "freshness", "appeal" and "reliability, and the global light aspect".

Significant object colour coordinates displacements in LEDs lighting were observed. As it was predictable from LEDs spectral distribution, orange – red colours were poorly reproduced. However, the subjective experience did not show a remarkable preference to the conventional light sources. Furthermore, several observers qualified the objects under LEDs light as "more naturals".

MEASURING BANANA APPEARANCE ASPECTS USING SPECTROPHOTOMETER AND DIGITAL CAMERA

Poster presentation

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Visual colour appearance of banana fruits dominates the consumer's decision when buying the fruits on the market (Hutchings 1999). Banana colour charts are currently used to manage fruit quality through the whole supply chain. The method is subjective and the scale is coarse. Others apply spectrophotometers for the colour measurement on small areas of the peeled skin (Ward and Nussinovitch 1996). Previous studies have shown that digital imaging methods can be used for fruit colour measurement (Park et al. 2005, Balaban 2008). A more reliable instrumental method is necessary to describe banana ripeness using colour appearance terms and freckle percentage. Such a method would benefit decision making in the supply processes (such as harvest, transportation, packhouse, and on the market shelf), speed up the communication between each supply stage and reduce waste.

In summary, a digital image method has been developed to automatically scale banana images through colour information and freckle percentage to reveal the ripeness of banana fruit. This method is repeatable, reproducible and non-destructive. The technique can be further developed for quality control purposes throughout the whole fruit supply chain. The industry will be benefit from this objective technique by reducing decision time and reducing waste.

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AN INVESTIGATION ON COLOUR SCHEME OF ICE POP PACKAGE IN TAIWAN

Oral paper

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Ice cream sales increased in Taiwan year by year. The amount of annual sales has grown to 2.0 billion New Taiwan dollars (about six thousand three million US dollars) in 2008 (Central New Agency 2008). Ice pop is the most popular types of ice cream. It accounts for 66% of the total sales volume (Eastern Online 2009).

The formula of ice pop can not change after it is launched in the market. The tastes of long sale products are not much. It is inexpensive and the price gap among different varieties is small. Therefore a well-designed packaging is necessary in order to distinguish the different popsicles in market, and to attract more consumers.

People can image the freshness and aroma of food by its picture without touching and seeing it directly. Colour is the most important element to help people make right judgment by sight. Hence this study tries to know how and what colours are used on the package of ice pop.

This study is divided into three parts. First, a survey has been carried on to investigate the ice pops sold in market. There are 89 products that we have found. Fifty-two of them were chosen as examples to analyze their packages. The colours are recorded by Munsell values. This is followed by finding out the major colours and minor colours used in packages. Photoshop software is used to calculate the pixels of different colours on each package. The ratio of colour area were calculated by those data.

It is found that the most commonly used image on the package is the photograph of real ice pop, 71% samples adapted that idea. The hue of background in the majority is similar as the major colour of real ice pop. It is up to 51%. A lot of packages use 3 or 4 colours. Each of them are applied on 30% samples separately. The most popular colours used on package are neutral, by the number of 37%. The next one is yellowish red which is 21%. After all the principle of colour design applied on ice pop package was concluded.

The results of this study are very useful for ice pop package designers and ice cream manufactures.

WHAT IS THE COLOUR OF A GLASS OF WINE?
A multidisciplinary research project aimed to organize the perception of transparent objects and materials into a colour system

Oral paper

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Perceptual colour systems as NCS and Munsell are based on colours perceived on surfaces. When it comes to transparent materials, e.g. glass, plastics and liquids, there is no available colour system based on perception. Pantone has a set of three-step plastic samples with progressively increasing thickness, specified colour codes, but not organized in a colour-space like NCS. Glass Research Institute, GLAFO (Växjö, Sweden), also a partner in this research project, has produced and collected about 2,000 five-step coloured glass samples with progressively increasing thickness receipts and measured with a spectrophotometer for L*a*b* values.

Questions:

1. Can we classify coulor perception of transparent materials in a visual colour system?
2. Can this colour perception be comparable to perception of coloured surfaces as they are represented by the Natural Color System (NCS) in samples and on the computer screen?
3. Can we create a virtual tool to help designers chose colours for transparent materials and simulate the perceived colour in a transparent objects with regard to its transparency, material thickness, shape and light reflections?

Pilot study:

We conducted a pilot study with 20 design students trained in colour observation to perform a variety of 420 colour observations. The students assessed the colours of seven different samples of transparent coloured glass. Three different methods were used for the colour observations, which could later be compared with one another and against the spectrophotometetric measured L*a*b* values.

Method **A**. Each glass sample was compared with the colours of the NCS colour map in that the sample was placed next to the NCS colours on a white background (lightning and other conditions according to Swedish Standard, SS 019104, colour specifications with NCS).

Method **B**. The same as method A but with the difference that the glass samples observed were lifted from the white background so that the background was not shadowed by the glass samples.

Method **C**. The students compared the coloured glass samples with NCS colours represented on a computer screen by holding the sample in front of the screen.

Results summary:

In conclusion, the answer seems to be yes to the three questions. We found that method B and C have a high degree of correspondence among themselves and with the measured L*a*b* values. We also found that the chromaticness of the NCS samples was not high enough for all glass samples. The research team will make extended colour tests with transparent materials, e.g. see how colour perception will change with different thickness of the transparent material. The team will also conduct workshops with designers to find out how a digital tool for colour representation of transparent materials can be designed.

TO DEFINE COLOUR AND SET UP COLOUR TOLERANCES FOR NATURAL FRUIT OR BERRY BASED YOGURT AND JUICES

Poster presentation

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Natural fruit based products such as yogurt and juices are not only be judged according to their flavour, texture, shape or smell but also their colour appearance. The colour will give us visual information and, as such, arouse feelings, thoughts, associations and expectations that make us react. The colour of the juice or yogurt is an important part of the user experience and whether consumer will like to consume the product or not.

For natural products, where additive for colours or flavors is absolutely not permitted, the natural colour from the fruit or berry will be the only source from which to add colour to the product. Depending on the season, the origin and the family, the fruit or berry itself will vary in colour, resulting in a colour deviation of the product. For a raspberry-flavored product most of us will expect it to have a reddish pink appearance. But the question will be how much or little reddish pink it must have and what we can accept in deviation without loosing the raspberry appearance when we will see it. Another question concerns how we form our associations between different raspberry products, natural or artificial. From an early age we will think “ahh raspberry” when we will get a bowl of yogurt or a glass of juice in front of us with a colour we associate with that particular fruit.

By using a colour system, like NCS (Natural Colour System), it is be possible to determine the colour of natural fruit or berry-based products such as juice or yogurt in a given situation. It is also be possible to create and determine the colour area that will be accepted and approved by the customer depending on the flavor of the product. This colour area can be visually illustrated by samples that will indicate the borders for the tolerance and work as a practical tool for the producer.

This paper will present some case studies examining the importance of defining colours and how to manage these colours with the help of visual colour tools for products such as yogurt and fruit juices.

APPLYING MACHINE VISION FOR QUALITY CONTROL OF FRUITS IN HUMAN BASED COLOR SPACE

Poster presentation

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Quality control is an important factor for modern food and agricultural industry because of the increased expectations for high quality and safety standards. Traditionally, the quality evaluation has been done objectively or manually, which is tedious, laborious, time consuming and costly. Moreover, the assessment results are affected by human mood and there are inconsistencies between subject's viewpoints. In recent years, machine vision systems have been substituted for manual inspection of some products in different industries. Computer vision has been also employed for different assessment such as color, texture, shape, size of food and fruit products with the advantage of on-line processing tasks and consistent results.

The present study was an attempt for defect detection and sorting of fruits. To this end, the fruits were put on a uniform black background and the images were captured using a digital color camera. The image was captured with a capturing degree of zero and under almost D65 illuminant, which is a simulation of daylight. At first it was necessary to separate the object from the background, to do that the image was converted from RGB to HSV color space. The experimental results showed that there was an identical threshold in the histogram of the S (saturation) channel of the image which can be applied to separate the object from the background. Then it was necessary to identify the defect parts from the objects. To do that, different methods such as color image clustering in RGB, HSV and, etc. were applied. Furthermore, quantization of the images in single channels such as H, S and V as well as gray scale image was tested. The results showed that the change of color because of the defect is more distinguishable in Hue channel. The effect of illumination and shadow of 3D imaging is less noticeable to this channel in comparison to Saturation and Value. Then the image of H channel was quantized to four groups based on the difference between each pixel value and a healthy object. In this way, the defect of the fruit can be detected according to the degree of destruction. Moreover, the percentage of different degree of defects can be computed and used for sorting of the fruits.

EFFECTS OF STIMULUS CHROMATICITY ON TRANSPARENCY PERCEPTION: A STUDY ON PERCEPTUAL "CLARITY" OF SPATIALLY OVERLAPPING FIGURES

Poster presentation

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In our daily life, transparent material, such as wrapping paper, is often used to make foods (e.g., fruits and vegetables) appear attractive. In this study, we report the result of a basic research concerning human transparency perception.

Previous studies on transparency perception have shown that, for achromatic stimuli (e.g. light- and dark-gray rectangles) presented on a white background, perceptual transparency becomes increased when the luminance of the overlapping area of two figures was around the average level of those of the figures. On the other hand, we have found that, when the luminance of the overlapping area is set at much lower than those of the figures, perceptual transparency becomes much more enhanced, and further, the figure appears to be very "clear", but not "cloudy" or "foul" (Kawai, AIC Color 2001). In this study, we examined the effect of stimulus chromaticity on the perception of "clarity" of the stimulus.

In the experiment, chromaticity of one of the two rectangles was set at one of the four colors which were located pair-wise on the LM- and S-axes of the DKL color space. CIE chromaticity coordinates of the four colors were x = 0.366, y = 0.293 for "red" (increase in L cone activation), x = 0.233, y = 0.355 for "green" (increase in M cone activation), x = 0.269, y = 0.232 for "blue" (increase in S cone activation), and x = 0.386, y = 0.516 for "yellow" (decrease in S cone activation). The luminance of these chromatic stimuli was 30 cd, and that of the achromatic stimuli (x = 0.306, y = 0.321) was 50 cd. The distances of the stimulus chromaticity coordinates from the origin of the DKL color space (corresponding to the adapting white background; x = 0.306, y = 0.321, 74 cd) were the same for the four colors. Chromaticity of the overlapping area was the same as that of the chromatic rectangle, and luminance of the area was 10 cd.

For each of the four test stimuli, a "clarity-matching" experiment was conducted, in which observers matched the perceptual clarity of the achromatic rectangle of the comparison stimulus, composed of two achromatic rectangles (30 and 50 cd), to that of the chromatic rectangle of the test stimulus, by adjusting the luminance of the overlapping area of the comparison stimulus.

The results showed that, for both the LM- and S-axis color conditions, the magnitudes of perceptual clarity of the chromatic rectangle were different between the two color conditions in each pair. For the LM-axis condition, the green or red rectangle appeared clearer than the red or green one, depending on the observers; for the S-axis condition, the blue rectangle, for most of the observers, appeared clearer than the yellow one. The difference in the perceptual clarity within each of the LM- and S-axis conditions, together with the individual difference in the LM-axis condition, suggest that perceptual clarity of chromatic stimuli may be mediated by uni-polar, non-opponent chromatic mechanisms rather than by bi-polar, opponent mechanisms.

MATCHING TARGET COLOURS IN A FOOD SYSTEM USING THE ALLEN COLORIMETRIC ALGORITHM

Oral paper

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The aim of this project has been to develop a colour matching tool for a novel printed food application. The three-dimensional printed food being developed is an "on-demand" consumer product that can be rapidly formed, coloured and cooked. A wide range of colours will need to be accurately reproduced within the food matrix from a set of three or four primary colorants. These capabilities are additional to what is available currently.

The first objective was to develop and validate a model to describe the colour mixing behaviour of selected food dyes. The approach taken was to apply the linear, additive model based on Kubelka-Munk theory in single constant form, common in non-food applications. Unit absorption to scatter (k/s) ratios for three synthetic food dyes, Brilliant Blue, Ponceau 4R (red) and Tartrazine (yellow), were determined from the reflectance of microwave-cooked cake samples containing the dyes, and which were added to raw cake batter at levels which formed a doubling concentration series for each dye. These, along with the K/S ratio for the un-dyed cake, have been used to predict K/S, and subsequently the L*a*b* values, of cake samples containing blends of dyes. The model was validated by comparing predictions with the L*a*b* values of actual samples containing the dye blends. Predictions were within 3 ΔE^*_{ab} units of actual colour, equivalent to a difference that would not be appreciable visually.

The next objective was to match target colours in the cake by adding the food dyes at concentrations computed by the Allen colorimetric algorithm. The targets were the CERAM Series II glazed ceramic tile colour standards. For most colours the predicted ΔE^*_{ab}, a measure of the differences between tile and cake colour, was smallest when K/S of the target was based on the internal reflectance of the tiles. However actual ΔE^*_{ab} was smallest when the specular component was included, and dye concentrations adjusted to range between zero and the legal maximum. Substitution of alternative red and yellow dyes for Ponceau 4R and Tartrazine further improved matching where ΔE^*_{ab} was greater than 5, either by reduction in ΔE^*_{ab} or by shifting the hue angle of the cake colour closer to that of the corresponding tile. The colorimetric approach provides a useful basis for rapid matching of target colours for this food system, and potentially could be adapted to apply to a range of other food substrates.

STUDIES ON DYEING BY "KIKURAGE" MUSHROOM (*Auricularia auricula* (Hook.) Underw.) – RESERCH FOR OPTIMUM EXTRACTING CONDITION

Poster presentation

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Auricularia auricula (Hook.) Underw. (syn. *Auricularia auricula-judae*, *Auricularia auricula*, *Hirneola auricula-judae*) is a fungus, commonly known as Jew's Ear or Judas's ear fungus. In Japanese, it is called "kikurage" (lit. "tree-jellyfish"), and is known as a black or brown color mushroom (Fig. 1). This species is used often in Asian cooking, especially Chinese foods, and is also known as a medicinal mushroom. It is familiar to Asian people and is easily bought in common supermarkets. The foods application for the dyes is superior from the viewpoint of ecology, safety, and convenience. In the West countries, many people try to the mushroom dyeing. However, just several examples of the mushroom dyeing are recognized in Japan. Authors therefore tried the dyeing by using Jew's Ear changing the extraction condition.

Fifty g of the dried Jew's Ear (grown in China, Sanada Co. Ltd.) was crushed with a cooking mixer for 30 s and extracted with 250 ml of extracting liquid under following condition.

- Water extracting condition: distilled water, boiling, 30 min.
- Alkaline extracting condition: sodium carbonate (anhydrous), 80 °C, 30 min.
- Acid extracting condition: hydrochloric acid, 25 °C, 48 h.

After the extraction, the multi fiber (cotton, wool, silk, rayon, acetate, nylon, polyester, acrylonitrile, and vinylon) test cloth was soaked in the extracted liquid, and was dyed at 80 °C for 30 min.

In the acid extracting condition, reddish dye was obtained, and this dyed acetate, vinylon fiber, and especially wool, silk, and nylon fiber to red (as shown in Fig. 2). Generally speaking, the dye from Jew's Ear is suitable for the ionic fibers. On the other hand, *Pleurotus salmoneostramineus* is known as a pale red (rose) color mushroom. It was suggested that Jew's Ear has the same chemical component. It nevertheless appears as a black or brown color mushroom.

Fig. 1. Dried Jew's Ear mushroom.

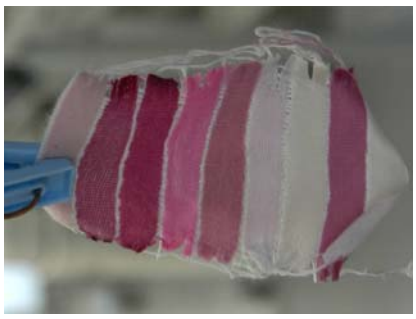

Fig. 2. Dyed multi fiber test cloth.

COLOUR AND LIGHT IN RESTAURANT DESIGN

Oral paper

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The aim of this research is to investigate the interaction of light and colour with colours of food in restaurant or similar locations devoted to food consumption environment and eventual fallouts.

The research focuses on providing the design information needed to make possible perceptual situations that can better interact with both the physiologic and psychological balance of human beings through the identification of colour ranges appropriate to the exigencies of users and operators and of responding and giving consistency to a planning extended to all the problems that characterize this kind of surrounding.

Case Studies / Applications: The research is carried out through case analysis and workshops like the one performed in the Design Campus of Pukeberg (Kalmar, Sweden) consisting in a full scale experimental laboratory testing the connections between light, colour and space. The work was to be made in six teams and each team designed its own box measuring 2.5 × 2.5 × 2.5 m.

There is an understanding of the connection between light and colour, physical, visual and emotionally. Light and colour interact with each other and create visually one unit, a three dimensional "picture" which is experienced as a space.

The space performance is the basis for our understanding of the physical environment. Colour and visual impact of design products and services. The spatial appearance effect on humans bodily, visually and create feelings of well being or the contrary. The projects constitute thus a hypothesis of perceptive elements usage consistent with the adequacy finalities of the environment towards the intrinsic needs of the individual's prolonged sojourn in a specific place.

The general scientific methodology for design research is a phenomenological and holistic approach.

A STUDY OF THE RELATIONSHIP BETWEEN COLOR AND THE CHINESE FIVE ELEMENTS –EXEMPLIFIED BY THE COLOR SCHEMES OF HEALTH FOOD IN TAIWAN

Oral paper

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Not simply for satisfying people's appetites, Taiwan's diverse food diet has been developed and influenced by the natural environment, the economy, politics, religion and culture. The health-enhancing concept of "tonic foods" is inherited from China's "I-Ching" (Book of changes), including the philosophies of Yinyang and five elements, which affect the taste, appearance and cooking method of health foods.

The basis of the "five-flavors / five-colors" concept evolved from the Chinese five elements: Right White Tiger (West), Left Green Dragon (East), Rear Black Tortoise (North), Front Red Phoenix (South) and Middle Yellow Chi Lin Dragon Horse (Chinese unicorn) being the five colors; and metal, wood, water, fire and earth representing the five flavors. Chinese medicine considers internal organs as being related to the five elements: lungs to metal, the liver to wood, kidneys to water, the heart to fire and the spleen related to earth. Therefore, the commonly used regimen of health foods in Taiwan correspond to the five elements and to the five internal organs and are represented by the five colors: white, green, black, red and yellow. The five flavors also correspond to the five elements: spicy, sour, salty, bitter and sweet (respectively corresponding to metal, wood, water, fire and earth). Moreover, seasons are important to tonic foods, with autumn, spring, winter, summer and year-round as the five seasonal times. Special attention must be paid to seasonal rhythms in order to maintain the original flavor of the ingredients with respect to color, smell and taste. When serving food, containers of appropriate color, shape and texture are selected for different dishes and seasons.

The focus of this study is to discuss literature relevant to the preparation process of health foods, from raw ingredients to cooked dishes. Color survey samples will be selected and evaluated for investigating taste and smell. The *color image scale*, developed by Shigenobu Kobayashi, Japan's leading color psychologist, will be used to explore the effects of food color on human senses and appetites on a psychological level. By studying traditional eating habits, a health-enhancing color scheme that integrates Eastern philosophy with modern food culture will be proposed.

VISUAL TEXTURE IN FOOD

Poster presentation

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The wide variety of texture in foods allows one to appreciate the firmness, smoothness, succulence, resistance to chewing, fibrousness, etc., of edible products. To measure these qualities various methods are applied that not only determine the product's resistance to force, but also allows the following: to select duration and temperature of cleaning and mixing, to determine appropriate packaging and machinery for peeling and cutting, to determine the grade of maturity and to predict the expiration date of the product.

Visual texture is also important, of which Hutchings refers to as the character or the "bumpiness" of a surface. This depends on the scale, lighting, distance and visual angle from which the object is observed. In the past, only experts measured texture, and they did so by eye or even by finger. To date various techniques of objective measurement have been developed, considering the texture as a variation of one or more linear dimensions of the material's surface. In such processes, new image digitalization techniques play an important role in allowing to measure, when compared to an established norm, the standard deviation of the samples. The Fourier transformation, in permitting surface analysis in both space and time, has been applied to auto correlation functions to detect deterministic components of a texturized surface.

Building upon previous visual texture investigations, this paper proposes to endorse a more effective method that is able to automatically classify texture. Our proposal combines the wavelets technique to extract the texture's characteristics, with an RNA (artificial neural network) model based on the SOM (self organization map) in order to automatically classify its qualities. On the other hand, the wavelets allow distinct function families to be used, which can better adapt to the different types of texture, offering a better representation than the Fourier transformation. In applying DWT (successive discrete transformations) different patrons that represent the same texture can be obtained. Each RNA can independently classify these aspects so that they may later be integrated into a superior RNA, similar in form to the original, but also that works with human vision.

The entire method, in offering considerable flexibility, is adaptable to numerous circumstances. Additionally, it is very efficient computationally and can be applied to any real situation requiring automatic classification.

COLOR CHARACTERISTICS OF RAW MILK FROM SILAGE AND ALFALFA-FED COWS

Poster presentation

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Food color is the result of natural products associated with the raw material from which it is processed and/or colored compounds generated as a result of processing. It is influenced by how the food matrix interacts with light. The white appearance of milk is the result of its physical structure. The casein micelles and fat globules disperse the incident light and, consequently, milk exhibit a high value of parameter L*. The other color parameters (a* and b*) are influenced by factors related to natural pigment concentration of milk. Carotenoids pigments are related to the yellowness of milk, being this characteristic associated with b* parameter. Forage diets improved the content of carotenoids and vitamins in milk when compared to grain-based diets.

The experiment was conducted during spring (October to December) at the National Institute of Agricultural Technology in Rafaela (Argentina). During a first four-week pre-experimental period, ten Holstein cows were fed on a silage-only diet (SS) with at least 50% of forage; this diet also contained soy expeller and sunflower pellets (3.5 and 1.1 kg/day per cow, respectively) and hay (1.5 kg/day per cow). Thereafter, five cows were randomly assigned to an alfalfa diet (ALF, at least 60% alfalfa of dry matter on dietary basis) while another group remained as control, during 60 experimental days. At each measure time, CIELAB parameters were recorded using a reflectance spectrophotometer (BYK Gardner Color View model 9000), with large port area (5 cm diameter) and D65-artifitial daylight.

	Diet	Feeding time (days)			
		0	20	40	60
L *	SS	89.4 ± 0.7	89.3 ± 0.7	89.6 ± 0.4	89.4 ± 0.2
	ALF	89.6 ± 0.6	88.8 ± 0.8	88.9 ± 1.0	89.1 ± 0.5
b *	SS	8.46 ± 0.7 b	8.63 ± 0.4 b	8.55 ± 0.5 b	8.70 ± 0.5 b
	ALF	7.99 ± 0.5 b	9.09 ± 0.8 b	9.08 ± 0.9 b	10.61 ± 0.3 a
a *	SS	-1.9 ± 0.3 ab	-2.2 ± 0.3 ab	-2.0 ± 0.2 ab	-2.0 ± 0.2 ab
	ALF	-1.7 ± 0.3 bc	-2.1 ± 0.3 ab	-2.4 ± 0.1 a	-1.2 ± 0.2 c

*Different letters show significance differences ($p < 0.05$) in diet*feeding effect.*

As regards of b* component, raw milk corresponding to the alfalfa-based diet showed significant differences at 60 days after implementing the diet. These samples presented higher b* values, which indicates a more yellow color. No significant differences were observed for L* parameter.

A STUDY ON THE PROPER COLOR TEMPERATURE OF LED LAMP IN SPACE OF DINING TABLE

Poster presentation

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The supply of 100 W incandescent lamp was totally stopped in 27 countries in EU from September 2009. In addition, the incandescent lamp beyond 75 W will be disappeared from September of 2010. Every incandescent lamp will be disappeared at the store from September 2012. The supply of the lamp with low energy efficiency will be prohibited until 2016 and the demand of the lamp with high energy efficiency will be increased gradually. As such social trend, LED lamp is upcoming because it be can lower power consumption and various colors and presentation for the plan of energy reduction effect and eco-friendly lighting technology.

This study is to suggest the range of color temperature of LED lamp which has energy saving effect and environment friendly effect as an alternative for incandescent lamp, one of the light source used at the dining place.

The one to one comparison has been performed in the same illuminance through installing the incandescent lamp and LED lamp into two light cabinets respectively. The color temperature of LED lamp was changed in 7 steps in range of 3000~6000 K. The experimental purpose was to evaluate the color rendering, preference and sensitivity evaluation for the food with color range of in R, Y, G, P,W system depending on color temperature. The subject was composed of 30 persons graduated the lighting.

The average value was suggested for evaluation on color rendering and preference through 7 steps likert scale. The factor analysis on sensitivity evaluation depending on color temperature was performed utilizing 7 steps semantic differential method.

COLOR PREFERENCE FOR DINING SPACE AND ITS IMAGERY

Oral paper

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This exploratory research studied color preferences of our dinning space through a series of electronic format surveys asking: 1) What are the color preferences for your dinning space? 2) Are there correlations between demographic factors and color preferences for people's dinning space? And if yes, what are the correlations? 3) What are the color imagery for the colors of dinning space interior?

Altogether 382 undergraduate students of Chinese Culture University participated in the survey using an electronic questionnaire system under a controlled environment. Based on the Natural Color System (NCS), 4 primary colors with 4 intermediate colors, 3 neutral colors - black, gray and white, a total of 11 colors were selected from the color circle to cover the walls of dinning space in the surveys.

The results show white as the most favored wall color for the, with blue a second favorite color, whilst red is third favorite color for dining room. For the least favorites, black is the least favored color. Yellow and leaf-green are the second least favorite color for dining room.

In the color imagery study, a semantic differential scale consisting of 5 bipolar word-pairs (beautiful-ugly, soft-hard, warm-cool, elegant-vulgar and loud-discreet) was used to rate living spaces one after one with 7-step Likert scales. Subjects were asked to pick their most and least favorite wall colors from a set of the above mentioned 11 colors for their dinning spaces. Charts of preferences and color imagery were drawn based on findings and analyses.

Color preferences are related to evaluative factors such as beautiful-ugly, soft-hard, and elegant-vulgar. Yellow, orange and red are related to the warm part of the temperature imagery scale warm-cool where the rest of the colors are related to cool side. Regarding the potency factor on the loud-discreet imagery scale, neutral colors are correlated with discreet imagery, and other colors are correlated to loud.

After a data mining process, results indicate clear relationship between demographic factors and color preferences.

COLOR AS AN INDICATOR FOR THE MAILLARD REACTION AT MILD TEMPERATURES. THE EFFECT OF REDUCING SUGARS

Poster presentation

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Maillard browning is one of the main chemical reactions occurring during the processing and storage of foods containing reducing sugars and proteins. This reaction affects milk protein quality and gives rise to compounds responsible for color and flavor changes.

It is useful to consider three stages in the Maillard reaction: initial, advanced and final stages. In the early stage, the reducing sugar condenses with free amino group of amino acids or proteins and amino acid availability is reduced. In the final stage most of the color is produced.

The rate of the reaction is strongly dependent on concentration, ratio and chemical nature of reactants, temperature, time of heating, water activity and pH. The regulation of these factors is one of the means to control the Maillard reaction progress.

The purpose of this work was to study the effect of heat treatment at mild temperatures in milk protein-sugar models on the development of color by nonenzymatic browning. The kinetic behavior of the Maillard reaction of casein was compared to that of whey proteins and the influence of the nature of reducing sugar on the extent of the reaction was compared at the initial and final stages.

Model systems containing casein or whey proteins and glucose or lactose as reducing sugars were stored at 37 and 50 ºC. The kinetic of the initial stage in the nonenzymatic browning reaction was studied by measuring the extent of lysine loss over time and the final stage was studied by reflectance measurements of the color attribute lightness with a white background of reflectance ($L-L_0$).

At 37 ºC, in the systems containing lactose no color was detected along the experiment, and in those with glucose a slight color was noticeable only at prolonged times of storage, when the loss of lysine was higher than 50%. At 50 ºC, the reaction occurred at a considerably faster rate in the system with glucose, and kinetic constants for lysine loss and color development were higher in the systems containing whey proteins than in those containing casein. In systems with lactose, instead, no significant differences were observed between both proteins. In most systems analyzed, color was detected only at prolonged storage times, when lysine losses were higher than 50%. The glucose-whey protein system was the only where color was detected when losses of lysine were lower than 40%.

The influence of temperature and of the nature of the reactants was stronger on the first stage of the reaction than when color was analyzed. Hence, at mild temperatures, parameters related to the early stage of the reaction could be better indicators of heat treatment than color.

WHAT YOU SEE AFFECTS HOW YOU FEEL ON FOOD

Poster presentation

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It has been shown that color enriches flavor. However, whether color in fact increases our appetite and consumption, either via the enriched flavor or directly, is unknown. In this study, we investigate whether consumers' appetite and spontaneous consumption is affected by color and whether people are aware of the causal relationship between the color and their appetite/consumption. Participants were first asked to perform a cognitive task with priming of a specific color, e.g., red or purple. Then, they were asked to participate in a candy taste study to complete a questionnaire regarding the perceptual characteristics of the candies such as smell, sweet, sour, and taste, as well as the attitude towards the candies such as liking, willingness to buy, and willingness to recommend. Supplementary candies of various colors were provided and the participants' actual first choice and amounts of consumption were measured. In results, we found that taste, liking, willingness to buy and recommend in the questionnaire were all correlated with both of the behavioral measures, i.e. the first choice and the amount of consumption. Most importantly, color priming correlated with the initial choice on the candy color as well as the actual consumption, but not with the explicit rating scores of taste, liking, willingness to buy or recommend. The results indicated that pre-priming color may enhance our appetite and consumption, and that the effect may be direct without via conscious evaluations of taste, liking, etc. The implicit nature of the effect was also evident in that none of the participants were aware of the relationship between the color priming in the cognitive task and the consumption behavior. This research has specific implications on the literature of priming and construct activation, suggesting that color prime could have a direct impact on people's perception of food, attitude, as well as their consumption behaviors. In addition, this research also has implications on food-industry practices; for instance, the packaging of food products and the decoration in restaurants could be altered to strategically prime the concept of the specific color in consumers' minds, and thus enhance the desirability of food products.

USING IMAGE PARTITION AND PROCESS SYNCRONIZATION TECHNOLOGIES TO SHINE FOOD VIA WEB-BASED COLOR GAMUT MAPPING IN CROSS-MEDIA

Oral paper

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The objective in this study is to propose a flying-up approach in color renditions of food considered in complex images among different imaging devices, via a web-based color management system (CMS). Algorithms of both color-gamut and tone mappings among different image devices, via the use of both current information and web technologies, are the focus of this research. A Java Web Start technology is utilized here and provides a GUI (graphical user interface) service and tools of image cropping, image partition and process synchronization. It also performs concurrent color (especially) communication and collection of color-appearance dataset on food considered in complex color images via web, among different food clients and users.

Process of color-gamut mapping in this study is modularized into two modules, including mappings between original medium to reproduction medium (medium-to-medium mapping) and original image to reproduction medium (image-to-medium mapping). The medium-to-medium mapping needs only to be carried out once in the beginning. Then the corresponding information generated is saved into the database and can be reused without performing mapping again. As for the image-to-medium mapping, it can be processed in distributed computer systems after Web Start service has been activated. The mapping modules, by applying multithreaded programming, can incorporate with approaches of both image segmentation and re-combination, and perform in parallel.

In this web-based GUI service, a reference target is configured using an X-Rite ColorChecker Passport alongside with 3 ramps of red, green, and blue. The reference target is used as a visual aid to help with color correction/adjustment and dataset collection of various food color-appearances. The ramps of RGB in visual reference target have perceptually pure appearance of red, green, and blue respectively, when seen on AdobeRGB type of display devices (set to white point of D_{65}). The database system, therefore, is the major platform for information exchange during the mapping and process procedures. Performance of the proposed approach derived will be also evaluated using food-rendition indexes, in terms of both the computational time of mapping and the rendition quality of food considered in complex images among different devices. Testing cases of different kinds of food are analyzed and compared between modules with and without the parallel processing of mapping. The web-based CMS, plugged with GUI service which utilizes the Web Start technology and combines with multithreaded programming, should be proved the applicability of shining food when they are surfed on the web.

THE COLOR RESEARCH OF FOOD PACKAGE IN GLOBAL MARKET

Poster presentation

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Economic globalization promoted by the direct investment of trade and capital and convenient transportation already opens a market gate and brings opportunity once in a blue moon for all the companies all over the world, at the same time, the market competition is also becoming more an more fierce. Under this situation, the visual communication and the brand of the corporation become more and more important in the fierce market competition to outstand products in thousands upon thousands of goods. Color as an important visual communication element in the process of design, essential media of culture and ideology, embodies and represents corporation culture, and maintains it in independent status. At the same time, culture diversity in global market asks designer to consider the diversity of color culture, color preference in local market. So in the new century, it becomes a quite important research topic how to choose and design color in the process of product package in order to obtain emotion resonance and recognition of identity.

The research about several successful cases in the food packages in Chinese market including imported and domestic products finds that all of them choose red as important color communication language. In order to exploring the successful communication process between products and customer, the paper firstly tries to find out the clue from traditional Chinese color culture, analyzes and summaries the history origin, classical character and the package application in ancient time; then elaborates Chinese red and gets conclusion that red experiences three main steps: 1) inescapable biological reactions, 2) symbolisms of the conscious, and 3) cultural influences and mannerisms; finally figures Chinese special red culture and red preference, and summaries that the color culture and color preference still influents the sale of products. Finally, concludes that modern package design based on color culture can improve value-added of product and identity of brand, promote the communication between product and customer. Food package design need consider the different color culture, color preference and color semiotic in order to help the better communication between brand and local market.

A MULTI-SPECTRAL APPROACH OF CROSS-MEDIA HDR IMAGING TECHNIQUE FOR FOOD STORE SCENES UNDER MULTI-ILLUMINANTS USING A LOCALLY OPTIMIZED AUTOMATIC WHITE BALANCING METHOD

Poster presentation

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Multiple illuminants with different color temperatures within a scene, especially of food store, provide a complicated situation for color constancy and automatic white balance algorithms in digital photography. This problem gets even worse in high-dynamic-range (HDR) imaging of such scenes of food stores considered illuminating using various color-temperatures light sources to shine and shine different types of food, since a large scale of luminance information captured from the influence of different illuminants. Under such mixing lighting, the approach of a single global adjustment of colors may not yield a good result, and tends to exaggerate or mess up the color appearance of each food illuminated under its corresponding illuminant, as compared to what observed with the human eye. A set of comprehensive integrated type of cross-media HDR imaging module, using a locally optimized automatic white balancing method, for realistic color reproduction of food-store scenes under mixed multi-illuminants, is proposed to solve this problem. The module will be based on multispectral approach. It also integrates automatic approaches of multi-illuminants whit-point estimation, white balancing via a locally trilateral filtering plugged with chromatic adaptation or color appearance modeling (CIECAM02), gray balancing, perceptual tone-mapping using a bilateral edge-stopping filter, a multiple-conversing-points type of gamut mapping, and device characterization.

The AdobeRGB type of LCD (set to either D65 or D50) is used as a platform to evaluate scene-referred HDR rendition quality of food stores and performances of algorithms in question. Moreover, for reduction of metamerism and color constancy problems which often happened in imaging systems, an ideal type of simulated CIEXYZ camera will also be derived here to carry out the multi-spectral HDR imaging.

Two advanced evaluation of models, conducted via a set of forced-choice paired-comparison psychological experiments and an extension of color difference formulae of S-CIELAB metrics, will be separately applied to deal with the visual differences of complex copy of food-store color images produced on different LCDs. Finally, an optimized full set of general HDR color-transform module applied on food-store scene-referred images will be developed to perform color conversion between imaging devices. The outperforming module derived should be proved usefully and satisfactorily when applied to image quality metrics, image compression methods, and perceptually-based image synthesis algorithms, designed especially for multi-illuminants scenes such as food stores.

KINETICS OF MELANOSIS IN SHRIMP. EFFECT OF PRETREATMENT USING CHEMICAL ADDITIVES

Poster presentation

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To extend the shelf-life of shrimps or crustaceans, melanosis inhibitors have been used. Sodium metabisulphite (MBS) is widely used as polyphenoloxidase (PPO) inhibitor through preventing the polymerization of quinones, combining irreversibly with them, and forming colourless compounds. However, sulphiting agents are known to produce allergic reactions therefore substitute agents must be proposed.

The objective of this work was to study the effects of several chemical additives to prevent melanosis of shrimps. The melanosis kinetics of shrimp was studied during 96 hours using specimens of Pleoticus muelleri from Chubut, Argentina, which were stored at 4 ºC. Three chemical additives were used: MBS (0.6 - 1.25% w/v), 4-Hexylresorcinol (4-HR: 0.0025% - 0.01% w/v) and ficin (F: 0.5 - 2% w/v). An untreated sample was adopted as control.

To evaluate the progression of melanosis (black spots) the color change (darkening) of fresh samples during iced storage was measured. An experimental device was designed to capture digital images of the samples. The lighting conditions in the measuring chamber and the location of the samples were standardized. Analysis of digital images was performed by means of Adobe Photoshop CS3 Extended Version 10.0 software. Total area and darkened area were measured to estimate the color change and the percentage of darkened area (PDA) for each treatment was calculated.

A significant reduction of darkness (60%) was observed at 24 hours for pretreatment samples in comparison with control sample (PDA: 30.3%).

Darkness during ice storage of shrimps was modeled assuming zero order reaction kinetics. Rate constant was obtained by linear regression analysis. The values of rate constant were 0.18 h^{-1}, 0.078 h^{-1}, 0.049 h^{-1} and 0.068 h-1 for control, MBS (0.6%), 4-HR (0.025%) and F (2%) respectively. The effect of additive concentration was only significant for MBS and Ficin. The analysis reveled that the best results were obtained using 4-Hexylresorcinol with a significant reduction (65.2%) of darkened area due to melanosis.

COLOUR AND VISUAL APPEARANCE IN FOODS

Keynote lecture

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Since almost a decade I have involved myself in the study and understanding of the visual phenomena called *visual appearance*, which was added to the experience of almost 40 years in subjects related to colour, and, among other subjects, colour of foods: salted anchovy, beans, corned-beef, nuddles, apple juice, orange juice, milk sweet (dulce de leche), corn, apples, margarine, honey, fish, sausages, tomatoes, wheat, wine, "yerba mate", etc., has been some of the subjects which were studied while I worked at INTI, the National Institute of Industrial Technology.

The present work deals with the intention to describe something more than colour. In fact, it intents to establish a reasoning ground to understand a very complex phenomena, such as the whole visual appearance phenomena, which includes colour, but does not restrict to it.

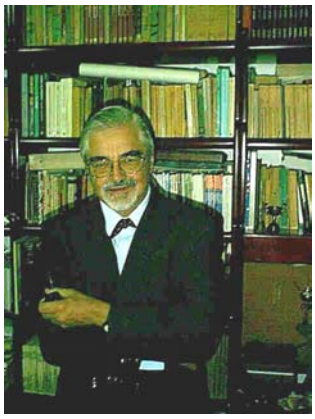
It is well known that only three primaries are necessary to see colour. We shall forget in this abstract to define which primaries are we dealing with. Presently we shall accept that they are three: one red, one green, and one blue. Also, we shall not define which are exactly these colours. Now, when we see a texture, such as the skin of an orange or a lemon, the shell of a walnut, a peach or a strawberry skin, not only colour identifies the product, but the morphological characteristics of its surface and its *visual appearance*.

Just to imagine the complexity of the problem it is sufficient to tell that up to six different orientation angles can be set up relative to the horizontal, defined as 0º (90º, 60º, 30º, 0º, -30º and -60º). To this, one must add what it is called *spatial frequencies*, which are the lines of different width which we recognize as "bar code" used to identify commercial products at the supermarkets paying boxes. It is supposed that only eight of these spatial frequencies are needed to identify its appearance effect.

Three colours, six orientation angles, and eight spatial frequencies make 144 variables, 144 possibilities. And then, this is the question that bristles the skin: If we have three different detectors in the human retina, one for each of the three colours we see... Do we have 144 different detectors systems in the retina to see form, colour and texture? Which are they? How do they work?

That is the subject of this talk.

Roberto Daniel Lozano



Lic. on Maths, he has worked at INTI (National Institute of Industrial Technology) for almost 40 years. His work was related to radiometry, photometry and colorimetry, mainly related to industrial problems, but he has also worked in visual colorimetry. He has published more than 200 papers and a book, *El color y su medición*, and is finishing the second one, titled *La apariencia visual y su medición*.

He was an invited member of the CCPR (Comité Consutative de Radiometrie et Photometrie) of BIPM (Bureau International des Poids et Mesures, Sevrês, France), he has been appointed as consultant expert of the UNIDO for his program UNDP in Asia, and has given courses and lectures in different countries of South America, Europe and Africa.

He is holder of the Deane B. Judd Medal of the International Colour Association, and is an honorary member of the Grupo Argentino del Color.

COLOR CLASSIFICATION OF VEAL CARCASSES: PAST, PRESENT AND FUTURE

Oral paper

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In The Netherlands, veal carcasses are classified on the basis of three factors: conformation, fatness and color. Of these factors, color has become an important parameter in the pricing system (involving both farmers and buyers). In the past 20 years, major efforts have been put into the development of a reliable color classification system. Such a system is necessary to guarantee uniform classification results among different slaughterhouses in the Netherlands, but also to provide a sound basis for international trading since the majority of veal meat produced in the Netherlands is exported to other European countries. In this field the Netherlands has a leading position in Europe and third countries.

Initially, the color classification at the different slaughterhouses was performed visually by certified employees of the Central Office for Slaughter Livestock Services (CBS). At 45 minutes post mortem, the color of the m. rectus abdominis (muscle tissue) was visually matched to a 10-point scale ranging from light (1) to dark (10), under prescribed lighting conditions. The colors of the 10-point scale were determined from analysis of the gamut in CIELAB color space encompassed by representative variations in veal meat samples.

As a logical next step, the subjective visual color classification was replaced by objective instrumental color classification. A handheld tri-stimulus meter (Konica-Minolta CR300) measures X,Y,Z tristimulus values which are converted into a color class on the 10-point scale. The algorithms underlying this conversion were derived from comparison and discriminant analysis of the measured L*a*b* values with the visually assigned color classes.

Today, the instrumental classification is still in place. However, to further increase the quality and stability of the color measurements, the instruments have been replaced by newer versions (CR400). Using an additional calibration tile and an improved quality control procedure, these instruments showed excellent inter-instrument agreement and stability of color measurements over time. Also, a new algorithm was developed to convert X,Y,Z measurements into a color class. This scientifically well-founded algorithm is based on the conventional ΔE color difference measure and was tuned for optimal performance with respect to historical databases containing visual classifications.

In the future, we may expect to further benefit from technological breakthroughs in color measurement.

EDIBLE COLOUR NAMES

Oral paper

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A colour naming experiment was conducted via the Web,[1] enabling a large number of observers from culturally and demographically diverse populations world-wide to contribute in a short period of time. The subject had to provide a name for each of 20 single colour patches, presented in sequence at the centre of the display screen on a grey background. The colour naming was unconstrained, so that any combination of words could be used. The stimuli were selected at random from 600 test samples in the Munsell Renotation Dataset and specified in the sRGB colour space. Data was gathered on the subject's age, gender, educational level, colour experience, display type and viewing conditions, as well as the response time for each sample. A simple test was included in the procedure to determine whether the subject had normal or deficient colour vision. So far, over 1200 people have done the experiment, of whom approximately 45% used the English language.[2]

The data for non-deficient observers over the age of 16 were analysed. The centroids of the basic colour terms were validated against the psychophysically rigorous results of Boynton & Olson and Sturges & Whitfield. The refined dataset in the English language resulted in 5428 observations of 1226 unique colour words. 51% of the responses consisted of a single-word, 42% of two words and 6% of three or more words. The eleven basic colour terms proposed by Berlin & Kay occurred in 28% while non-basic terms were involved in 23% of responses. The 27 most frequent chromatic colour words showed excellent correlation with the results of the web-based experiment of Moroney in terms of the location of their centroids.

This paper considers the relationship between colour names and food, or at least edible substances. In the experimental results, approximately 21% of 5500 responses in English were derived from or related to food, of which 65% were single-word and 35% multi-word. 443 terms were used twice or more, of which 85 (19%) were directly related to food (e.g. 'cherry red') and a further 53 (12%) were indirectly related to food (e.g. 'sunflower yellow'). Females tended to use colour names related to food more often than males, and subjects with colour experience more often than naïve subjects. The analysis of response time showed that warm colours were named most quickly, followed by greens. Classification of the 320-colour Munsell Array, using the top 24 colour names related to food, yielded the arrangement in Figure 1. The results indicate the importance of familiar food-stuffs in the recognition and articulation of colours. This is coherent with recent findings on the influence of language in categorical perception.

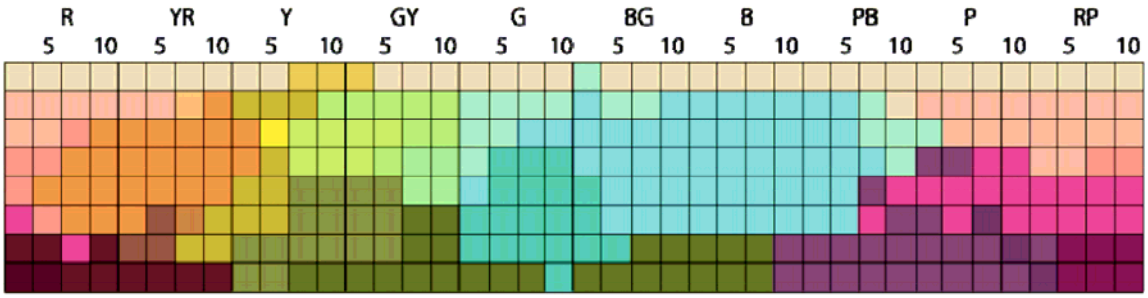

Figure 1. Classification of the Munsell 320-colour array by 24 food-related colour names: apple green, aqua, aqua green, aubergine, Bordeaux, cerise, chocolate brown, cream, dark maroon, dark orange, lemon yellow, light orange, lime, lime green, mint green, mustard, mustard yellow, olive, olive green, orange, peach, plum, salmon, wine.

Notes

1. www.colournaming.com
2. The site also provides versions in Greek, Spanish, German and (most recently) Catalan.

COLOR OF DRIED PEARS AS AFFECTED BY PRIOR BLANCHING AND SUGAR INFUSION

Poster presentation

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It is well known that, among the dehydration techniques, air drying causes browning discoloration in foods. The use of osmotic dehydration -also known as sugar infusion- as a pre-drying step has received increasing attention in the field of fruit preservation processes as a medium to improve quality of fruit products.

The objective of this study was to investigate the color of pear discs (Packham's *var*), after dehydration with and without pretreatments. Convective drying (t = 4 h, T = 65 °C, 4 m/s air velocity, 6% relative humidity) was carried out and two previous treatments were assayed: 1) infusions with sucrose (SI) or glucose (GI) to partially dehydrate the product and reach different water activities (aw = 0.87 and 0.97); 2) a combined treatment of infusion with previous blanching (B + SI; B + GI) with saturated steam (1.5 min) and further cooling in water at (4 °C, 1.5 min). Blanching was used in order to inactivate the enzymes responsible for enzymatic browning. A set of experiments was carried out without pretreatment as dried control (C). Infusions included potassium sorbate and sodium bisulphite as antioxidant and antimicrobial agents.

Color of infused and dehydrated pears was measured by photocolorimetry (2° observer, illuminant C, CIELAB color space) in the central point of both sample surfaces. Color changes of pears were evaluated through L*, a*, b* components and these numerical values were converted into global color change ($\Delta E^*_{a,b}$) and browning index (BI) functions, calculated with respect to fresh fruit (F).

All dried samples (with and without pretreatments) showed a decrease in L* values, except for SI pears pretreated at 0.87 aw which maintained a lightness similar to that of fresh fruit. A significant decrease of lightness was observed in all blanched fruits. All dried pears exhibited an increase in a* values, mainly C samples and those pretreated at 0.97 aw. According to browning index, dried samples pretreated with less humectants (aw = 0.97) developed higher browning than those with infusion at 0.87 aw, which retained a light colour due to the presence of sugars on tissue surface. Blanching promoted enzymatic inactivation and led to less discolored pears. The more important changes in global colour occurred in these samples, probably due to the translucency developed during blanching.

Since pears slices pretreated with sucrose infusion at 0.87 aw before drying appeared with minor browning, the protective effect of sugar concentration was confirmed. According to these results, an adequate control of blanching and infusion treatments prior to drying seems to be useful as a tool for improving product colour.

THE EVER-CHANGING COLOUR OF AN APPLE

Oral paper

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Throughout the times of pictorial production the protagonist has been, without a doubt, the human figure. It can be found in nearly every painting except for abstract works. Thus, to refer to the human figure in painting would be almost too obvious.

On the other hand, have we ever pondered or estimated how many times the representation of an apple appears in pictorial iconography?

This precious fruit, apparently original from the Middle East, is represented as both food and ornament, and even as an icon of biblical history, not to mention in Adam and Eve's epic with the forbidden fruit, still lifes, fruit garlands, among others. The apple appears time and again all throughout pictorial events.

However, what colour is the apple in every case? Does it correspond to the current index colour of the typical *red delicious*, today's referent of apple colour? Does it relate to aesthetic criteria? Is its figure recognized by the narrative context in which the apple is represented?

The paper I am hereby presenting will point out that chromatic trail, its tonal variables, its identity and stylistic treatment, which will be classified depending on the case into: referential, analogical, symbolic and aesthetic. This categorisation is based on the classification I formulated and presented in a previous national colour congress organized by the GAC (Manganiello 1996), at which time I also referred to the import of the chromatic sign in the image, where colour can generate the formal proposal (from the colour red to the idea of apple), or emerge as a result of the shape (a series of different colour apples), or emerge solely from the conception of the idea (red apple).

Reference

Manganiello, Cristina. 1996. El color como elemento comunicacional y sus significados, en relación a la concreción de una idea-mensaje visual. In *ArgenColor 1994, Actas del 2° Congreso Argentino del Color*. Buenos Aires: Grupo Argentino del Color, 19-22.

STATISTICAL RELATIONSHIPS BETWEEN SOIL COLOUR AND SOME FACTORS OF SOIL FORMATION

Poster presentation

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Soil formation is a function of several well-known factors such as climate, topography, parent material, organisms, and time. In the particular case of agricultural soils there are additional factors such as crop management or irrigation systems. The resulting soils have a number of characteristics that must be compiled in order to classify them correctly.

Soil colour is a physical characteristic which can be related to such factors. In addition, it can be used as an indicator of presence or absence of certain components such as iron and manganese oxides, organic matter content, or even water saturation levels over time.

In this paper we use a combination of colorimetric data together with geographical data in order to find out those relationships. A key tool in this approach is the Geographical Information System (GIS) that was used to gather all the information available for every soil sample. Sample colours were measured under laboratory conditions with a colorimeter, whereas geomorphologic variables were derived from a Digital Elevation Model (DEM). Geomorphologic variables include terrain slope, aspect, height, and curvature.

Once all the data were collected, colour information was linked to geomorphologic variables in order to build a unique geographical database. Finally, the data was input to statistical software in order to find relationships between variables.

The study area is located in the province of Alicante (southeastern Spain). Specifically, the statistical analyses were performed on data from several agricultural fields belonging to the municipality of Sax. The principal crops are vineyards, olive trees, and almond trees, either under irrigation or not. On the other hand, some fields are cultivated with conservation techniques, and the stoniness is very variable. The area is relatively small in size, therefore factors such as climate, parent material, and soils are totally defined. The mean annual rainfall is 305.5 mm, and the mean annual temperature is 15.2 ºC. Parent materials are mainly limestone, clay, conglomerate, and sands, and soil orders include *aridisols* and *entisols*, which are the most common in semiarid environments.

FACTORS THAT INFLUENCE FOOD PACKAGING QUALITY

Poster presentation

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The International Trade Center, formed in partnership with the United Nations Committee on Trade and Development (UNCTAD) and the World Trade Organization (WTO), helps developing countries build the trade-related skills and infrastructure necessary to implement and benefit from WTO agreements and to boost their trade.

During 1998, these institution conducted an interesting analysis on the importance of packaging in developing countries as Zinbabwe, keeping in mind the minimum requirements these must fulfill.

While Argentina has a GDP of 14,413 US dollars per inhabitant, 51.4 percent of the population is poor, among which 7,777,000 are indigent poor. This comprises, in addition to other countries, an interesting case study, similar to the cited example. More importantly, a total of 8,319,000 of the poor in Argentina are children and adolescents, whom, for their age, require quality nutrition. This data is taken from the System of Information, Monitoring and Evaluation of Social Programs, a department under the direction of the President of the Argentine Nation.

From this point of view, the current study is of even higher importance than the mere interest and meaning consumers expect from the color and form of packaging, a topic which few would argue if Argentina was not facing a serious poverty problem, or if it was able to export, at least to neighboring countries.

Of course even in poor areas, packaged food items are sold so ensuring that packaging at least partially meets health, security and environmental standards is essential. Furthermore, the poor are still sensible consumers and color in food and packaging does not loose importance. In particular, we refer to the label, which in general comes on low-cost flexible PVC packaging, does not meet minimum information requirements.

This paper aims to analyze the aforementioned, as well as climatic factors that can negatively influence packing, recycling and re-using packaging, incineration of environmentally-damaging waste and energy recuperation, proposing solutions that include color and form.

COLOR-DIFFERENCE MEASUREMENTS USING 9-STEPS GRAY SCALES

Oral paper

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Luis GOMEZ-ROBLEDO,[1] Pedro A. GARCIA,[2] Darya KHAUSTOVA,[3] Syed Qasim BUKHARI,[3] Jabarullaj Khan BISMILLAH,[3] Peng WANG,[3] Alain TREMEAU[4]
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Color differences are often computed in food-color research to measure the influence of different intrinsic or environment parameters, etc. Although agreement with visually perceived color differences is usually desired, advanced color-difference formulas proposed after CIELAB are not employed in most cases. This paper illustrates the advantages of the last CIE-recommended color-difference formula, CIEDE2000, encouraging its use. Using the commercial 9-steps gray scales for "Change in Color" and "Staining", provided by the Society of Dyers and Colourists (SDC) and the American Association for Testing Chemists and Colorists (AATCC), a set of 10 color pairs have been visually assessed. These pairs were produced by Dr. Alman (DuPont Automotive Products, Troy, MI) to show the advantages of the CIEDE2000 color-difference formula with respect to CIELAB. The experiments were carried out in two different laboratories (*L1* and *L2*), by two groups of 9 and 12 inexperienced observers (CIMET Erasmus-Mundus Master students), all of them with normal color vision. Color assessment cabinets with D65 simulators were always employed. The *STRESS* index (García et al., *J. Opt. Soc. Am. A* 24, 1823-1829, 2007) has been employed to evaluate the performance of CIELAB and CIEDE2000 color-difference formulas with respect to the average visual results, as well as to evaluate the average inter-observer variability. Lower STRESS values (always in the range 0-100) indicate better agreement. Next Table summarizes the results found:

STRESS	SDC Change in Color		AATCC Change in Color	SDC Staining		AATCC Staining
Laboratories:	*L1*	*L2*	*L2*	*L1*	*L2*	*L2*
CIELAB	41.8	49.5	44.5	42.2	45.0	55.5
CIEDE2000	27.4	29.6	30.4	33.2	29.4	33.1
Inter-Observer	33.7	36.1	48.0	29.7	35.4	36.5

From this Table, the main conclusions are as follows: 1) In all cases the CIEDE2000 color-difference formula considerably improves CIELAB, in agreement with previous results (Melgosa et al., *J. Opt. Soc. Am. A* 25, 1828-1834, 2008). A higher number color pairs should be necessary to show that CIEDE2000 significantly improves CIELAB. 2) The inter-observer variability is considerably high, in most cases higher than the results found using CIEDE2000. This means that CIEDE2000 (but not CIELAB) predicts average-observer's results better than individual observers as a group.

Presenting author: Manuel Melgosa

USING A PSEUDO STANDARDIZED RESIDUAL SUM OF SQUARES (STRESS) TO MEASURE THE INTRA-OBSERVER AND INTER-OBSERVER VARIABILITY IN A GREY-SCALE COLOR-DIFFERENCE EXPERIMENT

Poster presentation

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The Standardized Residual Sum of Squares (*STRESS*) index was proposed (*J. Opt. Soc. Am. A* 24, 1823-1829, 2007) as a measurement of the strength of the relationship between perceived (ΔV_i) and computed (ΔE_i) color differences, for a given set of $i=1,...,N$ color pairs. Two possible definitions of the STRESS index (in percentage) are given in the next Equations, where F_1 and F_3 may be interpreted as two different scaling factors between perceived and computed color differences:

$$STRESS = 100\left(\frac{\sum\left(\Delta E_i - F_1\,\Delta V_i\right)^2}{\sum F_1^2\,\Delta V_i^2}\right)^{1/2} = 100\left(\frac{\sum\left(\Delta E_i - F_3\,\Delta V_i\right)^2}{\Delta E_i^2}\right)^{1/2}$$

$$with \qquad F_1 = \frac{\sum \Delta E_i^2}{\sum \Delta E_i\,\Delta V_i} \quad ; \quad F_3 = \frac{\sum \Delta E_i\,\Delta V_i}{\sum \Delta V_i^2}$$

The STRESS index can also be used to measure intra- and inter-observer variability. For the intra-observer variability, ΔV_i and ΔE_i are replaced by the visual answers of a given observer in two different assessment sessions, while for the inter-observer variability, ΔV_i and ΔE_i are replaced by the average assessment of each observer and the average of all the observers. The goal of this paper is to analyze the consequences of assuming $F_1=F_3=1$ for the measurement of intra- and inter-observer variability. In a grey scale experiment it can be considered that this assumption is plausible, because the same scale is used for each observer in two different replications, as well as by all different observers. We report results for 10 color pairs assessed by a group of 31 non-experienced observers with normal color vision, using a GretagMacbeth SpectralightIII color cabinet with a D65 source, and a 5-step grey scale (ISO 105-A02).

The assumption $F_1=F_3=1$ leads to a pseudo STRESS index modifying some important properties of STRESS. For example, two different pseudo STRESS values are found when two lists (i.e. ΔV_i and ΔE_i values) are exchanged, this being undesirable for intra- and inter-observer measurements. In our experiment the average intra-observer / inter-observer variability measured with STRESS was 48.3 / 36.1, which increases to average pseudo STRESS values of 62.5 / 47.3 and 55.2 / 44.7, for $F_1=1$ and $F_3=1$, respectively.

The F_1 and F_3 values in STRESS definition provide minimum values of this index, and are an essential part of its definition. Therefore we don't recommend to employ $F_1=F_3=1$ in STRESS formulas for measurements of intra- or inter-observer variability.

NUTRITION BY COLOUR: FOOD WITH BRILLIANCE – HOW HUMAN HEALTH DEPENDS ON ORGANIC PHYTONUTRIENTS

Oral paper

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Linda Montgomery is an award-winning Canadian freelance illustrator, artist, and educator at the Ontario College of Art & Design (OCAD), teaching colour to design students.

I have always been fascinated by the relationship between food, colours and wellness. My presentation will use colour and food as the basis for a visual essay called "Nutrition by Colour". It will use the art of storytelling through a series of illustrations showing ways in which complex science and biology data can be turned into a visual narrative. It will lay the groundwork for a dialogue that can take place and be of value in our contemporary multi-cultural world.

This visible spectrum will illustrate the health benefits of fruits and vegetables that come from the bioactive compounds that give these foods their intense and vibrant colours –specifically the photonutrients in each of the seven colour groups of white, blue, green, orange, yellow, purple and red foods. The project will demonstrate the power of visual communication to show how creating a daily diet of colour can result in positive health benefits, by helping to slow the aging process, increase longevity, support immune and prevent and protect specific organ systems.

In creating this illustration series, my first step is to research the science and biology of food and colour and then translate the facts into a visual language. The resulting images will depict the phytonutrients and the effects on the body systems using the facts available as a design brief to tell the visual narrative in a storytelling mode. The illustrations are used as visual communication in a conceptual process using the elements and principles of design, including, line, value, shape, space, texture, and most importantly, colour.

My main objective is to reinforce that highly processed foods using synthetic colour dyes cause internal disharmony, and create a false sense of external colour value. These foods lose their natural colour, flavor and photonutrients quickly when exposed to high temperatures, light, air and moisture, in comparison to organic fresh foods that retain their life-giving and colourful energy.

The "colour and food" narrative will showcase the importance of organic farm food to health and wellness –and explore the notion that eating a variety of food colours maintains balance in the human system and protects us from the superficial and synthetic colours which challenge our immunity and our well-being.

The illustrated presentation will highlight the importance of colour in representing the sustainability of human health, and visual information that contributes powerfully to our contemporary search for longevity. Creating compelling visual communication makes complex science and biology information accessible to a broad audience –and this is critical to the development of health and wellness practices across the globe today.

THE SWEET TASTE AND THE KNOWLEDGE OF COLOR BETWEEN FORMS AND SPACES

Oral paper

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The color in architectural space is not a superficial quality imposed at the end, instead, it is an intrinsic part of the matter of which it is composed and it is contained. The color is a protagonist of the creative process, it enhances the formal qualities and emphasizes the settings suggested by the designer, in exploration and experimentation phases, enabling to produce multiple levels of complicity in order and layering structures.

The economic, technological and cultural aspects of the new millennium impose a new stage of relations, where space and identity, articulate thru communication and consumption. Against this, our proposal makes a study of the architectural object and its relationship with the colors of food, trying to analyze the dialectic established between the bakery and the stage, shape-space that contains it, “Tea Rooms”. The way to present candy, appearance, color, texture, as opposed to the spaces created for that purpose, where coexist generate postal tradition, art, anthropology to sociology.

Colors have special influence on our lives, because they appear to us perceptually and interact with the spaces and textures of food, a play of light intensity, contrast and saturation levels, resulting in different forms of emotional reaction and social-behavioral response. Color is one of the parameters that most influence has in the rejection or acceptance of food by consumers.

All these elements are involved and organized, are explored and are considered as subjects of design. It is important to discover and build through a conscious and creative management, to be translated into a project or architectural object.

They appeal to the visual memory that guides relations between shapes, spaces, colors and foods and produces a close intertwining between intellect and consciousness tasting. The psychological components of the color producing act a certain sensation in the observer-gourmet, function as facilitators to elicit kinesthetic sensations.

It's about finding the meanings of color in their functional, psychological, perceptual, beyond its conventional context and rhetoric, appealing to a communications field of gourmet entanglement between the metaphorical and the architectural object.

COLOUR AS A CODE IN FOOD PACKAGING: AN ARGENTINE CASE

Oral paper

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Intellectual and emotional aspects of the product's image raise the concerns about its qualities; concerns about nutrient content, the ingredients, the amount of sugar, salt, fat. The product appearance induces expectations. "Expectations govern our attitude to food and the food scene. We deduce from the appearance of the food in front of us whether it will harm us or be good for us", says John Hutchings. The consumer searches for the attributes he considers most suitable according to his internal needs, in the products he wants to buy. It is necessary to define a target segment to propose the product that is effectively closer to the ideal of the buyer and to communicate its benefits.

This is why the packaging has a big responsibility. Emotions, memory, social patterns, are behavioural areas in which colour plays an important part. There is a message to remember, and the packaging is a message in itself; it helps to guide, motivate and encourage consumers in their purchase decision. It is imperative to choose the potential customer for the message; each target has its language, its expectations.

Visual identification

The graphics and colours used in the pack must be consistent with the status or image or expectations that it wants to give and must serve to identify and locate the product. Colour improves readership. Colour can be used as a referent code system for the product. Colour coding helps to clearly identify the desire product.

In spite of the fact that some brands traditionally use green as a strong identifier, green colour is used in associations with the green countryside and healthy products in most countries. Green is related to nature, freshness, fertility, peace, hope, humidity, regeneration, growth, relaxation; is calming, curative, balsamic, in its positives meanings. In many countries is used to identify bio products. In some others, green is also a visual attribute related to low fat; so do pink and light blue.

It is interesting to see how in Argentina, green colour has definitely been adopted as a category' code, especially in dairy products. At the supermarket it is easy to recognize from far away the area for low fat milk if you see a green spot. The green theme emerges in the Argentine market around the 90s, when the changes from diet products to light ones come out in order to clarify what is being offered to consumers. The diet products sought in a colour as blue / cyan a cleaner and pure image, in association with reduced-calorie diets. At the beginning of the change, diet and light were virtually synonymous, but light category products wanted to find their own individuality in a codified meaning, an identity charged with emotional values as care and health, without giving up flavour. Big companies of massive consumer products invested heavily in communication to encourage the stablishing of an expressive symbolic code. In the last two years this code has widely spread to others categories.

The official Argentine food code and that one of the Mercosur include the requirements for food labelling, in order to give the information that builds confidence, but no rule appears mentioning the use of colour as an identifier.

IS THE COLOUR MEASURED IN FOOD THE COLOUR THAT WE SEE?

Keynote lecture

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The foundations of Colorimetry establish that the measured colours must correspond to the colour seen by observers. If the correspondance is not good, the response of observers is the correct one, and the experimental conditions of colour measurement must be revised.

Since I have been measuring food colours, for the last 30 years, I have had a doubt: are food colours well-measured? Or rather: Does the colour coordinates that have been found in the laboratory correspond to the food colours seen by customers (or experts)?

On numerous occasions, I have found that the answer is negative. There are four groups of problems responsible for this.

Firstly, official methods to measure the colour of certain foods are not related to the actual observation methods of expert colour assessment.

Secondly, some authors (and, consequently, referees) do not know the significance of colour coordinates. On other occasions, authors make a statistical study of each colour coordinate separately to ascertain the acceptability of results, instead of the three coordinates together and/or the colour differences.

Thirdly, authors use measuring instruments which are not suitable for the optical properties of the food to be measured, producing unacceptable results.

Finally, if the foods whose colours are to be determined are not homogeneous (mainly fruits with red and green or orange areas), the methods of measurement used (one measure of each colour) cannot agree with the results of the panel of experts. It is necessary to change the measurement method.

This talk will discuss these problems.

Angel I. Negueruela

Angel I. Negueruela is Senior Lecturer of Applied Physics in the Faculty of Veterinary Science and of Food Science and Technology of the University of Zaragoza (Spain). For 30 years, he has been working on the colour of a range of foods that include liquids such as wine, vinegar, oils and honey, and solids foods such as meat, fruits, rice, vegetables and bakery and confectionery products for sufferers of celiac disease.

He now belongs to the “Foods of Vegetable Origigin Investigation Group” managed by Professor Rosario Oria, and is responsible for the group’s studies on colour and on digital image processing of foods. He has been vice-president elect (1997-2000) and president (2000-2003) of the Comité Español del Color (Spanish Committee of Colour).

COLORADD. COLOR IDENTIFICATION SYSTEM FOR COLORBLIND

Poster presentation

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In the most developed states colorblindness affects 10% of the male population. This handicap incurs limitations as well as uncomfortable personal and social situations for those afflicted that depend on others to choose products in which color is a predominant factor, such as pieces of apparel and decoration.

A sample group of colorblind people showed in a recent study found relevant the development of a system which would allow them to identify colors. The development of a graphic color identification system was the answer to this need, its concept and structure make it universal, easy to communicate and memorize.

The first symptoms of color blindness are detected at school age due to the difficulty in interpreting drawings, maps and identifying colored pencils. Later in life a color blind person is prohibited of performing certain jobs completely, while some professions will bring added difficulties. Similarly, managing daily routine poses problems, buying and choosing wardrobe as well as using maps and signs to provide orientation. Even while accessing the internet some text can become illegible due to the use of certain colors.

This system can be used in a variety of products and allow the colorblind to reduce or even eliminate their dependence on others. Each day society grows more individual centric. Each person, sometimes, becomes totally dependant on itself and asking for another person's help, besides creating some frustration and feelings of dependence, is not even always possible. The "wrong" interpretation of colors can harbor insecurity in social integration of the individual whenever the projected personal "image" is a key factor in rendering judgment.

Using primary colors, represented through simple symbols, the system was constructed through a process of logical association and direct comprehension, allowing its rapid inclusion in the "visual vocabulary" of the user. This concept makes additive color a mental game, which lets the color blind relate the symbols amongst each other and with the colors they represent, without having to memorize them individually.

The system proposed is based on the search of the pigment color, using as basis the primary colors its additive secondary colors, because the color blind person does not possess the correct vision of the colors, nor a tangible knowledge of how their addition works.

Its use, given the characteristics of the system, means a practically insignificant cost and its adoption by the industry and society can improve the satisfaction and wellbeing of a group of individuals whose particular vision characteristics deprive them of a fully independent and tranquility every day experience of picking their clothes or select the right food product, where the color is also reference.

THE USE OF COLOR IN A VILLAGE OF FISHERMEN. CASE STUDY: NEIGHBORHOOD "SAN PEDRO PESCADOR", ANTEQUERAS, CHACO, ARGENTINA

Poster presentation

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The aim of this paper is to know the use of environmental color in the San Pedro Pescador neighborhood houses, Antequera town, Chaco; with a purpose of improving the life of its inhabitants –mostly fishermen– through a visual identification from color, giving the area a tourist attraction. The focus of relationships –living in a village of fishermen, use of color in their houses and boats– seeks to provide concrete tools for planning to promote a more "human" identification of persons who live in this neighborhood of houses.

The San Pedro Pescador village is located near to the Resistencia downtown, in the northeast of Argentina, on the coast of the Paraná River –at the levee or embankment– on the left side of the bridge linking access to Chaco and Corrientes, being fishing the principal activity and source of life and employment for its peoples.

The research issue is of interest because the architectural space and its constraints are very important features, qualities and attributes of materials that make up the environmental envelope, as well as color, texture and joints, as part of the perceptual process of the people of the neighborhood, as inherent to their quality of life.

In the first phase, it is expected to work in the neighborhood on the morphology and urban image, in the geographical, social and economic context of Great Resistencia and its surroundings.

We propose to use the methodology developed by Jean Philippe Lenclos, who, to preserve the sense of place against the growing anonymity in neighborhoods, has reviewed the traditional colors of each region applied to buildings. In this case, given the economic condition of the population in which the work develops, it enlarges the survey of the use of color of the boats, and then transfers them to their houses.

Working stages:

- Stage exploratory and surveys
- Stage of systematization and data analysis
- Stage of testing and implementation
- Stage of definitive proposal

FOOD COLORANTS: ITS USE IN THE DYEING OF TEXTILES

Poster presentation

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Concern for the environment, as well as the use of renewable resources and clean technologies in production, has increased in recent years and has kindled interest in natural materials. Likewise, production processes have become increasingly sustainable and socially just.

Going back to craft techniques and community production processes, imprinted in the cultural tradition of different parts of the world, has also been a response to the negative consequences of globalization for regional economies in developing countries. Within this context, there is a revival of interest in natural dyes for use in cosmetics, food, and textile dyeing.

In Argentina, in the field of textiles and clothing design, craft dyeing with natural dyes has been gaining ground, among both designers and a still small market of users interested in eco-design. This circumstance has allowed to incorporate the work of communities, where the traditional artisanship has not disappeared, and to value this knowledge as an identity element.

Beyond this perspective, the marketing of textiles often involves the need to reproduce the color within certain acceptable ranges for the consumer. It is quite difficult to reproduce a color with natural dyeing inasmuch as this process does not have the same controls as the ones employed in the industrial production.

Although the accuracy requirements for reproducibility are not very strict in the consumer market in question, we thought it would be interesting that these standards be adjusted to some extent. Given that, historically, natural dyes have been used for both food and fabric coloring, and that the food industry currently uses natural products under control standards that ensure a greater similarity between one batch and another, we have begun to explore the use of these products in the dyeing of textile fibers, to see if they can contribute to an improvement in color reproducibility.

ART AND COLOUR DESIGN OF COMMERCIAL ARCHITECTURE DEVOTED TO FOOD

Oral paper

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The colour design in the field of food commerce architecture has been in place since the very beginning of architecture, and some of those structures are still available today. Roman and Greek commercial architecture included the building of elaborate structures, complete with specific colour design (painting, mosaics, etc.) for courtyards, market places and meeting rooms. Today, most architects work in commercial architecture and especially restaurant design. There are four stages to restaurant design projects: obtain client requirements, determine site location, create design proposal and submit a project plan. The space requirements for particular building types (color design in different food restaurants such as French, Chinese, American, and Japanese foods) required different approaches of colour design. Colour study of modern or historically precious buildings helps us to get a sense of local style, height, physical presence and use of color. New materials and technologies demand new solutions of colour design and its strategy. Thus colour design can no longer be understood as the design of surfaces: his consecutive perception embraces the overall effect of light, space and time, of movement and change, of fiction and reality. Architectural polychromatic restaurant design has two main parameters:

1) Activity or magnitude of contrast between the elements of colour combinations: relationship between different colour components.

2) Degree of independence of spatial colour composition and structure in relation to volume and space parameters of architectural form.

The harmony of colours in the art and design of restaurant architecture is a true colour 3D conception, with its nuances and details, with specific colour combinations, constantly changing in space and time. Our system is built on the balancing of the rational harmony of the real world and the emotional transcription of the “reflected” imaginative world. We can distinguish 4 colour fundamental groups: ”Colour”, ”Value”, “Nuance”, “Mixed” and 24 complementary intermediate colour groups. They are the colour combinations inside which the different components lose their own characteristics to the profit of a global perception. The colour combinations can be completely transformed by their surroundings, but they can transform as well the environment design of commercial architecture devoted to food and create psychologically favorable or not favorable atmosphere.

We study the colour harmonies and its classifications with the Natural Colour System (NCS) through history of art and colour design in different epochs and geographical spaces: brasseries, cafeterias, bars and restaurants, any kind of commercial architecture devoted to consummation, gastronomy and commercializing food products. An environmental approach of colour design in order to create the comfortable special background is considered as indispensable for colour conception of exterior and interior design of food commerce buildings.

ON THE COLOR ANALYSIS OF THE PRESENTATION OF JAPANESE FOOD, THE RELATIONSHIP BETWEEN COLOR AND TASTE

Poster presentation

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Color has a significant effect on the psychology of people. The number of studies about color in the presentation of food is less than the number of research and study of artificial coloring and color of food. But the percentage of visual sensitivity is approximately 90% of the total sensory receptors, the color and presentation of food is critical to directing the taste. We noted the information of the colors in the presentation of Japanese food. And we discussed about the color analysis and the conditions we feel food delicious. We processed some photos of the arranged dishes to the mosaic images, because we aimed to exclude the form effect of stimulating images. We measured the color configuration of those stimuli in the pixel unit. In addition, we presented the stimulus of a pair of images to the subjects and let choose a delicious presentation and analyzed the selection process. We got then the results below:

Main color composition of Japanese food consists of white, gray and brown. In addition, there was also a high percentage of yellow and green. Yellow is the color of natural ingredients such as fish and meat, green is the color of vegetables. Subjects are often looking at the middle of the dish. Even when the participants compare the left dish to the right, the eyes of participants will gather in the center of the dish. It became also clear that the eyes of their subjects have a trend to gather accent color of the dish. Subjects prefer a clear boundary between the presentation of dishes and foods in the presentation of the Japanese food. However, Japanese food in the presentation that is scattered in many color, is not preferred. The presentation of Japanese food that consists of white, gray and brown base color with one accent color looks very delicious.

EFFECT OF ILLUMINANCE AND CORRELATED COLOUR TEMPERATURE ON VISIBILITY OF FOOD COLOUR IN MAKING MEALS

Oral paper

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Making meals include many tasks: food preparation, cooking, and so on. In food preparation, visibility is important in checking the freshness of the food, and in detecting perished, spoiled, or damaged portions. Visibility is also very significant in cooking meat in order to know the degree to which it has been cooked.

In this study, we carried out a subjective experiment of the visibility of food ingredients and cooked meat, using light of different sources, illuminance and colors.

We created 36 different lighting conditions with a combination of illuminance and light colour, using 10 fluorescent lamps (D_{65} lamps and 2700 K lamps) on a ceiling in the experimental space, and 12 lighting conditions with 6 steps of the illuminance, using 2 types of LED (2900 K and 5400 K). And we could manage the range of illuminance from 50 lx to 1200 lx, and that of correlated color temperature from 3000 K to 5500 K.

Subjects observed 2 color charts for the food ingredients and cooked meat, according to the measuring results of the luminance and chromaticity. And they evaluated the visibility for the food ingredients and the visibility for cooked meat, according to the 4 steps of categorical scales 'clearly visible', 'visible', 'barely visible' and 'invisible'. They also evaluated with the method of Magnitude Estimation as the basis for the lighting condition, 1200 lx in illuminance with D_{65} lamps. The subjects were 22 female university students, in their twenties. And they were accustomed to cooking, in their cooking class, belong to the department of food science and nutrition.

According to the results, it was found that the visibility was higher as the level of illuminance on the worktop increased. It was also found that the visibility slightly increased as the colour temperature was higher. 80% of the subjects evaluated 'visible' or 'clearly visible' for the food ingredients, under the lighting condition of fluorescent lamps, in 800 lx / 3000 K and in 400 lx / 5000 K. And they marked 'visible' or 'clearly visible' for cooked meat, under the lighting condition of fluorescent lamps, in 400 lx / 5000 K, but in the case of 3000 K, they answered 'barely visible' under all illuminance conditions. We showed the chart which could indicate the visibility level under the lighting condition with a combination of the illuminance and correlated color temperature.

FOOD AND ITS PACKAGING. COLOR, TRANSPARENCY AND SENSE

Poster presentation

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Vision shares with speech the distinction of being the most important means by which apprehend reality. (Gyorgy Kepes)

Visual communication is one of the most powerful means to convey facts and ideas. Perceiving an image involves our participation in an organization process which has a structure, an order and a system of relationships that allows us to build up meanings. Between the outside world and man's experiences stands a network of meanings, a maze of signs, that mediates this relationship.

The spectrum of the objective world that surrounds modern men is unlimited. In this sense, designers have found in food an interesting field of action. Even though it has neutral zones, this field has aspects that intersect and sometimes overlap with views of other specific disciplines that focus on the design language of form.

Considering that designed shapes carry a meaning, and that the designer defines the formal qualities of the products, we are interested in inquiring about the importance of the visual appearance of packaging, containers or displays of foods, particularly its sensitive manifestations, to suggest meanings and provoke feelings and emotions associated with food.

Transparency, translucency and gloss can enrich the visual language, enhancing the expressive possibilities of the products.

The use of glass food containers, allows us to imagine transparent bowls that *exist without existing*, without imposing virtually its materiality, using the product as a visual image, to convey emotional advantages and benefits of it.

Due to this communication the consumer perceives a superior quality product at the moment of purchase. Its impact on the shelf is well known, the consumer sees the product, its color and imagines the smell and taste, awakening all the senses. The designer uses these tools to differentiate their designs and to emphasize quality, safety, elegance and durability. The message arrives almost instantaneously, therefore, it is clear that the transparent material remains the top choice at the moment of designing food packaging.

The designer develops seduction techniques to tempt consumers or customers, highlighting the distinctive features of the packaging such as brightness, quality of the presentation, functionality, and image.

THE COLOR OF TOYS AND ITS RELATIONSHIP TO CHILD DEVELOPMENT. ASPECTS TRANSFERRED TO THE APPEARANCE OF SWEETS

Poster presentation

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This team of teachers and researchers is responsible of teaching Morphology in the Industrial Design career at the National University of Cordoba. As members of the Color Institute, the relation of this with the expression of the shape and behavior of man mark one of the linchpins of our investigations.

The knowledge of the laws of the psychology of perception allows us, through the concept of reading, guide the search for new forms responding the supporting levels and the effects of these on human behavior.

Children are particularly sensitive and receptive to stimuli that surround them. The visual stimuli generate different reactions in the body, and the colors, especially, that not only stimulates them visually, but also affects their humor and emotional feelings. This paper is the result of contrasting the results of an investigation that study the shape of the toys, their "skin color" or visual appearance, and the relationship of this variable with the development of children, and the world of sweets.

The concept of sweet that we managed is the product that children preferably consume outside the regular meal times, and often not classified as a food according to the popular concept. The candies, "empty calories", have almost no nutritional value, and are basically formed by simple sugars and artificial colors that are giving the bright colors that cause the attraction of potential consumers.

The color of these products is determined by explanations from different fields, directly related to the particular worlds of this public. In some cases, the representation of the flavor alludes to some singular fruit colors through clichés.

In the particular case of sweets for children, the recurrence to words related with games, fantasy, television and films, is obvious. Thus we find by analogy, filled biscuits which recall the color of ogres globalized or some princess, and in cases more figurative, candies that, not only by color but also by aspects of shape, they look like things as different as those similar to dinosaurs or to the false denture of a vampire.

COLOR, FOOD AND EMOTIONS

Oral paper

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The belief that men's main needs are body and soul's feeding exist since many centuries ago. Because of that, both needs have been studied from different angles, one of them being color and its relationship with food and emotions.

This relationship is based mainly in the fact that everything we eat has a color, which united with the food's shape allows us to distinguish what we eat. On the other side, color can persuade and tranquilize us, and even direct our behavior towards certain direction.

As time goes by, it has been discovered that color indicates the type of food, quality and even nutricional value; that's why it's easy to understand that it influences our preferences towards certain food and the addition of the emotions in this color-food relationship.

This is why when we think in a food or certain dish, we combine the elements trying to achieve a chromatic balance (even unwittingly) that covers our feeding needs. As an example we can choose a steak (red protein) and combine it with vitamines and carbohidrates given by orange (carrots), yellow (pineapple), green (vegetables) or white (rice) food.

Another important factor in food is social, this is because food goes beyond the body nourishment, sometimes the type of food seems to be not so important, being the main concern who you share the food with. There is where the psychological aspect of emotions appears, influenced by culture, traditions and personal needs. These are why food is used to mitigate loneliness or stress and abstinente of food is used to gain social acceptance, which takes us to the field of emotions.

Which is going to be added in this relationship is the emotional factor, and that is why the main goal is: to know the relationship between color, food and emotions in a group of youths.

Method

There were 99 students researched, mainly with ages between 20 and 35. This work is an exploratory study, which makes the basis for a wider research formed by various population spheres. With this purpose, an instrument was developed, in which the three elements of study are related and its design is comparative between genders.

The results show that food relationship with emotions is related with the significance given to its colors, so in some cases it can be said that the relationship emotion-food is based in the meaning of colors.

MIXTURE DESIGN APPLIED TO THE DEVELOPMENT OF EXPLICIT COMESTIBLE COLORANT PASTES

Poster presentation

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The determination of the correct and exact quantities of dyes to obtain a specific color is an example of an industrial problem in a wide field of applications including the food industry products. The answer can be found either experimentally or applying statistical techniques. The so-called "Design of Experiments" (DOE) techniques provide an efficient way to optimize the process through mathematical relationships with a low number of selected experiments.

A particular case of DOE is the mixture design that employs polynomial regressions. In this situation, the response depends on the proportions of the input ingredients used in the mixture experiments. Thus, the relative amount of a particular component in relation to the total amount of the mixture is known as the proportion or fraction of that component in the mixture. Hence, the proportions of the mixture components in a combination add up to unity. In mixture experiments, the working region of interest is defined by the value of the proportions in a regular q-1 dimension, where q denotes the number of ingredients of the mixture. For q = 3, it is an equilateral triangle.

In this work, a simple experimentation test that employs the mixture design is proposed to relate the proportions of predefined pure colorant pastes with the resulting color of the mixture. The goal is the possibility to obtain a predictive model for estimating an entire range in color with few experiments. In this way, the fractions of the different components that produce a color as similar as possible to the corresponding one of an arbitrary sample can be established.

Three food commercially available colorants (in this case, blue, yellow, red) were used as received and added to a paste to cover cakes. Different proportions of the three basic pastes were mixed and the resulting samples were inspected to obtain the coordinates in the color space CIELAB using a HunterLab Miniscan XEPlus colorimeter. The results were processed using the Statgraphics Centurion XV software. After performing the statistical analysis, a mathematical function that relates the fractions of each mixture to the CIELAB coordinates is obtained. These polynomial equations may have a linear component, a quadratic component and a cubic component that correlate the different models. In the present case, quadratic models were considered adequate to represent all the color coordinates.

THE COLOUR OF FOOD AND ITS RELATIONSHIP TO APPETITE APPEAL

Oral paper

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It is well established that we "eat with our eyes" before placing food in our mouth to taste it. This of course is hugely important when the selection of food involves choice between several or many observable options, or if we are paying for it in a restaurant. But how important is the visual appeal of food we prepare for ourselves? Does it matter if it has appetite appeal or not?

Perhaps when our health is good (both physically and mentally) the visual appearance of our home-prepared meal is of little consequence, as long as the food tastes good and satisfies our hunger. But if we are not well, then food not only nourishes our body, but can also benefit our state of mind by encouraging us to eat, when perhaps we may not actually feel like it.

I am particularly interested in the role colour theory may play, in relation to the visual (appetite) appeal of a meal, prior to consumption.

To examine this hypothesis, participants will be asked to photograph their home-prepared meal prior to eating. They will also rank the following on a scale of one to five: the degree of hunger they feel, the appetite appeal (based on the colour/s of their meal), and the actual taste when finished eating. I intend to survey a broad age range, both genders, and participants from a variety of cultural backgrounds.

I propose that the most visually appetising meals will approximate complementary or triadic colour schemes, and the least appealing will approximate monotone or analogous colour schemes. To further test this theory, a selection of what proves to be the most, and least, visually appetising meals will be resurveyed. At this stage no tasting will be involved, but the submitted photographs will be utilised.

It is acknowledged that professionals in the food industry would be aware of the importance of colour to appetite appeal, but I propose that the majority of people preparing a meal for themselves or their family do not fully realise this significance.

Should the final results prove convincing, the information may be of interest to social welfare organisations that support life skills training.

BREAKFAST CEREAL PACKAGING IN AUSTRALIA

Poster presentation

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A bowl of cereal is a long-established breakfast choice in Australia. Breakfast cereal is generally ready-to-eat or quick to prepare, children can even serve themselves as no cooking is involved, and it is considered by all ages as a healthy start to the day. There are many companies, brands and varieties of breakfast cereals on supermarket shelves, and television time is purchased to advertise the benefits of particular cereals, to vie for consumer preference. (For the purpose of this study I will focus on wholesome cereals, and exclude cereals marketed primarily for children and porridge because it requires cooking.)

How is a product that is essentially in the colour range of beige to brown presented through packaging? How do colours of package graphics enhance the product and differentiate it from its competitors? As the colour brown is the admixture of all colours, and some complementary colours, to some observers it lacks visual appeal. To lovers of the colour brown (myself included) it needs no visual support, as it represents, indeed epitomises, a wholesome, nourishing reference to all that is essential in food. But to many people brown represents a muddy, unappetising colour, which does lack visual appeal and so requires the visual support of additional colours. So between these two consumer sentiments, and with an ever-increasing emphasis on foods with nutritious content and health-giving benefits, how does each company that markets breakfast cereal present its products and range, to successfully compete for consumer choice from the supermarket shelf?

Additionally, as brown is also considered to be a neutral colour, what colours does each package use to accompany the visual representation of their product (usually depicted in context in a cereal bowl), and how does colour theory (ie analogous, complementary, triadic, tints, etc) factor in the outcomes? Is there general uniformity, with only minor variations? Do brands utilise distinctly different colour approaches? Importantly, which packages appeal most to the consumer, by successfully achieving visual appeal and communication of content, and its values, in the supermarket context?

COLOR CHANGES IN FRESH-CUT FRUITS AS AFFECTED BY CULTIVAR, CHEMICAL TREATMENT AND STORAGE TIME AND TEMPERATURE

Poster presentation

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An important issue in fresh-cut fruit processing is the control of discoloration or browning at cut surfaces. This quality attribute is mainly affected by cultivar, processing techniques, packaging and temperature management. Therefore, the objective of this work was to evaluate the color changes of different cultivars of fresh cut apples and peaches during storage, studying the effect of an anti-browning solution or different storage temperatures.

Two apple cultivars (Granny Smith and Princesa) and four peach cultivars (yellow pulp: Early Grande, Flordaking, Hermosillo; white pulp: Tropic Snow) were studied. Apples and peaches were prepared as fresh-cut fruits. The effect of an antioxidant treatment with a solution of ascorbic (1%) and citric acid (1%) on the color of fresh-cut apples was evaluated during refrigerated storage. In addition, color changes of fresh-cut peaches were evaluated during storage at 1.5, 5, 10 and 15 ºC. Color (CIELAB and XYZ values) was measured with a Minolta spectrophotometer CM-508d/8, D65/10º, SCE. Chroma (C*), hue angle (h), total color difference (ΔE*) and browning index (BR) were also calculated.

Browning development occurred in all fresh-cut apple samples during refrigerated storage but it was significantly lower for samples treated with ascorbic and citric acid. Between both apple cultivars, the lowest browning development was found for Granny Smith. The decrease of L* values (darker), and increase of a* (redder), and Br values clearly represented browning development in fresh-cut apples. The lowest changes in L*, a* and BR during storage were found for treated fresh cut Granny Smith apples.

On the other hand, all color parameters changed significantly with cultivar and storage time and temperature in fresh-cut peaches. After 4 days of storage at 15 ºC, fresh-cut Early Grande peaches showed the greatest color changes (ΔE* = 32) followed by Flordaking and Hermosillo samples (ΔE* = 10) and finally Tropic Snow samples (ΔE* = 5). Total color differences were mainly due to L*, a* and b* decrease for Early Grande samples, but for the other yellow pulp cultivars (Flordaking and Hermosillo), color differences were found mainly in L* decrease and a* increase. For the white pulp cultivar, ΔE* were mainly due to a* increase.

No color differences were found between samples stored at 1.5 and 5 ºC for all peach cultivars. However, L* and h values of Early Grande, Flordaking and Hermosillo samples decreased with higher storage temperatures. Finally, fresh-cut Tropic Snow peaches, the white pulp cultivar, showed an increase in a* values at the higher temperatures.

EVALUATION OF COLOR CHANGES OF MAIZE CORN SPAGHETTI MADE BY EXTRUSION-COOKING

Poster presentation

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Wheat pasta is consumed in large quantities throughout the world. However, there are people intolerant to prolamins of wheat, rye and barley. This serious syndrome, characterized by intestinal malabsorption, is called celiac disease that may lead to severe malnutrition. Many researchers have investigated the possibilities of substituting other starches for wheat flour.

Although rice pasta is commercially available in the argentine market, no corn pasta has been found. Moreover, gluten free pasta is made by forming cooked dough (from rice or corn) in a traditional pasta extruder and then dried. The use of cooking extrusion to combine both cooking and forming process is an alternative to produce this type of product and particularly, corn flour can be a good raw material, because its natural color could favor consumer acceptance of corn pasta.

Corn spaghettis were obtained by cooking extrusion, using two types of corn (red hard and yellow dent) and a two factors (temperature and moisture) experimental design. Spaghetti were made from each maize corn flour pre-wetted to the corresponding humidity level (27, 31 or 35%) and extruded at three temperature levels (80, 90 or 100ºC) with a Bravender extrusor 10DN, with a die of 3 holes, having 1.5 mm each and at 100 rpm screw rate. Spaghettis were dried at low rate oven with humidity control. Color (CIELAB values) was measured with a Minolta spectrophotometer CM-508d/8, D65/10º. Chroma (C*) and hue angle (h) were calculated. In addition, total color difference (ΔE*) were determined between each spaghetti sample and its corresponding flour.

Results showed that type of corn and extrusion-cooking conditions (moisture and temperature) affected spaghetti color. Spaghettis from hard red corn were darker (lower L*) and redder (higher a*) than those from yellow dent corn. Extrusion temperature affected significantly all color parameters and flour moisture only affected a* and h values for red hard corn spaghetti. Spaghettis with both good cooking characteristics and resistance to overcooking could be obtained at 27% flour moisture for the three temperature levels used. At lower moisture levels (27%), color changes were greater: L* and h decreased (darker and redder), and C* increased as temperature increased.

For yellow dent corn spaghetti, extrusion-cooking temperature only modified L*, b*, C* and ΔE* values, but flour moisture did not affected color parameters. L* decreased and b* and C* increased (darker and more yellow) with the increase in temperature extrusion.

We conclude that good quality spaghettis can be obtained using a single screw cooking extruder, and taking into account that color of pasta is an important quality attribute, it is suggested the use of flour from yellow dent corn as raw material.

DETERMINATION OF KINETIC PARAMETERS OF COLOR DEVELOPMENT IN EVAPORATED GOAT MILK DURING HEAT TREATMENT

Poster presentation

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The consumption of goat milk would be an alternative choice for people with allergic reactions to cow milk. Its lactose content is about 10% lower than that of cow milk and the protein and lipid composition is also different. Furthermore, the evaporated and sterilized goat milk is a dairy product that may be utilized as a final product for the consumer, especially in those countries where the availability of fresh milk is difficult.

The color of evaporated milk is of considerable commercial importance since it is one of the fundamental characteristics by which the consumer judges the product. The time-temperature relationship during sterilization is the most important factor affecting the color of evaporated milk. An increase of exposure to heat is accompanied by an increase in color.

Therefore, the purpose of our work was to determine the kinetic parameters (rate constants and activation energy) of color development in evaporated goat milk (25% total solid) during heat treatment. Normal evaporated goat milk was prepared and samples heat treated at three different temperatures (100 ºC, 112 ºC and 124 ºC) and for various lengths of time until a series of samples were obtained ranging in color from that of non-sterilized evaporated milk to a deep brown. At each testing time, color (CIELAB and XYZ values) was measured with a Minolta spectrophotometer CM-508d/8, D65/10º, SCE. Chroma (C*), hue angle (h), total color difference (ΔE*) and browning index (Br) were also calculated.

During thermal treatment, milk became darker, redder and more yellow (L* decreased while the other color parameters increased). Changes in color parameters followed a (pseudo)-zero-order reaction model. The temperature dependence for color development (activation energy estimated via the Arrhenius equation) was between 92-109 kJ mol^{-1} for all color parameters. These values were similar to those found for other concentrated milk systems. The Q_{10} values obtained (relationship between rate constant at temperature T and T+10º) were in the range of 2.1-2.5.

Currently, experiments to determine optimal time and temperature conditions for sterilizing evaporated goat milk are being conducting at retort temperatures in the range of 117-123 ºC and times to reach a sterilizing value (F_R) of 5 min. Therefore, the equations found in this work to model the color development during heat treatment of evaporated goat milk would help to determine the color of this product at appropriate sterilizing conditions.

ASSESSMENT ON RELATIONSHIPS BETWEEN COLOUR AND TENDERNESS PARAMETERS IN DIFFERENT STEERS BREEDS

Poster presentation

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Consumers identify tenderness as one of the most important attributes of meat quality (Miller et al. 1995, Boleman et al. 1995) demonstrated that consumers are willing to pay a premium for improved tenderness and Savell and Shackelford (1992) found that there is a strong relationship between price and tenderness. The aim of the present work is to assess color parameters as costless predictors of tenderness.

Ninety steers were used of three different phenotypes (British, Holstein and Indicus) of a general cattle population. Samples were obtained from *Longissimus dorsi* (LD) at 10º-11º rib after 24 hours post-mortem. Samples were vacuum packaging and frozen. At the evaluation, samples were thawed in a refrigeration chamber (2 ºC ± 0.5 ºC). For Warner-Bratzler shear force analysis (WBS) portions of LD of 2.5 cm thick were cooked in a heated pan without oil up to 40 ºC in the cold spot of the piece, then turned to the other side and cooked until that 70 ºC were reached (AMSA 1978). Ten cores of 1.25 cm in diameter were obtained from each beef in the direction of muscle fibers. Color Hunter Lab and CIELAB parameters were measured with a Colorview-model 9000-Colorimeter (BYK-Gardner, USA), illuminant D_{65}, geometry 0°, L/L* (brightness); coordinate a/a*:-a/+a green-red, coordinate b/b*:-b/+b blue-yellow on raw meat. The relative amounts (%) of meat pigments were calculated in the muscle surface according to Feldhusen et al. (1995). Statistical analysis was performed using procGLM, the averages compared by Tukey, and correlations using procCORR of SAS.

British and Holstein phenotype are significative different ($p < 0.05$) from Indicus in WBS. Huffman et al. (1996) reported that consumers at home or restaurants were 98% satisfied with steaks that had WBS values of less than 9.02 lb. According to this result, British and Holstein steers meat of this study would be widely accepted by the consumers.

Meat color parameters analysis did not show significant differences in L and L* (lightness). Color parameters: a/a* (redness) and b/b* (yellowness) shown significative differences($p < 0.05$) between Indicus vs. Holstein, and Indicus vs. British and Holstein, respectively. British and Holstein steers presented higher L and L* values and b and b* values than Indicus. The a and a* values are higher too contrasting with the results obtained by Wulf et al. (1997). Indicus phenotype tended to be darker (less yellow and less red) than the others; its means that British and Holstein cattle had a red color more "saturated". Significative correlation values ($p < 0.05$) were obtained between color parameters and WBS of the different breeds.

Although it is difficult to predict meat color consumer perception by means of objective color measurements, dark meat might be considered by consumers as low quality meat.

It can be concluded that British and Holstein breeds presented similar quality attributes such as tenderness and color, being significative different of Indicus. Correlation equations might provide costless method trying to predict meat tenderness from objective color measurements.

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COLOR VARIATION IN NUT KERNELS DURING STORAGE UNDER DIFFERENT DRY METHODS

Poster presentation

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Walnuts' darkening is a phenomenon that depends on the variety and characteristics of the harvest and postharvest treatments. Market preference is for light colors because dark colors are often associated with deficiencies in quality. Consumers generally relate dark colors with adverse conditions on harvesting, processing and storage environment.

The aim of this study was to evaluate the effect of drying processes and storage conditions on kernels of three walnut varieties (*Juglans regia* L.) through instrumental color assessment.

Criolla, California and Chandler walnuts were harvested between February and March of 2007 in a commercial plantation in the town of Mutquín, Pomán department, province of Catamarca, Argentina. After collected, they were subjected to two drying methods: natural (exposed to sun in tries without cover) and in oven (48 hours with hot air flow at 38 ºC) until the kernel reached 4 to 6% of moisture content. Shell samples were stored in netbags for 225 days at an average temperature of 21.1 ºC (with 23.1 ºC maxima and 19.0 ºC minimum).

The color of the kernels was determined every 45 days using a BYK Gardner ColorView (model 9000) with large vision area, D65 illuminant and CIELAB scale.

Data was analyzed using ANOVA using SPSS® (v 12.0 Illinois, USA).

At the beginning of storage, statistically significant differences ($p < 0.05$) were observed between the three varieties on L* parameter. Being Chandler kernels the brightest (54.0 ± 1.4), followed by California (49.0 ± 0.66) and Criolla (42.0 ± 3.5). Parameters a* and b* showed significant differences between Criolla and Californian varieties (Chandler and California), even tough no differences were observed among them.

It was observed a decrease of the parameter L* during storage for the three varieties, being statistically significant ($p < 0.05$) in Californian walnuts after 180 days. Parameter a* increased significantly in the three varieties while the parameter b* decreased significantly only in California walnuts.

Comparing oven and natural drying methods, it was observed that kernels from the first method were less brightness, redder and less yellow.

EFFECTS OF MATURITY STAGE AND USE OF DRYING ON SWEET CHERRIES *(NAPOLITANA VAR.)*

Poster presentation

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This work compares the effect of pre-drying treatments and convective drying on cherry color of different mature degree. The following pretreatments were used: 1) B: blanching with saturated steam (1.5 min) at atmospheric pressure and cooling in cold water (2 min at 4 °C) in order to diminish enzymatic browning, and 2) combined treatments: a) B + dipping in 10% citric acid (w/v) during 5 min (Dip1) and b) B + Dip 1 + dipping in 2.5% calcium lactate (w/v) during 5 min (Dip 2). These combinations were studied in order to evaluate the possibility of protection of anthocyanic pigments throughout the drying process by the incorporation of acid and to preserve product texture by means of calcium adding in mature as well as in immature fruits. Chemical composition of fresh fruit was determined in order to study color degradation as a function of mature degree and process. Drying of cherries, with and without pretreatment, was performed at 70 °C, 4 m/s air velocity and 10% RH. Weight loss (WL), colorimetric coordinates (HunterLab color space) and pigments (extracted and measured by spectrophotometric reading at 530 nm) were evaluated throughout drying (Ochoa et al. 2001).

Soluble solids concentration (SSC) was higher in mature fruits, but titratable acidity (TA) levels were similar. Mature cherries had almost full dark red skin color, while immature ones had full light yellow-pink skin color.

During drying, fruits without pretreatments presented an important WL and a red color decrease (L and a parameters diminished in relation to initial values) from bright red color, more or less intense according to mature grade, to brown. Blanched fruits, of both stages, appeared discolorated and luminosity increased. During drying, lack of color maintained from the beginning of the process; red color disappeared and fruits exhibited an intense yellow color, this being due to variations in the structural form of anthocyanins. At the end of the process luminosity decreased in all cases, but in a lesser extent for immature fruits. A red color enhancement was observed in mature cherries as a consequence of acid concentration that positively influenced pigments expression. Because of a lower initial concentration of pigments, immature fruits did not exhibit the same behavior that matures ones. The combined treatment was more effective for stabilization of pigments and texture (preliminary evaluated). The fruits at lower pH did not showed browning during dehydration compared with fruits without acid treatment. The greater values observed in mature fruits would indicate that high initial sugar concentration enhances color stability. Moreover, concentration of fruit compounds due to drying process could have contributed to protection of red color.

Pigment degrade during processing evaluated by spectrophotometric method was in agreement with the changes observed in colorimetric coordinates.

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TEMPERATURE, AIR SPEED AND PRE-TREATMENTS INFLUENCE, IN DEHYDRATED SOUR CHERRIES COLOUR

Poster presentation

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Colour is considered to be the most important characteristic in the appearance of food (Francis and Clydesdale 1975), especially if it is associated to other quality aspects, such as, fruit ripeness or the visible spoilage that takes place when food is processed. The sour cherry is a very attractive red fruit but of low consumption when it is fresh due to its high levels of acidity. The dehydration process would be a good way of preserving this kind of fruit to enhance its consumption but it causes important effects on the superficial colour. The variables of the process can be handled to minimize the negative effects on the colour of the dehydrated product.

We worked with Montmorency sour cherries coming from El Bolsón, Río Negro. They were subjected to dehydration by hot air at three different temperatures, 40, 55 and 70 ºC, at an air speed of 0.1, 2.5 and 4 m/s. Besides they were subjected to two different pre-treatments on the fruit: scalding and enzymatic treatment. The Hunter "L", "a" and "b" parameters were measured on each curve of the dehydration process, on fresh and pre-treated fruit, with a CR-300 Chroma Meters Minolta colorimeter. The instrument was standardized with a white ceramic plate (L = 95.55; a = -0.10; b = +2.69). The changes in colour were evaluated from the parameters ΔE, Δa, Hue angle and Chroma. Two readings by fruit were taken in the equatorial zone. The results are the average of twenty determinations by each point in the curve. The results show the following:

- The drying at 70 ºC without pre-treatments produce the least variation in the superficial colour of the sour cherries and a better preservation of the reds since at the end of the dehydration process Δa is positive, Hue angle only changed 3º and Chroma increases.
- The changes of the superficial colour would not depend on the air speed when it is being worked on a range between 1.5 and 4 m/s
- The scalding pre-treatment shows the greatest global colour variation.
- Observing Δa evolution we can conclude that pre-treatments are not effective to preserve the red colour at any of the tested temperatures.
- Observing Chroma we can conclude that any of the pre-treatments at the studied temperatures is adequate to maintain the intensity of the colour.
- The Hue angle varies 10º maximum in the process, which is too little to predict the colour stability of sour cherries as it has been informed for other red fruits (Skrede, 1985, Ochoa et al. 1999) in which the Hue angle limit of acceptability was of 35 to 45º.

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COMPATIBLE COLOUR PALETTES FOR NATURAL FOOD PACKAGING

Oral paper

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The idea of packaging is as old as human civilization, since the transportation and storing of products has always demanded putting them in containers and boxes, as well as the protection of food from dust, rain, humidity and other deteriorating agents. Similarly, the influence of colour as an identifying and communicating element of the "attributes" of those signs, acquire today a central role, key in the visual communication of the product image.

In the case of consumer goods, particularly food, the packaging is not only a simple wrapping for protection, but it becomes a mean of communication, used to reflect the product "image" that is intended to transmit to the consumer. Consequently, the packing size, shape, colour, the typography for the texts and materials used in its elaboration, become of key importance making the packaging its own seller and becoming sometimes the connection with the consumer, since it anticipates what the consumer thinks or awaits from the packaging, generating a sort of *meta-communication* since it expresses what the packaging contains or supposedly contains.

There are many factors in our reality, either psychological or visual, that determine the appropriate choice of the packaging colour, shape and material, according to the adopted commercialization strategies. These factors become more important day after day, and they vary according to the cultural traditions and tastes of the different societies.

Food packaging design has been one of the disciplines that has been more related to the graphic industry in the last decades. We intend to investigate this issue and show some incompatibilities that certain design decisions have, regarding the colours used to represent the natural shapes and the resulting colours of the production of the printing standards. We will also offer some possible solutions to these conflicts which occur between one system and the other in the colour treatment. It is also the objective of this work to offer some ideas to the designers providing some conceptual and visual tools, establishing a series of compatible chromatic palettes between the suggested colour and the depicted colour.

In this opportunity, we do not intend to deal with the packaging colour as an industrialized product material, but we want to deal with some particular colour features in the graphic messages and its relations with the possibilities of reproduction.

NATURAL COLOURS FOR NATURAL FOOD

Poster presentation

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The digital and technical possibilities for the formulation of colour are nowadays an efficient tool in the colour creation and depiction in graphic productions. These productions are found in advertising, containers, wrappings, natural food packaging, which are displayed in shelves or in printed or digital magazines. The problem is that it is not always possible to create and reproduce colour with the desired precision.

There are many reasons for these incompatibilities, which in most cases come from the technical field, either because of transpositions between different interpretations of digital tools, or different colour spaces, as well as some incomprehension or inexperience in handling colorimetric coordinates in the different colouring handling systems. Also, some of these inconvenients do not come from a purely technical area, like certain decisions taken in a rush, with consequence that can be expected when only "perceiving" colours. The planning operations in the digital field, where you can work almost simultaneously with different colour profiles, generate some inconvenient when trying to reproduce those colours thought for a particular program, processed in RGB and reproduced in CMYK.

The representation of colours "from nature" in packaging, wrapping or even in the advertising of natural food (solids or liquids) fail for different reasons in the representation of colours due to system incompatibility. Many of these incompatibilities have its proven solution methods, but others do not, so designers have to use their knowledge or intuition, since they do not have a solution to determine the chromatic fidelity when comparing the represented element and its reproduction on the standard system.

Our intention is to show a wide variety of comparative chromatic tables between the dominant "real" colour of natural food and the represented "possible" colour adding different ranges so as to offer a practical and efficient tool for graphic design, that ensures a repertoire of compatible colours within the different types of food that can also be represented with fidelity on the printing systems.

COLOR CHANGES DURING ROASTING OF ARGENTINEAN ALGARROBA (*Prosopis alba* Griseb) PODS

Poster presentation

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Prosopis alba Griseb is a leguminous tree that grows naturally in the Argentinean Chaco. Its fruits (pods) are sweet and have significant protein content. They have been used for human and animal feeding, especially dried and milled, and also as an aqueous extract.

The influence of roasting process on the color of *Prosopis* pod flour at six different temperatures (100, 115, 130, 145, 160 and 175 ºC) and at three different times (30, 45 and 60 min) was studied. Samples of roasted material retained by 0.25 mm sieve, were analyzed in order to determine degree of roasting (color development). CIE color coordinates L*a*b* were measured with a spectrocolorimeter, then the color index (I_c), the color differences (ΔE^*_{ab}) and the metric chroma (C^*_{ab}), were calculated.

Color of *Prosopis* pod flour is highly dependent of the roasting temperature. During roasting, color development occurs initially on the pods surface and continues in deeper layers of the pod, in different form according to different temperature. Values of apparent activation energy (E_a) were similar for both the colour functions lightness (L*) and metric chroma (C^*_{ab}), which indicates that they are good indicators of the browning evolution during roasting. On the samples roasted at 160 and 175 ºC, the resulting values for hue, chroma and lightness are comparable with those found for roasted coffee. The functions of color present major values when temperature or duration of the roasting process increases. Since color of the *Prosopis* pod flour is related to both variables of process, linearly with the time but not with the temperature, this can be a good control parameter of the process, and the wished color of product can be reached by controlling the temperature and the time of roasting.

FOOD DESIGN: PERCEPTION OF COLOR AND POLYSENSORIALITY. COLOR AND TASTE

Poster presentation

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The aim of this paper is to create a bridge among the many perceptual studies of color and polysensoriality referred to food design. In the last decade food acquired a position of absolute centrality in Western society: more than ever we speak of food not only in relation to nutrition but also as a social, cultural, ethic, environmental and political fact. Food culture has permeated countless fields: from general and specialized edition of books to the birth of schools of gastronomy and didactical programs linked to nutrition science, from the plentiful of TV programs dedicated to food to the celebration of the figure of the chef as a true guru of modern life, from the birth of food design as a discipline to the presence of alternative networks of consumption such as slow food, or the discovery and spreading of modalities of feeding from other countries at a massive level.

This relevant position of food as an object in our culture produces also perceptible effects in the physical environment in which we live. The logic of food production in all phases of its vital cycle, from crop growing to elimination, transforms the space, modify the landscape, create new modalities of use, model new spatial configurations and induce new perceptions of the environment. The fact is that food is of interest to many disciplines: agricultural sciences, biology, nutrition, production and distribution, and also graphic and industrial design, architecture, urbanism and landscape.

While the studies about perception in general are based upon solid grounds since two centuries, and are conducted scientifically, privileging mainly the architectural, scenic and dwelling environments, the urban environment as well as fashion, products and advertising, food design is still a new and rather unexplored discipline. Also, the problem of color in the presentation of food and in all its sensorial aspects, while being of utmost importance in daily life, has not been sufficiently considered, even when its importance has been recognized by psychologists, nutritionists, dietitians and agricultural scientists.

This situation is changing, with the tendency of developing a new field of research that simultaneously with color laboratories satisfies the gap that has been created, carrying out in a scientific and methodological way the analysis that relates color and food in a polysensorial level.

After an introduction that will define and frame food design, the paper will describe the present scenarios in the world of food, and will concentrate on the aspects related to the perception of color and synaesthesia applied to the craft and industrial production of food, considering color perception of food on the consumer side. The paper will face various topics that affect this important aspect of culture from a sociological, communicational and industrial points of view, conferring a primary importance to sustainable development and ecological compatibility, in view of the Expo 2015 to be held in Milan under the title “Nurture the planet, energy for life”, in whose manifestation the issue of food will have a fundamental role.

COLORS OF THE DESERT. THE COLORS OF THE DISHES IN NORTH MEXICO

Poster presentation

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The northeast of Mexico is a desert region in which the ancestral presence of the nomadic Indians was occupied from the second half of the 16th century by the Spaniards and Portuguese.

Although the natives disappeared of the territory by the continuous wars of more than 300 years, some of their customs in the preparation of foods were object of hybridizations that were mixed in addition with the dishes brought from the center of the country by the tlaxcaltecas, allies of the Spaniards. The more representative gastronomical products of the northeast of Mexico, in that triple influence (of the nomads, the tlaxcaltecas and the European) have like common element the being of brown colors, as if it was a peculiar mimicry of the desert ground. Indeed, as well as salty foods (goat, roast of pig, dried meat) candies (burned milk, jamocillos, pulque bread) have similar tonalities and in their sobriety they offer a singular aspect that is hardly found in other sites of the national territory.

The proposed theme is the product of an investigation held by the author with a group of students of communication science and history.

COLOR AND VISUAL IMPACT ON CONSUMERS

Poster presentation

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The poster presented will involve the issue based on a propaganda-style publication designed for the presentation of a female beauty product for hair care, which tells the importance of color and appearance (visual) of the recipient and also shows the quality of the product (non-visual). The scene in the graphic parody, whose main actor is an eatable object displayed in its perfect shape with all the vanity of local color saturation, shows the importance of the color in the consummation. This eatable object represents an image of the food technology involved.

The aim of the poster will be to rediscover the socio-economic meanings of color and values in today's societies. This presentation will be based on the importance of color in food intake, its relationship with the techo biology and transgenic food. It will be also based in the visual and psychological impact caused by the color from design and marketing, the concept of product quality related with the color and the shape, the influence of the media and the design of the current image.

The sub-themes that will develop this poster are: "psychology of color", "design and color", "color and appearance", "marketing and color in food". All topics will be developed from a theoretical framework grounded and research related to this topic and practices which will be experienced through the senses the importance of color for the client and the viewer.

SIMPLE METHOD FOR SIMULTANEOUS QUANTITATION OF DYES IN HYDRATING BEVERAGES (GATORADE, POWERADE)

Poster presentation

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This paper describes a novel method for the quantitation of four artificial dyes (brilliant blue, sunset yellow, allura red and tartrazine) which are usually present in hydrating beverages.

The commercial samples analyzed were Gatorade and Powerade. These drinks are recommended to rehydrate, restore depleted carbohydrates and electrolytes during exercise or in situations of dehydration. Most soft drinks available in the market contain artificial dyes among its ingredients, which are added to make them more attractive, modifying the preferences of the consumer.

Owing to the toxicity of dyes, it is extremely important the compliance with the requirements and to control the amount of them used during the manufacturing process of products because of the risk for the human health. According to international standards, the maximum daily intake should not exceed 12.5 mg/kg body weight for bright blue, 2.5 mg/kg for sunset yellow, 7 mg/kg for allura red and 7.5 mg/kg for tartrazine. Above these amounts allergic disorders, asthma, hyperactivity in children (ADHD), etc., can be originated.

This work arises from the need to develop alternative fast and simple methods, which could be adapted to medium or low complexity laboratories.

For quantitation, a calibration set of 19 mixtures, using a central composite design for 4 components in 5 concentration levels was prepared. Spectra of these mixtures were recorded in the range of 400 to 750 nm in a spectrophotometer. The data obtained were managed with the Matlab MVC1 routine, which allows multivariate calibration PLS-1 implementation.

In this novel method, the pre-treatment of the sample has been simplified: it is only necessary to pass the sample across a “syringe filter”. Sample and calibration mixtures are then diluted with acetate buffer (pH 5), to adjust pH of all solutions. The spectra of the samples were recorded under the same conditions than the calibration set and their concentrations were predicted with the PLS-1 model.

Obtained results were highly satisfactory, with errors of 1.46, 1.99, 4.56 and 3.01% for sunset yellow, tartrazine, allura red and brilliant blue, respectively. In addition, recovery rates varied between 98.7 and 103.5%.

As a conclusion, this method allows the quantitation of dyes without extracting them from the food, does not require sophisticated equipment or complex techniques. On the other hand, the simultaneous quantitation simplifies the analysis, reduces the time for processing each sample and reduces the costs, not being necessary the addition of reagents. Finally, the method can be used for quality control of dyes in commercial beverages.

APPLICATION OF IMAGE ANALYSIS TO THE COLOUR-PHENOLIC COMPOSITION RELATIONSHIPS OF GRAPE SEEDS

Oral paper

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Colorimetry is widely used for evaluating the quality and composition of foods. Digital image analysis appears as a successful complement for deeper studies since other characteristics such as shape, texture and homogeneity can be also determined. In this work, the chemical characteristics of grape seeds have been correlated with their colour characteristics measured by digital image techniques.

In *Vitis vinifera* grapes the phenolic compounds are mainly in seeds and skin. During fermentation process these phenolics pass from the solids to the wine (40%-60%). Although phenolics are non-coloured components they influence the final colour of red wine due to copigmentation reactions with anthocyans. Copigmentation phenomena consist of non covalent molecular associations between anthocyanins and other organic compounds such as flavonoids, yielding to changes or increments of the colour intensity. Among the phenolic compound hydroxicinamic acid derivatives, benzoic acid derivatives and catechins have the highest copigmentation activity.

The phenolic composition of the seeds changes during the grape maturation (phenolic maturation of the seeds) which can induce changes on the sensory properties of the obtained wine. Thus, during grape maturation phenolics undergo polymerization reactions which diminish the astringency. This fact together to a reduction of the acidity yields to a less aggressive must. Currently, the adequate maturation level is determined based on chemical characteristics of the grape, and the phenolic maturation of the seeds are not considered.

The chemical changes occurred during the phenolic maturation induce changes of appearance of the seeds, modifying the colour (from pale green to dark brown), as well as their size. In previous studies we have determined the usefulness of the digital image analysis to assess the phenolic maturation evolution of the seeds in grapes for vinification, reaching industrial interest results. This study goes ahead to a deeper knowledge of the phenolic composition of the seeds and the relation with their appearance by applying digitalization techniques.

The study was carried out on red grapes seeds (cv. *Tempranillo*). Digital images of the seeds were taken from which colour as well as morphological and colorimetric heterogeneity characteristics were determined. The phenolic content of the samples was also determined by HPLC (high performance liquid chromatography). A positive correlation was found for catechin and a negative correlation for protocatechuic acid, having high correlation coefficients.

STUDY AND ANALYSIS OF THE CONSISTENCY OF THE COLOUR FROM THE PIECE OF FOOD TO THE VIRTUAL REPRESENTATION IN THE SCREEN AND IN THE PACKAGING

Oral paper

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By considering "the consistency of the colour" it is intend to explain how to perceive a colour in different media and which tolerances are admissible in this process. The standardization of the processes is the most appropriate path to reach the expected quality of the printed production. The implementation of the international standards in each phase of the graphic workflow allows:

- To establish what is the objective that must be fulfilled in each phase of the workflow and to determine the corresponding responsibilities.
- To have a proper "chain of clients" (designer - prepress - printing).
- To establish the acceptance and rejection criteria, applying quality control guidelines based on the technical controls established by standards.
- In the market, there are technical resources to implement standards such as printers, RIPS, mediums, inks, human resources and standards.

In particular, the standards evaluate certain points of graphic workflow, but they do not indicate how to carry out that workflow or how to relate it with o standards of graphic workflow.

With the objective of standardizing the workflow from the design to the printing process, Gutenberg, together with the Federación Argentina de la Industria Gráfica y Afines, FAIGA (The Argentinean Federation of Graphic Industry and Related Fields), and with the support of the Consejo Federal de Ciencia y Tecnología, COFECYT (Federal Council of Science and Technology), and the Unión Industrial Argentina, UIA (Argentine Industry Association) is carrying out an investigation project, which main objective is to establish methods and procedures based on the international standards for the standardization and subsequent certification of the different processes of graphic production flow.

The project focuses on the analysis and application of the three ISO standards, and its referential rules.

1. Standardization in the offset printing process, according to NM ISO 12647-2:2008
2. Standardization in the printing process of digital proofs, ISO 12647-7:2007
3. Standardization of the terms of use of monitors for tests visualization, ISO 12646:2009

The goal is to offer to the Argentine graphic companies improvement tools based on international standards that would allow them to empower their production and achieve differentiation through quality.

By aligning the productive processes with the renowned international standards, companies receive many benefits which will be mainly noticed in the optimization of their workflows, in the stability of the processes, by working with defined parameters and tolerances, in the improvement of the corporate image, in the assurance of regular quality, and in the improvement of corporate image and its relation with clients.

The requirements of the graphic industries which are related with food industry will be benefited by the application of these procedures since consistency of colour is one of the highest technical standards to comply, and the printed work not only must attract clients but it also has to position and maintain the food brand that is being printed.

ON THE PROTOTYPICAL TRANSFORMATION OF FOOD APPEARANCE FROM THE FARM TO THE TABLE

Poster presentation

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In the present poster two experiments are described, concerning the assessment and comparison of long term color memory (or prototype) of food (vegetables, meat) raw, and cooked (boiled, without condiment).

In the first experiment, a direct mode of assessment is used: a matching procedure consisting in visual scaling with the use of Natural Colour System (NCS) color samples. The observers, with normal color vision, were subdivided into two groups: ten, tested in Perugia, are professionally involved in color, but scarcely familiar with the NCS; five, tested in Florence, are experts in visual experiments. Both groups easily identified the nuance of the raw food sample as different from that of the cooked food sample. However, as expected, the former group activated only the color category (the same for raw and cooked). The second group scaled intracategorially the raw and the cooked food as different. For these observers the colorimetric difference between the farm and the table is highly significant (CIELAB and CIE94 results are compared). In conclusion, the direct mode of assessment allows for both a classification of various foods based on their prototypical color and the quantification of the effects of the cooking process.

Food is a complex test object, it is the outcome of synesthetic contributions of cross sensory responses. We sense clear differences, because cooking raw food involves changes in structural, biological and chemio-physical properties, and in particular calls taste into play in addition to color shift (Hutchings 1994).

The second experiment is based on a global response. We are recording the difference between the visual weight of raw food and cooked food, by including cesia, texture, lightness, local contrasts, etc., in a complex feature conjunction. Raw and cooked foods are paired in a display (10° high and of variable width), placed on a table, and uniformly lit by a source fitted in the ceiling, the observation geometry being 0°/45°. The cooked food is regarded as a test, and its size is kept constantly at 10° × 10°. The raw food acts as a reference, 10° high. The reference width capable of balancing the test is being sought for by the use of the constant stimuli method. Cooking modifies both nuance and hue in different ways for various vegetables; allowing for classification. Evaluation of color in long-term memory decreases in difference, with respect to that of the real samples. Cooking increases the food's visual weight compared with the raw condition.

Reference

Hutchings, J. B. 1994. *Food colour and appearance*. London: Aspen.

COLOR TEMPERATURE VARIATION FOR FOOD LIGHTING: A TEST ON USER PREFERENCES

Poster presentation

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The way food is presented and how it appears to the final user has a great effect on his/her will to buy or consume it, especially in the case of fresh food. Color and glossiness can be easily manipulated choosing the proper lighting, varying its geometry, luminance level and spectral content. The final visual appearance can make the food appear more or less fresh, ripe, juicy, appetizing, etc.

This paper presents an experiment designed as follows. Five light booths have been prepared with 5 different light sources and filters (see Table). The chosen food, from a big retail store, is usually exposed under artificial light directly or through transparent wrapping. The test aims at verify the changes in consumers buying intentions as caused by changes in CCT illumination and consequently appearance. Test has been held in a temperature-controlled room without natural lighting.

Lamp	Power	CCT	Ra	Filter
Halogen	150W	2900K	100	neutral antiUV
White light sodium	100W	2550K	83	neutral antiUV
Metallic halides	150W	4200K	96	neutral antiUV
Metallic halides	150W	4200K	96	warm light dichroic
Metallic halides	150W	4200K	96	cold light dichroic

All the light emissions have been measured in terms of spectrum, chromaticity and corresponding correlated color temperature (CCT). Then the luminance from each food under each illuminant has been characterized in the same way.

In the second phase a subjective preference test has been carried out on 124 subjects (50% males and females) subdivided into different age groups. The chosen types of food have been: red meat, bakery products, fish, fruits and vegetables.

The subjects stand in front of the same food item lighted by the different spectra and indicate their personal purchase choice.

Results are presented and discussed.

FEATURE EXTRACTION OF PAINTER-SPECIFIC COLOR DISTRIBUTION FROM REAL PAINTINGS

Poster presentation

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Color analysis of art paintings is an important issue in the fields of color image reproduction, computer vision, art history, etc. The color analysis is often based on digital image data which were taken by scanning the printed matter in a picture collection book or obtained by retrieving the data file through Internet. However, it should be noted that the reproduced colors from the image data are not generally equal to the original colors of the original painting observed under a certain museum lighting environment. This fact is a great stumbling block in the precise color analysis.

This paper proposes an analysis method for extracting the color features of painter-specific color distribution from real paintings. We photographed directly famous paintings in the Orsay museum and the Orangerrie museum by using a calibrated digital camera, and constructed a large database collecting high resolution digital images of paintings for each painter. In the image capturing, the light source information was also recorded for each painting by using a white calibration plate. First, the captured camera image is transformed into CIE-XYZ image with the calibration data. We estimate the color temperature of illumination for each painting, and then transformed the XYZ image into a standard image representing the appearance under Illuminant D65. This image is further transformed into the RGB image of a standard display device with the Adobe RGB gamut. Second, we analyze the color distribution in the RGB color space for individual painters based on the principal component analysis (PCA). We add up the standard RGB image data of all paintings by the same painter. The PCA of the image data set provides us the principal components of the distribution of painting color which are inherent to the individual painter.

We have performed experiments using the art works by eight painters of Corot, Millet, Courbet, Manet, Cezanne, Monet, Renoir, and Van Gogh. The color features of paintings belonging to each painter are represented by the mean vector and several principal component vectors in the RGB space. As a result, the mean vector represents the average color feature of a painter from a global point of view, which is the center of gravity of the color distribution. We have found that the mean value is high for Monet, and low for Manet and Courbet. The first principal component represents lightness that means the directional vector combining the center point and the origin of the space. The contribution of the first component (percent variance) is more than 95% for Corot, Millet, Courbet, and Manet. The percent variance of the second component is less than 3% for these painters. On the other hand, the feature for Van Gogh is the first of about 75% and the second of 20%. The percent variance of the principal components corresponds to the variance of color distribution. The above color feaures are useful for color correction of the digital image data obtained from arbitray image media including a picture collection book and Internet.

COLOR REPRODUCTION OF 3D PRINTER

Poster presentation

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3D printer can produce three dimensional objects based on 3D model data made by 3D CAD or 3D modeling software. There are some types of 3D printer: Stereolithography, Sintering powder method, Inkjet printing method and so on. The stereolithography was put to first practical use as 3D printer. This method makes an arbitrary three dimensional shape using a vat of liquid UV-curable photopolymer and a UV laser. The Sintering powder method makes a three dimensional shape by fusing small particles of plastic, metal, ceramic, or glass powders using a high power laser. Recently 3D printers are used not only for the rapid prototyping in the development of products but also for the medical field, hobby, food samples and so on.

In these methods, the inkjet printing method is the only one method that can make full color 3D objects. This method makes 3D objects based on layers of a fine powder by printing an adhesive and color inks from the inkjet printer-head in a shape of each cross-section as determined by the 3D CAD data.

This paper reports a color reproduction of a 3D printer with the inkjet printing method (Z Corporation, ZPrinter450). This printer has four-color binders (clear, cyan, magenta, and yellow), and can make full color 3D objects with the use of these four-color binders. To evaluate the color gamut, 24 samples that are square tile with colors of Macbeth color checker were made by the 3D printer. The side of the tile is 40 mm, and the thickness is 3mm. Moreover samples that were processed by transparent resin were made.

The color of samples were measured by Chromameter (Konica Minolta, CS-200), and plotted on xy chromaticity diagram. The results of experiments show the chromaticity of samples moves to direction of white from the original chromaticity of Macbeth color checker. Moreover the chromaticity of the resined sample became closer the original chromaticity than the chromaticity of samples without post-processing by transparent resin. These results are useful to output desired color with the use of 3D printer.

EFFECT OF TASTE AND TONE LISTENING ON ACHROMATIC COLOUR PERCEPTION

Poster presentation

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Auditory stimuli influence our perceptions about the world. Synaesthesia is known as a phenomenon in which the stimulation of one modality evokes a sensation in another modality. Here, we discuss what is called chromaesthesia, which is a type of synaesthesia wherein a chromatic perception is elicited by the other modality of perception such as auditory stimuli.

We examined the manner in which the kind of taste and the frequency of tone effects change in the perception of colour in normal subjects. Participants were asked to sit on a chair placed in front of a cathode ray tube (CRT) monitor connected to a personal computer which presented stimuli of 2 degree disk on the CRT screen. The subjects tasted sweet, bitter and sour, or were exposed to a single-frequency tone (1 kHz) and multi-frequency tones (white noise and pink noise) and required to adjust the colour of a target on the monitor until it was achromatic. The adjustments were made in small steps of colour changes that were close to their differential threshold. The explicit results of the manipulation were not revealed to the subjects.

The average of adjusted achromatic colour and the standard deviation of the adjustments made for the 3 taste conditions and the 3 tone conditions were evaluated against those made in the absence of taste or auditory stimuli, e.g., when the subjects wore earplugs in auditory condition. However the average phenomenological achromatic colour showed no differences between three taste and auditory conditions, the standard deviation obtained for single-frequency tone conditions was lesser than that obtained for multi-frequency tones. The data obtained in this study were also analyzed using MacLeod and Boynton's chromaticity diagram to confirm the equality of cone inputs between auditory conditions. For some observers, the chromaticity coordinates for single-frequency tones were different from those for multi-frequency tones. The results of our findings on normal subjects are supportive of our hypothesis that auditory stimuli have an effect on the adjustment of colour perception in normal subjects. They also suggest that some kinds of effects, such as visual attention, are drawn by auditory stimulation by primitive mechanisms. In addition, we discuss the implications of this finding in terms of visual attention or the concentration effect of sound on colour perception.

COLOR OPTIMIZATION OF DIFFERENT FRUITS AND VEGETABLES FOR COMPUTER DISPLAYS

Poster presentation

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With the spreading of modern CAD applications, printing technologies and the conquest of the internet the correct display of colors has become very important in several applications. One example from the marketing point of view is that not only the shape and resolution is important on a product photo but it also should reflect its original colors in the brochures or in the catalogues. Nowadays the common experience is that the color of the products does not appear the same on the monitor or in the catalogue as in reality. Surely color sensation is a subjective perception but it can be measured in objective ways. Moreover it can be communicated and controlled when displayed in photos. The so called color management gives solutions to represent colors on the computer monitor similar to the real ones. With the application of color management we can attain that the color information of a given object will not become distorted to great extent while it migrates from one device to another. On the other hand we have to take into account that human vision can perceive much more colors than the color gamut of the monitor or printer can realize, therefore its parameters also have to be considered.

The aim of our research was to apply the spectral reflection distribution of color-stimuli of different vegetables and fruits onto the computer monitor with the help of the methods of color management thus giving back color perception like in reality.

The first stage of the research was when we measured the spectral reflection distribution of several color-stimuli of different vegetables and fruits with a Konica Minolta CM2600d spectrophotometer and we calculated the color coordinates in the CIELAB and CIEDE2000 color system.

With the measured values we created the specific colors on a calibrated LCD monitor by applying the “rendering intents” (perceptual, absolute, relative and saturation) used by the color management system. With these four methods we could convert the color stimuli from one color system to another and we could optimize the colors that lay outside of the color gamut of the specified display. Using the four different methods the displayed color stimuli were re-measured on the monitor by means of colorimetry and spectrophotometry.

The result of the research was the determination of the specific method providing the best color-fidelity for each color stimulus displayed on the computer monitor.

EFFECTS OF POSTHARVEST TREATMENTS IN RUBY RED GRAPEFRUIT QUALITY

Poster presentation

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Low-temperature storage is the most important method to reduce postharvest decay and to maintain the organoleptic and nutritional quality of fruits. Cold quarantine treatment, which involves the exposure of fruit to near-freezing temperatures for a specified period, is a procedure accepted for Mediterranean fruit fly *Ceratitis capitata* (Wied) citrus disinfestations in restrictive markets. This procedure is currently applied on commercial scale. However, many citrus cultivars, particularly grapefruit, are sensitive to chilling injury; and may develop peel injury when exposed to cold treatment that greatly reduces fruit marketability.

Ruby Red (*Citrus paradise* Macf.) grapefruits were submitted to postharvest treatments as described in the Table. In each stage, color index calculated as CI = (1000.a*) / (L*.b*) using a Byk Garden color view model 9000 with D65 illuminant and large vision area was measurement. Also some physiological variables were analyzed: juice percentage (J%) and deformation index (DI) by means of an Instron tests machine.

Data was analyzed using ANOVA considering stage and treatment effects, using SPSS® (v 12.0 Illinois, USA). CI, J% and DI showed significant differences ($p < 0.005$, $p < 0.01$ and $p < 0.005$ respectively) in stage effect, except for measurements done at harvest (stage S). No significant differences among postharvest treatments were observed. Color and deformation index showed an increase along conservation, ranging from 2.9 ± 0.46 and 0.57 ± 0.03 to 3.7 ± 0.63 and 0.62 ± 0.05 at SC stage respectively. On the other hand, the juice percentage decreased from 48.87 ± 1.63 to 46.80 ± 1.83.

Treat \ Days		1 to 18	19 to 22	23 to 29	30 to 35	36 to 42
T1	R	Q	Storage			Marketing
T2	R	Q	Storage	Marketing		
T3	C + R	Q	Storage			Marketing
T4	C + R	Q	Storage	Marketing		
T5	R	Storage				Marketing
T6	R	Storage		Marketing		
Stage	*S*	*SA*	*SB*		*SC*	

R = transport under refrigeration to laboratory; C = Conditioned, 7 days at 15-16 °C in packing house; Q = Quarantine simulation, 2 °C 85% HR; Storage = 13 °C 85% HR; Marketing = simulation of marketing conditions at 20 °C.

FOOD COLOR MEMORY AND NAMES – A LINGUISTIC VANTAGE

Oral paper

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We name colors of foods with great ease. We eat, choose, shop for, hunt/gather, cook and put the food on the table to eat. This process is quite conventionalized through our cultures and our biological dictates. People identify food colors through words that are again highly constrained. Linguistic constraints are of four types: *cognitive capacities*, *the nature of reality*, *convention*, *context* (Croft and Cruse 2004: 101-103). Our embodiment of experience and perception deals with these constraints to make color term use a cognitively economical mechanism, which allows us to keep vast numbers of concepts in mind through categorial conceptualization in our long term memory (Gibbs 2005). The parallel process that puts together our linguistic and visual information, allows the individual to map a correspondence between the two frames.

Basic color terms (*black, white, red, green, yellow, purple, brown, pink*, even *blue*) are all used in reference to foods and cooking processes in recipes. This use of color terms in cooking appears to have increased in time (Ronchi and Sandford 2010: 37-38). With this in mind I was interested in seeing how individuals would call the color of well known foods, both raw and cooked. The objective of this experiment was to verify if the participants identify a "cognitive color" (Derefeldt et al. 2003: 8) with a basic color term, a secondary color term, or a complete descriptive utterance, when asked to name the color of a food that they had just identified with the NCS color samples.

I have found that out of 120 items the cognitive color was represented by a basic color term in some form in 76% of the cases. A need to differentiate between the two states, raw and cooked, seemed to trigger a needed morphemic addition to the basic color term. Talmy (2000: 315-316) refers to a figure-ground alignment mechanism that uses what is more recent in our memory as the figure (the specific color object relation, or working memory) and what was earlier on the scene as the ground (the basic color, long term memory). This mechanism allows us to calculate through vantage theory (MacLaury 2002) the color name requested. The name used to communicate a desired signification is accessed through the judgement of similarity and difference with a point of reference; the food color vantage represents the cognitive color remembered.

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SPECTRAL SIGNATURES: A WAY TO IDENTIFY SPECIES AND CONDITIONS OF VEGETABLES

Oral paper

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When the optical radiation reaches the surface of any of the numerous components of the environment is subject to one or more of the following processes: it can be reflected, transmitted or absorbed, according to energy conservation laws. The characteristics and intensity of this behaviour depend on the material and surface quality the radiation impinging on. The particular combination of elements making up the material staff, their proportions, quantity, size and form will determine the characteristics of the interaction, setting which aspects of the incident radiation will be modify and in what extent. Among the characteristics of the interaction determined by the matter structure, we are particularly concerned in reflection and absorption. Those, expressed by means of spectral reflectance or absorbance functions of materials, especially of vegetables and named here as "spectral signatures", allows us to obtain information about constitution and condition of the material analysed: measuring the spectral signature with enough precision will allow, under specific conditions and by means of an adequate treatment of data, identifying not only the specie to which the signature corresponds to, but also its phenology and nutritional condition as well as the presence or absence of diseases, affections and scarcities of the plant from which the sample comes from.

This work shows the results obtained by the application of suitable techniques for the acquisition and processing of spectral absorbance data of several vegetable species, allowing its identification –assignment of each spectral signature to one specific plant– which in turn allows the control of origin of products (foodstuffs or not) and their characteristics. Spectral measurements of absorbance were performed on samples of two sugarcane varieties and four citrus types (orange, lemon, tangerine and grapefruit) taken periodically from a controlled crop, using a spectrophotometer FOSS-NIR 6500 in the range of 400-2500 nm by 2 nm. The measured samples were about 180 in the case of sugarcane and 160 in the case of citrus. A Principal Component Analysis was applied to the data by means of STATA 9 software and the results were interpreted in that PCA context. This procedure allowed us not only to clearly identify which variety of sugarcane corresponds to each spectral absorbance function, but also to determine which wavelength or wavebands have significative relevance for that identification. Similarly, this technique allows us to identify and classify the spectral functions coming from different types of citrus. The main conclusion is that the proposed technique is capable to precisely identifying the species each sample comes from; besides, this

technique would allow us to determine the nutritional or health condition of them at the moment of the analysis, as could be seen from the obtained results.

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Presenting author: José Sandoval

INFLUENCE OF CHEMICAL PEELING ON COLOR CHANGES IN FAVA BEAN (VICIA FABA)

Poster presentation

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Fava beans have a tough skin that should be removed before processing it. This is usually done by blanching, which affects bean color. The objective of this study was to evaluate color changes in chemically peeled fava beans. Fava bean samples were obtained from local market. A factorial design was used, in which process variables were temperature (80 and 85 ºC), immersion time (20, 40, 60 and 80 min), and NaOH concentration (5 and 10%), outcome variables were color and husk thickness reduction. Hunter values were determined with a Color Gardner colorimeter. After several time, temperature and lime concentration combinations used for peeling, the treatment selected was T = 85 ºC, t = 20 min and NaOH = 10%, since it showed the best process conditions related to husk thickness reduction and retained the characteristic green color without affecting the physical integrity of fava beans during treatment. Husk thickness reduction was up to 72% (3.38 mm to 1 mm), chemical treatment applied did not influence neither shape nor surface uniformity of fava bean. Quantification of initial Hunter values reported a = -22, b = 70 and L = 76, values recorded after chemical peeling treatment were: a = -12, b = 68 and L = 75.5, with these Hunter values, chroma was obtained being 73.37 for raw fava beans and 69 for chemically peeled fava beans, net color difference (ΔL) was 10.21. On the basis of the results obtained it is concluded that the selected treatment did not influence significant changes on distinctive green color in chemically peeled fava beans.

ENVIRONMENTAL COLOR DESIGN AND SYNAESTHESIA IN FOOD-RELATED CONTEXTS

Poster presentation

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This paper represents a line of research concerning an on-going project on "Synaesthesia in Environmental Colour Design". It is a subtopic of the current main research project of the Study Group on Environmental Colour Design of the International Colour Association (AIC). The starting point of our collaboration is Sanz's outline, "Synaesthesia as a basis of color design" presented during the informal ECD meeting at AIC 2008 in Stockholm (Sanz 2008).

Underlying the paper is a reflection on the relevance or predominance of some senses in experiencing the urban environment. It seems self-evident that the sensory experience of sight, hearing, touch, movement and time prevails over the experience of smell, taste or the somatosensory experience of non-synaesthetes. Yet from the point of view of an innovative and holistic approach multi-perceptual and synaesthetic criteria are key aspects in conceiving and designing urban environments.

The theoretical basis of this research project is extensively discussed in Juan Carlos Sanz's *Language of colour: Chromatic synaesthesia in poetry and the visual arts* (Sanz 2009). In short, the basis of the research concerns processes and systems of designating, categorizing and specifying colour and deals with different definitions and concepts of colour in the arts and sciences that are determined through cognition, linguistics and iconicity. Inquiring into synaesthesia as a modality of multi-sensory experience, the theoretical basis also considers forms of cross-modal interactions. Thereby the investigation of colour synaesthesia can involve sound, taste, smell, touch, motion, emotion and intuition.

The research project "Synaesthesia in Environmental Colour Design" itself aims to establish a general perspective on crucial criteria and colour concepts used in describing synaesthetic environments. Here two different categories of synaesthesia can be distinguished. First, genuine synaesthesia –as observed in synaesthetic persons– is defined by the neurologically-based and involuntary ability to experience an inter-sensory union or correspondence with extreme accuracy. In genuine synaesthesia two different types of synaesthetes can be discribed: "introceptors" who detect stimulation in the mind or body; and "projectors" who project their synaesthetic experience onto the exterior surroundings.

The second category of synaesthesia entails associative and eidetic or visual properties of perception. As well this kind of synaesthesia involves the occurrence of intensified analogies which take place between the sensed experiences (Caivano 2008).

Understanding these two categories can serve in identifying, conceiving and realizing inter-sensory chromatic environments. By means of simple or multi-media such environments can function through enhancing the senses and triggering synaesthetic

reactions. For example, in food-related contexts inter-sensory chromatic environments often involve multi-sensory correspondences that emphasize the synthesis of perceptive modalities such as “colour-flavour”, “colour-taste” or “colour-texture”.

A key quality of this research paper is its focus on the application of criteria and colour concepts discussed in the cognitive sciences, such as the psychological aspects of perceptual qualia or in philosophical terms the subjective quality of conscious experience. A preference is given to holistic and synergetic principles rather than using terms and definitions developed in neuroscience.

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CONTRIBUTION OF CHROMATIC INFORMATION IN DEPTH PERCEPTION WITH RAPIDDLY CHANGING DYNAMIC STEREOGRAMS

Poster presentation

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The use of three dimensional virtual reality presentations is rapidly becoming very popular in many fields including presentation of food because of recent progress in 3D display technology. In most application fields, presenting movie/animation in color is almost a must, but we know little about contributions of chromatic information in 3D perception, especially in dynamically moving images. It has been often said, in general, that contribution of chromatic information is relatively small compared to that of luminance information and chromatic information is weak against rapid temporal modulation, but systematic examination of these aspects are rather rare.

In this study, therefore, we examined the contribution of chromatic information in rapidly moving stimulus of various spatial and temporal frequencies. In experiments, two sets of stereograms, one chromatic and the other luminous, was superimposed. Each set of stereograms was consisted of vertical sinusoidally (in either luminance or chromaticity) modulated gratings of a certain spatial frequency. The spatial phase of the two gratings were shifted between the paired images to give binocular disparity. The paired images together changed horizontal positions very rapidly while keeping the relative phase difference between two binocular images constant so that, although there was a very rapid temporal modulation, a stable depth was perceived just as in dynamic random-dot stereograms. The chromatic and luminous stereograms have the same disparity but with different depth polarity. That is, if one appears closer, the other appears farther than the surrounding frame of reference. In each trial, chromatic or luminance contrast of each stereogram was varied and the subjects' task was to judge which depth, closer or farther, they perceived. Two types of chromatic modulation, red/green and blue/yellow were used to generate the chromatic gratings.

The results indicated that chromatic information certainly contributes to stereoscopic depth perception. The subjects perceived either depth depending on the relative luminous or chromatic contrast relationship even at very high temporal frequency over 30Hz. However, the contribution of the chromatic information tends to become smaller as temporal frequency increases. The equivalent contrast (against luminance contrast) of highest chromatic contrast measured with this depth canceling technique was 10 to 40% for red/green axis, and about 30% for blue/yellow axis. The variability was somewhat higher for the red/green modulation. The chromatic information has low-pass characteristics in the spatial frequency domain, and its cut-off frequency was 0.5 to 2.0 c/d with fairly large individual differences. In short, the present results clearly indicate significant contributions of chromatic information to human stereoscopic depth perception even at high temporal frequency range, but they also indicate its limitation in both spatial and temporal frequency domain relative to luminance information.

FROM RED BORDEAUX TO ABSINTHE GREEN, FROM HOT CHOCOLATE TO CAPUCCINO: BEVERAGES, THEIR REFERENTIAL COLOUR TERMS AND REFLECTIONS ON CULTURAL DIFFERENCES

Keynote lecture

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This paper inquires into colour concepts and terms specifically relating to beverages. On the basis of the system of direct and referential colour terms developed by French linguist and lexicographer Annie Mollard-Desfour, the aim is to analyse the connotative meaning of colour terms related to different types of beverages. Water is not included, but coloured beverages such as alcoholic (e.g., wine, champagne, spirits, liqueurs) and low-alcoholic drinks (e.g., beer and apple cider), soft drinks (e.g., colas), cold beverages (e.g., iced tea, lemonade, and fruit punch) and hot beverages (e.g., hot chocolate, hot tea, coffee, milk, herbal teas), as well as other liquids (e.g., milkshakes, buttermilk and yogurt) will be considered. Transparency versus opacity will be discussed as well.

It is essential to note that it is not the case that all beverages lead to specific colour terms in practice. Colour references for some beverages, for example red wines such as 'red Bordeaux' are common to all languages, while other wine types do not provide any colour reference. Some terms are integrated into the vocabulary of daily life and are quite common, whereas others are sophisticated and are used in specialised contexts only. The vocabulary of colour terms, as well as their connotations, may vary from one language and culture to another. A detailed comparison of colour terms from French, Russian, English, German and Spanish provides a striking panorama of cross-cultural differences and similarities.

This study inquires into such questions as: Which are the most important beverage-related colour terms of these five languages in particular? Are there any of them shared across all five languages? How is it that some of them have a positive connotation while others do not? In what ways do they reflect the 'taste' of a culture or society? How do their meanings change within a given framework of values and trends?

This study demonstrates that beverage-related colour terms reveal some essentially cultural aspects, which are also influenced by commercial activities and globalization. Principally based on geographical specificity and culinary taste, these specific colour terms reflect much more than a simple functional vocabulary, they mirror a culture's sensibility as an important source of a community's identity. They provide a distinct 'view of the world.' Therefore translating colour terms from one language to another is an extremely delicate enterprise. The linguistic approach to colour is not just a language problem, but embraces the whole cultural background through space and time.

Presenting author: Verena M. Schindler

Verena M. Schindler

Verena M. Schindler has a M.Sc. degree in architectural history from The Bartlett, University College London and studied literature, linguistics and art history at Zurich University. Since 2003 she has been the European editor of the Chinese magazine *World Architecture* (Beijing). She is affiliated with Atelier Cler Etudes Chromatiques (Paris), and was a founding member and is currently general secretary of the association *ad chroma*. Since 2006 she has been a member and delegate of the International Colour Association (AIC) representing *pro/colore*, the Swiss colour association. She was elected chair of the AIC Study Group on Environmental Colour Design in 2006, is the general chair of the upcoming AIC Midterm Meeting 2011 which will be held in Zurich, and recently has been elected to the executive committee of the AIC for the term 2010-2013.

Her research activities are mainly focused on colour in architecture and urbanism, the history of colour systems, and colour in art, interdisciplinary and cross-cultural contexts.

THE COLOUR OF FOOD: LAST LAYER IN THE PALIMPSEST OF ST. CATERINA MARKET (BARCELONA)

Oral paper

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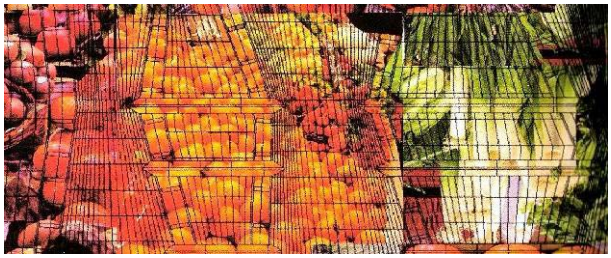
Throughout history, food has been an outstanding artistic inspiration source for many artistic disciplines, used as an argument to train with colour. The presence of food as a decorative element in architecture goes beyond a simple functional relationship with the use of space and is a useful tool for organizing colour composition. Examples include colored cornucopias of classical architecture, Biblical food in medieval fresco paintings (grape, bread, fish, etc.), painted still life in illustrated housing, glazed ceramics in modernist markets, etc.

This research aims to understand in depth the colour composition of a contemporary building, the St. Caterina Market (Barcelona, 2004) by architect Benedetta Tagliabue, who develops a poetic reinterpretation of the colours of a food stall.



We investigate the colour of the building at three levels. Firstly through the identification of physical reality: the colorimetric characteristics of the tiles, their proportion and distribution, etc. Secondly, through the analysis of the compositional strategies and means, covering the different stages of the designing process: the choice of an interesting visual reference, digital image processing, three-dimensional projections, technology for colour reproduction, craftsmanship work, construction, etc. Finally, describing the intentions that encourage the provision of colours, and have been expressed by the architect herself, with whom we maintain a close working relationship.

The result is a building understood as a palimpsest, which shows the accumulation of the various historical facts as strata. The substrate corresponding to the contemporaneousness is the roof, which plays virtually the chromatic experiences that take place in the inner space, and stages the lower level. The colour of a market that is transparent, thanks to technology, to express a final image, as a tele-reality. An interesting thought about contemporary perception, that blurs the boundaries between reality and fiction.

Presenting author: Juan Serra

COLOR OF PEDRO XIMENEZ SWEET WINE: FROM GRAPE TO RAISIN AND WINE

Poster presentation

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Changes in color measured by spectrophotometry during the raisining of grapes *cv.* Pedro Ximenez, as well as throughout the aging of sweet wine made from them in Montilla-Moriles D.O. (Andalusia, southern Spain) have been studied.

Drying process of grapes was carried out in two different ways: by means of the traditional sun-drying method and an alternative chamber-drying method with controlled temperature at 50 ºC. The latter process was mainly used with the objective to avoid possible development of fungi producer of toxins that can appear during sun-drying. Both drying methods were stopped when the grapes lost a half of their initial weight. Traditional sun-drying took 7 days, during which the grape musts decreased in h_{ab} and increased in C^*_{ab}, as a result they showing a progressive redness and higher color intensity. Chamber-drying grapes reached their final point in only 4 days, showing during this time similar changes in h_{ab} and C^*_{ab}. In comparative terms, hue final values were virtually identical in both types of drying, although differences were found in the final values of chromaticity, being lower in the chamber-drying method.

Pedro Ximenez sweet wines can be marketed without aging or after aging in American oak barrels. The aging can be carried out by blending wines with different aging degree ("criaderas and solera" system, typical in the aging of Sherry wines), or in a more current trend in a static way, that is by holding a wine during a time in the same cask. In order to observe the changes in the color parameters during aging were compared commercial wines without aging, aged by 4 months and 4 years without blends and also aged 4 years by means of the traditional system of "criaderas and solera", with blends. Likewise, as a reference of this last system, were also studied the color changes in wines with four aging degrees ("escala"), so-called in increased order of wine aging 3rd criadera, 2nd criadera, 1st criadera and solera.

During the traditional wine aging by means of the criaderas and solera system can be observed a progressive redness, it reaching a value in h_{ab} of 66.9 in the solera (highest level of aging), against the value of 80 corresponding to 3rd criadera (lowest level of aging). The chromaticity C^*_{ab} showed a strong increase from the 3rd to the 2nd criadera, then decreasing slightly in the 1st criadera and solera, showing in this last level of aging a final value of 80.8. Regarding to the commercial wines studied, it can be pointed out that the aged for 4 years without blends significantly differed in the values of h_{ab} and C^*_{ab} of the remainder wines, these showing more similar values among them and ranging into the data obtained for the wines aged by the criaderas and solera system.

Finally, it has been drawn in the a^*b^* plane the points corresponding to all the samples studied. In this plane can be observed the global changes in color terms from the raisin musts to the wines aged by variable time and systems.

COLOUR OPPONENCY IN CHROMATIC AFTER-EFFECTS

Poster presentation

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Food and its colour play very important role in our daily life. Both taste and colour are one of the sensations that are psychologically regulated in human brains. The colour of food contains very important information to judge its freshness, maturation and even the taste. Here, we test the hypothesis that chromatic adaptation is achieved by not only photoreceptors but also the binocular process occurring at the cerebral cortex, and we also discuss the after-effects of chromatic adaptation on the pleasantness and acceptability of images of foods and actual foods.

Participants were asked to set the colour of the test stimulus, a 2-degree disk on the cathode-ray tube (CRT) screen, such that its appearance could not be perceived according to its redness, greenness, yellowness, or blueness by the method of adjustment using an artificial pupil that was subjected to chromatic adaptation by using green and red or yellow filter in the first experiment.

The results of the first experiment obtained by using a narrow band-pass filter, which predominantly stimulates L or M cones, were compared to those obtained by simultaneous stimulation of both the cones. We used 2 types of adaptation conditions: the mutual condition, in which the L and M cones were individually exposed to red and green lights, respectively, and the simultaneous condition, in which the L and M cones were simultaneously exposed to yellow light, after the cones were previously adjusted to be isoluminant to the red and green stimuli. On one hand, according to the hypothesis that the hue of chromatic after-effects is regulated by a higher-order cortical binocular mechanism, simultaneous inputs from the L and M cones will affect the Y-B (yellow-blue) channel but will cancel each others effect at the R-G (red-green) channel; on the other hand, mutual inputs from the L and M cones will not affect either of the 2 chromatic channels. The use of the yellow-blue test stimuli resulted in adaptation and interocular transfer of chromatic after-effects. Anomalistic after-effects were also observed: most of participants had either the same or the opposite hues to the same adaptation stimuli in both the eyes. These results indicate that not only the photoreceptors but also the higher-order cortical process plays important roles in achieving chromatic adaptation.

In addition, the food impressions were rated between before and after green adaptation, which increased the perceived redness that might increase appetite in the second experiment. The results showed that the apparent taste of food changed depending on the chromatic after-effects and have been discussed in the context of colour constancy.

STORAGE EFFECTS ON BLUEBERRY COLOR

Poster presentation

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Chile is the biggest producer of blueberries in South America and the largest exporter to the northern hemisphere. Blueberries are blue little fruits from genus *Vaccinium* with high nutritional value and potential anti-diseases effects but with a short shelf life. Changes in texture and color during blueberry storage can have a profound effect on consumer acceptability. The objective of this work was to study the storage effects on color from different varieties of blueberries using computer vision.

Duke and *Brigitte* cultivars were stored during 0, 7, 14 and 21 days at temperature of 4 and 15 ºC and relative humidity (RH) of 75 and 90%: cv. *Jewell* with and whitout epicuticular wax were stored at 4° and 10°C during the same periods of time as above at 75% RH. Digital photos were captured through computer vision system. Color (L*, a*, b*) and fungal growth were obtained through image analysis. Sensorial evaluation of color and acceptability was also performed by 10 consumers using hedonic scale of 9 levels. Statistical analysis was performed by one-way Anova.

Results showed that significant differences ($p < 0.05$) were observed for initial color (time 0) between varieties. Along storage time, color changed from blue to red and total ligthness (L*) increased due to fungi growth for both varieties. The color changes observed during time were mainly due to temperature but not to RH. The extraction of protective epicuticular wax changed the initial blue and opaque characteristic color to dark blue and bright color, and during storage time the color changes to red were remarkable. Sensorial evaluation showed that consumers preferred blue than red berries and accepted ($p > 0.05$) color of blueberries without epicuticular wax at initial time. The acceptability along time was principally affected by flavor than color and it was not accepted after 14 days in all storage conditions without epicuticular wax and after 21 days for intact blueberries.

Important quality factors of blueberries as color were significantly influenced by both temperature and variety but not by RH of storage conditions. Fungal growth was lower at 4 °C (2%) than 15 °C (14%) and increased as storage time increased. Unprotective blueberries had high deteriorative effects (fungal growth, color change and acceptability) along time. Therefore, a low storage temperature is beneficial to maintain quality of intact blueberry fruits after harvest.

COLOR COMMUNICATION: PIECES OF CULTURE FROM PHOTOGRAPHS OF FOOD

Oral paper

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Cooking recipes from many cultures are found in sites about food in the internet, as "foodnetwork.com" for United States or "maisvoce.globo.com" for Brazil. Along with these recipes, we can find illustrations in photographic images from ready dishes, with are baked, boiled or fried food, soups, pies, cakes, deserts. These photographs are not just simple illustrations, but many times reinforce or deconstruct information resulting from their own recipes. Moreover, they show preferences in dishes and the ingredients chosen, becoming highlights of the essentials meanings of different cultures. The presences of color in these photographs are communication channels from culture where the dishes, the recipes, the sites are from.

Through analysis of the presences color meanings in photographic illustration of recipes in sites, it is possible to show important information about that given culture. The objective of this work is to evidence constructed meanings in Brazil and United States through color analysis in photographic images that illustrates dishes in sites about cooking recipes. The dishes are selected from named "comfort food" that represents different dishes in different countries. The concept of "comfort food" means simple dishes that refer the nostalgic memories about family. Generally the dishes are home-cooked, but many times we can find them in informal restaurants also. These dishes from this concept bring the feeling of comfort, well-being, tranquility and satisfaction. They are prepared from fresh, simple and basics ingredients, including salty and sweet. For instance, American comfort food are brownies, sandwiches, tomato soup, macaroni and cheese, soups, pizza, bacon or eggs, and for Brazilians, comfort food are rice and beans with steak, fries and tomato salad, bean soup, fried eggs or chocolate milk. These dishes bring strong feelings about nostalgic family's holidays for both cultures.

The methodology for color analysis in photographs will be based in three items, as the symbolic construction of color meaning between the American and Brazilian cultures, the color materialization in photographic images and the possible psychological effects from the use of this color materialization.

INFLUENCE OF DIFFERENT BACKGROUNDS ON THE INSTRUMENTAL COLOUR SPECIFICATION OF ORANGE JUICES

Poster presentation

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The objectives of this study were to evaluate factors affecting instrumental colour measurements of orange juice, such as the background and the surroundings of the measurements and the pulp content of the juices. For this purpose four squeezed orange juices bought in local supermarkets were diluted with their own serum (obtained upon centrifugation) to give 5 levels of pulp concentration (100%, 75%, 50%, 25 % and 0%). The total number of samples analyzed was therefore 20. The reflectance spectra were obtained by means of a CAS 140 B spectroradiometer (Instrument Systems, Munich, Germany), equipped with a Top 100 telescope optical probe and a Tamron zoom mod. SP 23, with D65 illuminant and 10º Reference Observer. The influence of the surroundings of the measurements was evaluated by comparing White/Black (S_W/S_B), White/Grey (S_W/S_G) and Black/Grey (S_B/S_G) surroundings. The highest colour differences (ΔE^*_{ab}) were observed when the surroundings S_W/S_B were used, followed by S_W/S_G. In both cases ΔE^*_{ab} was higher than the visual discrimination threshold (Melgosa et al. 2001). The lowest colour differences were obtained when comparing the surroundings S_B/S_G. According to these results and considering the CIE recommendations (CIE 2004), the grey surrounding was selected for the following measurements.

To evaluate the effect of the background three possibilities were considered: white background (B_W), grey background (B_G) and black background (B_B). As expected the lowest colour differences were obtained when comparing the pair B_B/B_G. The differences ranged from 2 to 6 CIELAB units, while the highest differences (ranging from 7 to 24 CIELAB units) were obtained when comparing B_W/B_B. In all cases ΔE^*_{ab} appeared to have an inverse relationship with the pulp content, that is, the higher pulp content the lower effect of background on the colour measurements.

Considering the backgrounds individually, it was observed that, the worst colour discrimination between samples with different pulp contents was achieved using B_W. By contrast the best discrimination was obtained when the B_B was used. These data are in agreement with a previous study (Meléndez-Martínez, Vicario and Heredia 2005) which concluded that the use of black background led to a better arrangement of orange juice solutions as a function of their colour intensity.

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COLOUR EVALUATION OF GREEN TEA DRINKS BY THAI OBSERVERS

Oral paper

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As colour can be associated with freshness, taste, and overall quality of beverage, it is one of important factors that affect consumers' decision when buying beverage. Recently, green tea has become one of the most popular drinks in Thailand, as it has been claimed for health benefits to regular green tea drinkers. As a natural product, a green tea drink is varied in colour. Since the product is normally contained in a transparent bottle, when put on display shelves, variation of colours from different bottles should be in an acceptable range. This study thus investigates a range of colours of green tea drinks in Thailand and their association with consumers' expectation and preference.

In the experiment, a number of green tea drinks obtained from four different readily available brands in the market are measured in terms of CIELAB values. Contrary to popular belief, colours of the green tea drinks in Thailand are in a range of brownish, not greenish colour. Moreover, the colours from four different brands are noticeably and distinctly different. Nevertheless, not much variation is found within the same brand. In order to investigate an acceptable range of colours of a green tea drink, a number of liquid colour samples with a good coverage of the drinks available in the market are generated using food colourants. The liquid samples contained in a transparent bottle are diversified in colour by hue, lightness and chroma. Forty observers ranging in age between 18-25 years old assess the colour samples in terms of acceptability, preference, and expectation of taste. Each observer assesses the colour samples one at a time under a well-controlled viewing condition. With an open-ended question, observers are instructed to associate the samples with green tea drinks and answer their expectation of taste arising from seeing the colour samples. In the case of acceptability and preference, observers make their judgements using an integer scale of 1 (the least) – 5 (the most). Four different tastes can be classified from observers' responses: sour, sweet, bitter and tasteless. The most preferred colour for green tea drinks is found to be light brown.

SIMULATING HUMAN BLOOD WITH TOMATO PRODUCTS FOR MOVIE SHOOTING: POSSIBILITIES AND SOLUTIONS

Poster presentation

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Thousands of action movies and horror films are produced yearly by movie companies all over the world. These genres are pretty different but have one common feature: all of them need much blood. In the majority of these bloody stories, not real blood is used. Human blood is simulated with the help of artificial chemical compounds or tomato products in these movies.

The aim of the authors was to compare the reflective spectra and colorimetric data of real blood and tomato products. The authors would like to omit the investigation of professional chemicals, and rather deal with products that are found in commercial trade.

Typical reflective spectra of human blood were obtained from the Semmelweis University, Hungary. From these specimens, a chromaticity domain of human blood in the CIE u'-v' 1964 chromaticity diagram could be designated.

Spectra of several tomato products and red sauces were also measured. From these spectra, CIE u'-v' 1964 colour co-ordinates were calculated and ΔE^*_{ab} and ΔE_{2000} colour differences has been calculated, using the colorimetric data of blood as a basis (reference). By doing this comparison, the most realistic product for human blood simulation could be selected.

Lighting is one of the most important issues by film shooting. Lighting is always present and could change the colour appearance of the scene. The appearance of blood and simulation tools were shown in the CIECAM02 colour appearance model in case of different lighting conditions, including incandescent and halogen lamps, fluorescent lamps, white LED and RGB LED clusters. Results have showed different products as optimum for simulating blood, depending on the spectral power distribution of the illumination.

FROM THE FARM TO THE TABLE: CHANGING THE COLOUR APPEARANCE OF NATURAL OBJECTS

Oral paper

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This study investigates the colour appearance of natural objects (especially tomato and orange) during the consumer chain. The consumer meets these products first in the supermarket or at the marketplace or greengrocers, but there are many products on the shelves of supermarkets that are made from tomato or orange (ketchups, sauces, canned fish, tinned food, canned fruit, dressings, juices, soft drinks) which come to the table of the consumer. On the package of these products the photo-realistic picture of the main ingredient can be seen very often. The appearance of the raw products printed on the package of the product can be a marketing tool: it can influence the costumer's decision on selection.

The authors measured the reflectance spectra of many specimens of these raw fruits and vegetables. As a second step, the reflective spectra of the symbol of the raw fruit or vegetable were measured on the surface of the package.

As a further step, the reflectance spectra of orange juice, tomato sauce and ketchup were measured. From these spectra, CIE u'-v' colour co-ordinates were calculated, and ΔE^*_{ab} and ΔE_{2000} colour differences have been calculated, using the raw product as a basis (reference). By following the way of the raw product from the farm to the table, significant colour differences and interesting colour shifts could be revealed.

The illumination of natural objects at marketplaces or different supermarkets is widely different. This fact causes different colour appearance of fruits, vegetables and other natural objects. This phenomenon was investigated with the help of the CIECAM02 appearance model in case of different lighting conditions, including incandescent and halogen lamps, fluorescent lamps, white LED and RGB LED clusters. Perceptual attributes were compared with memory colours of natural objects from previous research.

IT'S NICE… CAN IT BE TASTY?

Oral paper

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The speech introduces the conclusions of an exploratory research on a consumer target. This research set as basic objectives to investigate, at first term, the impact of color on the perception of food by the consumers and, in second term, the importance of color in the evaluation of that food. This assessment was considered related to the transmission of the following values:

- **Health/Nature** (fresh connotations, ingredients quality, production processes, etc.)
- **Appetizing** (drivers to intake connected to color)
- **Aesthetics** (way in which food color integrates to daily-life esthetics)

The investigation was made over three spaces of color impact: the food itself, packaging and advertising communications. Moreover, it considered food at the buying time and the consuming moment (distinguishing between daily consume and the gourmet, at restaurants's one).

The research is registered within the theoretical-methodological framework connected to a sociosemiotic perspective. This involves the articulation of an investigation from the focus group technique with the intervention of discursive focus on the group production's analysis. During target segmentation the following variables were considered:

a) Age level: As a working hypothesis, three levels were included:

- Adults, between 25 and 40 years old because it's the phase of family structure conformation and consolidation (operating as a key the birth and upbringing of children); consequently a key stage to study the behavior in terms of alimentary choices.
- Older than 45 years old because the element health/beauty takes up a place of privilege on food selection connected to current ideological trends.
- Teenagers between 15 and 20 years old because it is the period when sensuality acquire a polimorphological character so it's a privilege moment to study different organoleptic drivers to food selection. Investigation integrated to trends framework.

b) Socio-cultural insertion: In spite of the fact that diffusion of mass media promotes homogenization in terms of semantic proposals interpretation and, globally, semiotics set out by social communication, the research goes into mass media speeches reception in depth prioritizing stylistic patterns over socioeconomic levels in the orientation of cultural consumption.

c) Sex: Variable considered in terms of the different traditional insertion of both genres related to alimentary problematic resolution within the family. For sure, this difference is currently affected by changes produced in female and male roles assumption at home, but the research took it to support the criteria in which actual sexual roles sense needs historical perspective to be fully understood.

COLOR CHANGES IN VACCUM-PACKED SQUID MANTLE RINGS (*Illex argentinus*) INDUCED BY GAMMA RADIATION

Poster presentation

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Color measurement has been widley used for determining food quality, since color changes have been associated with deteriorating reactions such as lipid oxidation (particularly in squid), among many others.

In this study, four different gamma radiation doses (0, 1.8, 3.3 and 5.8 kGy) were used as a preservation technology on minimally processed vacuum-packed squid mantle rings (*Illex argentinus*).

Radiation induced color changes were analysed in order to understand how gamma radiation affects squid quality during refrigerated storage (4 ºC).

CIELAB color parameters, a*, b* and L* were determined using a portable colorimeter (NR-3000, Nipon Denshoku Kogyo Co. Ltd.) and color difference (ΔE^*_{ab}) was calculated for each day of analysis (1, 5, 8, 12, 15, 18 and 22 d) with respect to day 1.

Color parameters a*, b* and L* of squid rings were affected by gamma irradiation ($p < 0.05$). In general, radiated samples values did not changed during storage while in non-irradiated sample it was observed an increase of b* values towards yellow and a decrease of a* values.

Color difference of radiated samples, with respect to day 1, did not significantly ($p < 0.05$) changed during the whole storage period (22 days) while ΔE^*_{ab} of non-irradiated sample significantly increased ($p < 0.05$) reaching a value of 14.667 at day 22. Independently form the dose, radiation decreased colour changes of squid rings during vacuum-packed refrigerated storage.

Gamma irradiation was effective in improving color quality of mantle squid rings stored at 4 ºC.

PSYCHOLOGICAL EFFECTS OF THE TRAY-COLOR ON DINERS: COMPARISON BETWEEN YOUNG PERSONS AND ELDERLY PERSONS

Poster presentation

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We generally enjoy our meal time through our five senses. And the information obtained through the sense of sight is said to be the most important factor to promote our appetite. We already reported the various emotions produced by the tablecloth-color at the mealtime for university students. In this study, we investigated the psychological effects of the tray-color used in the food services frequently, which was made from FRP (Fiber Reinforced Plastics).

Questionnaire studies by SD method, which consisted of 11 antonym adjective pairs, were performed toward university students and elderly persons who lived in their own home or in the nursing homes. They sat a table putting trays having 6 kinds of colors as shown in Table with dish plates and bowls. In the case of elderly persons, the interview survey was performed. The questionnaire consisted of the general questions concerning to the physical and mental situation that day, the image of the tray-color, and so on. Statistical analyses were performed by using PASW Statistics18 for Windows.

By using factor analyses, two components, “activity” and “relaxation”, were extracted. In the case of elderly persons at the nursing home, all colors were in the positive zone for both components. But in the case of university students and elderly persons at their own home, the pastel colored-trays* were in the positive zone for both components, but the orange colored-tray was positive for “activity” and negative for “relaxation”, and the brown and the blue colored-trays were negative for “activity”. The pastel colors were shown to promote their appetite and to give comfortableness, cheerfulness and happiness. The psychological effects of the tray-color showed the different tendency depending on their life style rather than their age.

The tray-colors were shown to give the different emotion for diners. Then, we’d like to suggest that the usage of the tray-color effectively can give some rhythm in the life of the persons who spend all day at the hospital or the welfare facilities for the aged.

Table. Munsell values of each meal tray color.

color of meal tray	yellow*	green*	pink*	blue	brown	orange
Hue	6.8Y	6.8GY	1.7YR	6.9PB	8.6YR	10.0R
Value	8.6	7.8	8.3	5.2	3.5	7.2
Chroma	3.9	3.8	2.3	4.5	1.7	8.4

* pastel color.

EFFECT OF CHROMATIC ASSIMILATION (BEZOLD EFFECT) IN THE VISION OF THE CONTENT IN A DINNER PLATE

Poster presentation

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Experience shows that the perception of a test depends on the characteristics of their surround. This dependence has been studied extensively in the Gestalt psychology. Therefore the vision of olives, beans, anchovies… on a dinner plate, will depend on the distribution of other content.

We generalize this study, analyzing how vary the vision of a gray sequence, seen through a monochromatic red grating in doing so the frequency and orientation of both (Figure 1).

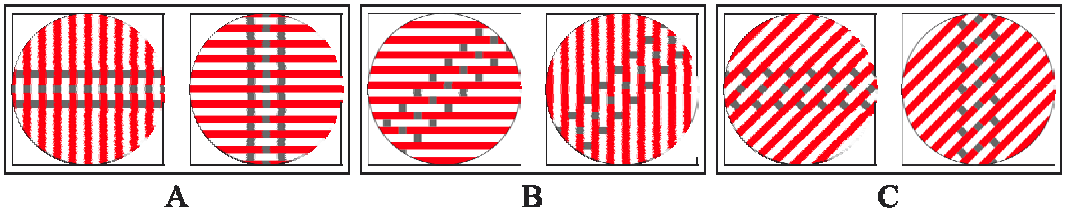

Figure 1. Gratings used in the tests. Only the central sequence is analyzed.

Variation of vision that depends primarily on the relationship between the Bezold effect (chromatic assimilation) with the orientation and frequency of the grating (content of the dish). The presence of the grating forces us to take into account the psychology of Gestalt.

This study (variation of the chromatic assimilation frequency), depending on the orientation (vertical, horizontal and inclined 45 degrees) of the sequence and the grating, conducted in three stages.

1. Compare vertical grating and horizontal sequence with horizontal grating and vertical sequence. (Figure 1-A)
2. Compare vertical and horizontal gratings, with 45º inclined sequences in both cases. (Figure 1-B)
3. Both gratings are inclined 45º and the sequences are vertical in one case and in the other one horizontal. (Figure 1-C)

The results tell us that the increase Bezold effect (redness of the gray sequence) on the vision of the gray sequence with the decrease of the frequency of the grating as a surround, is given by a linear connection. The Bezold effect that we see on the gray sequence is greater with the horizontal orientation instead of the vertical grating.

FOOD, COLOR AND HEALTH: THERAPEUTIC AND PREVENTIVE APPROACHES

Poster presentation

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The use of color as a healing item or balancer is not a recent discovery. The techniques that came with the use of colors also applied to the Golden era of Greece, ancient Egypt and the ancient civilizations of India and China.

These civilizations believed that everything happening in the cosmos affected the individual, as well as the whole universe.

We start from the basis that man is not only its physical body but mind, emotion, soul, among others. Our life is set in a constant interaction with our body with energies we create and which we cross. We also think that these bodies have different vibrational frequencies that correspond to different colors.

If this interaction is a dynamic and balanced process, it creates in us well-being and health, if there is resistance, interaction ceases, energy stops and diseases appear, occur.

It is not hard to imagine that long known civilizations decided to take shortcuts in the ways of healing.

Knowing that we can transmit our fitness as a confluence and resulting forces, we can also modify that state of mind with the intervention of other forces of nature but different vibrational frequency.

The proper use of color (i.e. its radiation) appears in the several processes balancing them, relieving illness, not as a substitute for drugs but with the original power of light, which works at all levels to be the most powerful cosmic force.

The disciplines that include are the color-therapy, the colorimetry, solarized water.

One of the most efficient ways of restoring the balance of the color in an organism is through food.

The color-therapy is a simple method to cure diseases and disorders of the mental, emotional and physical bodies based on the principle of energy. Each food has a value or degree according to the color of our bodies, to provide the vibration that is missing from the energy of light expressed by colors

As of the colorimetry it is mentioned by who that stands for the importance of a diet based on the 7 colors, as a preventive method.

Solarized water color, consists of drinking water after it has been exposed to the light of the Sun in colored bottles.

On the other hand, this theory is corroborated in the field of psychology that, based on the physiology of the perception of colors, developed various personality tests used in the technique of psychodiagnostics.

EFFECT OF WASHING-DISINFECTION CONDITIONS ON TOTAL ANTHOCYANINS RETENTION AND COLOR OF FRESH-CUT STRAWBERRIES

Poster presentation

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Strawberries are good source of vitamin C and anthocyanins. Anthocyanins are one of the most important pigments responsible for fruit appealing and bright red color. Another significant property is their antioxidant activity, which plays a vital role in the prevention of neuronal and cardiovascular illnesses, cancer and diabetes. There has been an increasing demand for fresh-cut fruits and vegetables, mainly because of their convenience as ready-to-eat products as well as for the health benefits associated with their consumption. Disinfection of fresh-cut products by washing is an essential operation to eliminate foreign matter and cellular fluids produced by cutting. The aim of this work was to evaluate the total anthocyanins retention and color changes of fresh-cut strawberries (*Fragaria x ananasa* cv. Camarosa) after peracetic acid disinfection at different times and temperatures. Response Surface Methodology was used with a Box-Benhken three-level, three-factor design. The factors and levels investigated were peracetic acid concentration (0, 50 and 100 ppm), time (10, 65 and 120 s) and temperature (4, 22 and 40 °C). The responses were: total anthocyanins retention and color parameters. Total anthocyanins content was determined in the untreated and processed fruits, and the results were expressed in milligrams of pelargodin 3-glucoside per 100 g of fresh weight (mgP3G/100gfw). Color (CIELAB values) was measured with a Minolta spectrophotometer CM-508d/8, D65/10°, SCE. Chroma (C*), hue angle (h) and total color difference (delta E*) were also calculated. Total anthocyanins content of the untreated strawberries were 24.8 mgP3G/100gfw. The response surface model described the experimental data adequately ($R^2 = 0.912$), exhibiting no significant lack of fit ($p \geq 0.05$). The peracetic acid concentration and the processing time, as described by a linear term, and the temperature, as described by the interaction term with time are significant ($p \leq 0.05$) for the total anthocyanin retention model. All the other terms were no significant. The anthocyanin retention decreased as both peracetic acid concentration and time increased. The only instrumental color parameters affected by process were in L* and a*. The response surface model described the experimental data adequately ($R^2 = 0.73$ for L* and 0.79 for a*), exhibiting no significant lack of fit ($p \geq 0.05$). Peracetic acid concentration, described by a linear and quadratic term, was significant ($p \leq 0.05$), for L* and a* parameters respectively. a* was significantly affected by temperature too, described by quadratic term. a* values decreased as both peracetic acid concentration and temperature increased and L* values increased as peracetic acid concentration increased. The predictive models obtained were shown to be adequate and could be used as a way of improving the washing-disinfection operation.

INFLUENCE OF WATER ADDITION ON COLOUR OF A CHOCOLATE COATING

Poster presentation

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Coverings and coatings are of utmost importance in confectionery production. In addition to blending with the product flavour, they should enhance the confectionery appearance. Consequently, a careful selection should be performed in order to attract the consumer. Cakes suitable for consumption by individuals with celiac disease were covered using a chocolate brand permitted in the food industry. Chocolate covering should achieve an even thickness in the shortest time possible as this development aims at marketing at industrial scale. Immersion was the selected process. The covering was thicker than expected. Therefore water was added in order to decrease viscosity.

Chocolate colour should be very dark, uniform and bright. Red and green are prevailing colours in the make up of brown. The objective of this study was to determine the influence of water addition on chocolate covering colour. A CR300 Minolta colorimeter with standard illuminant D 65 and 2º observer angle was utilized. L∗ (lightness) parameter, a∗ (red-green components and b∗ (yellow-blue components) were measured in the CIELAB space. Two elaborations using the covering, diluted according to manufacturer's instructions (samples 1 and 2) and two elaborations using 450 g covering and 200 ml water (samples 3 and 4) were carried out. Statgraphics plus 5.1 software was used for the statistical analysis. A simple ANOVA test was performed. Significant minimum differences were determined by Tukey test with 95% confidence. L∗ parameter showed 37.37^{ab}, 34.39^{a}, 36.88^{ab} and 39.32^{c} as results. The values for parameters a∗ and b∗ were 6.61^{a}, 6.76^{a}, 6.55^{a}, 6.71^{a} and 2.55^{b}, 1.59^{b}, -0.07^{a}, -02.24^{a} respectively.

Results show that lightness of undiluted samples as well as one of the diluted samples showed no significant differences, unlike diluted sample 4. No significant differences were observed in the red-green components parameter. Parameter b∗ (yellow-green components) was affected. Undiluted samples rendered positive values (yellow) and diluted samples exhibited negative values (blue). No differences in colour between undiluted and diluted samples were observed with macroscopic visual analysis performed by the research team. This result correlates with the instrumental test performed on b∗ parameter, red and green components, that make up the typical brown colour of chocolate.

COLOUR DETERMINATION IN MULTILAYER MINICAKES

Poster presentation

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Minicakes are a kind of sandwich cookies that are quickly gaining popularity. Individuals with celiac disease constitute a population sector with specific food needs. A wheat flour product available in the market was analyzed in order to determine its suitability to develop minicakes for the celiacs.

The aforementioned product consists of two chocolate covered sponge cake layers, filled with milk spread.colour is very important as it is the first sensory attribute to be perceived by the consumer. When opening the packaging, the first impression is offered by the product covering. After being hand broken in halves, the minicakes provide a whole picture of the three components. Colours displayed are brown (coating and milk spread) and yellow by the sponge cake. Different layers of a multilayer food product are not clearly differentiated as they overlap on the intersection areas. This study aimed at determining whether colours of different layers look like the original components or whether there is penetration of one product into the other. Ten samples of two different lots were analysed. A CR300 Minolta colorimeter with standard illuminant D_{65} and 2º observer angle was utilized. L∗ (lightness) parameter, a∗ (red-green components and b∗ (yellow-blue components) were measured in the CIELAB space. Statgraphics plus 5.1 software was used for the statistical analysis. A simple ANOVA test was performed. Significant minimum differences were determined by Tukey test with 95% confidence. L∗ parameter showed 38.01^{a} and 44.74^{b} as results. The values for parameter a∗ and b∗ were 9.60^{a}, 9.80^{a} and 4.20^{a}, 6.10^{b}, respectively. Results of L∗ parameter measured in milk spread filling were 36.2^{a} and 39.56^{b}. The values of parameter a∗ and b∗ were 11.98^{a}, 13.84^{a} and 11.98^{a}, 12.38^{a}, respectively. Sponge cake dough L∗ parameter measurements were 67.97^{a} and 69.02^{a}. Parameter values a∗ and b∗ were 1.88^{a}, 8.90^{b} and 26.99^{a}, 29.91^{b}, respectively. No significant differences were observed with macroscopic visual analysis performed by the research team. This may be due to the fact that red and green parameters, a∗ parameter (components of colour brown) do not show significant differences both in chocolate covering and milk spread. Sponge cake layers showed high values of yellowness, b∗ parameter. As a consequence, b∗ parameter in both chocolate covering and milk spread and a∗ parameter in sponge cake did not affect visual perception.

ENJOYING FOOD UNDER A NEW LIGHT

Oral paper

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After more then 120 years of living under the warm and colour reliable light of the incandescent bulb, we are now forced to replace it for an "energy friendly" source of light. The most faithful electrical light source for colour rendition is soon to disappear.

In many countries the process of phasing out all incandescent lamps is already underway and user concern over the suitability of energy efficient lamps is starting to grow. How will we cope in our everyday lives in the absence of the incandescent lamp? Will colours of fruits and vegetables look as vibrant and intense under CFL or LED light sources? Would our appetite and enjoyment of food be affected by this change in lighting condition?

It has been observed that the difference between an incandescent light source and that of a CFL or LED light source has not only to do with the colour rendering index but also with the perceived brilliance and reflectance that the same hue can give under these different lighting conditions.

It is a fact that the perception of colour varies under different light sources and therefore colour pigments and light cannot be treated separately. It is exactly this intimate bond between colour pigments and light that is often underestimated and sometimes even ignored by people when selecting the lighting qualities for spaces such as the kitchen or dining table.

There is a considerable lack of information regarding the advantages and disadvantages of new light sources available on the market, and it is perhaps now necessary to define guidelines in order to assist consumers and manufacturers in achieving the best condition possible in areas where high colour rendering is required.

This information should reach not only every discipline working with colour but also every individual that considers energy efficient lamps to replace traditional light bulbs within the home.

Nevertheless, one thing we can all agree on is that the light emitted from LED and CFL light sources is still not as inviting, comfortable and colour reliable as that of the incandescent lamp, making our traditional and "energy inefficient" bulb still incomparable to any other artificial light source.

FRENCH DESIGN COLOR WINE

Poster presentation

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In France the competition is held annually on the best design "Observeur du design". Visual analysis of shades of color actors compete with the various functions for the period 2006-2009, showed that the dominant shades of French wine.

Wines are divided by color into white, red and pink. Hue range of wines is vast. Shades of white wines include: silver-white, green, yellow, light-straw, golden, amber. Shades of red wine: purplish, ruby, violet-red, blue and red. Rose wines are obtained by blending white and red wines. For pink wines are wines with a hint of onion peel, which predominate in the color orange tones, as well as the color salmon.

The color of wine is largely determined by the properties of the vine and place of its cultivation. He embodies the "spirit of place" of France, which in architecture theoretically anticipated Frenchman C.-N. Ledoux (March 21, 1736 – November 18, 1806) in the 21st century. The palette of shades of wine has created a blend of French design.

The French say that white wine was created to quench your thirst, red –for pleasure–, and pink –for love. French design embodies the things that are created for a utilitarian purpose, for pleasure and for love. Function is painted in color. Thing symbolizes the quality of contact with her. Color is not just an aesthetic category, it reflects a lifetime the period of maturation, adulthood and old age. The result of maturation of wine is to change the color. Colors of red wine are becoming more intense shades of white wine - darken. Very old red wines may be lighter than whites. Color hue and brightness of the wine depends on the stage of oxidation and fermentation. Wine gets brown, brick hue and nuances of onion.

With regard to human life shades of wine show "the circle of birth" and "the circle of birth" and "wheel of inevitability" in full or partial sequence: birth - birth - life - death - immortality (revival). The wine reflects the concept of dualism, the asymmetry of the psycho-physiological states of people and situations: weak - strong, small - large, unhappy - happy, silent - talkative, cold - hot, quiet - a stubborn, cowardly - a brave, stupid - smart, etc. The wine changes the functional and sensory human condition. Things, objects, painted in shades of wine, changes people. Color hue the wine of French design reflect and give rise to the French philosophy, French character and mentality, the transformation of society, the French traditionalism, sensuality and religiosity.

PREFERABLE LIGHTING CONDITIONS FOR THE APPEARANCE OF THE DISHES IN THE DINING ROOM

Poster presentation

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When we have meals in the dining room, it is essential to enjoy dishes. The appearance of the dishes is one of the elements of palatability. And for the good appearance, the colour, the shape and the texture of the dishes are the major factors. Therefore, it is necessary for the lighting in the dining room to make the dishes look tasty in colour, shape and texture. So, this study aims to show the preferable lighting conditions for the dining room. And we conducted the experiment on the subjective evaluation under 11 conditions in total, which combined light source, light colour and illuminance.

In this experiment, we used fluorescent bulbs and LED bulbs. The conditions of correlated colour temperature of fluorescent bulbs were 2800 K and 5000 K, and of LED bulbs were 2800 K and 6700 K. And we controlled the illuminance on the dining table from 50 lx to 170 lx. We chose food models of Tempura, boiled greens, rice and miso soup as the visual objects. Under each lighting condition, 4 subjects sat around the dining table, and evaluated 4 factors: "Brightness on the table", "Visibility of the dishes' colour and shape and of the tableware's colour and design", "Appropriateness of the modeling dishes", and "Preference of the appearance of the dishes", with the 6 steps of the categorical scale. Finally, they evaluated "Impression of the dining table" using 20 pairs of adjectives with 7 steps of the semantic differential method. There were 20 female subjects, all in their twenties.

The results showed that the evaluation under the conditions of fluorescent bulbs was higher than under the conditions of LED bulbs in each of the 4 factors when correlated colour temperature was low. In the evaluation for "Visibility of the dishes' colour and shape and of the tableware's colour and design", it was shown that the evaluation under the conditions of high correlated colour temperature was higher than under the conditions of low correlated colour temperature. On the other hand, in the evaluation for "Preference of the appearance of the dishes", it was shown that the evaluation under the conditions of low correlated colour temperature was higher than under the conditions of high correlated colour temperature. And in the evaluation for "Impression of the dining table", there were differences in light colour and illuminance. In the results of the factor analysis, three psychological factors were extracted; the first factor is "activity", the second factor is "comfort" and the third factor is "high-quality". It was shown that the impression under the conditions of high illuminance was more active than under the conditions of low illuminance, and that the impression under the conditions of low correlated colour temperature was more comfortable than under the conditions of high correlated colour temperature.

ROSE PINK : A COLOR DOMAIN IN INTERACTION WITH FOOD

Poster presentation

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Rose pink (Turkish, *gül pembesi*) is a color that comes from the culture of food and soft drinks. It comprises scented rose petals and the use of essential oil and rosewater. The visual identity is preserved by an going cultivation of the rose and the achievement of a worldwide economic value. This is *Rosa damescena* Mill. (Pink rose) creates this area of synaesthesia of color, fragrance and flavor within its typical scent.

The imperial Ottoman cuisine has relied on the synthesis of flowers and fruits with copius use of spices and sugar that provides the polychromy of food. Yet, fragrant rose petals put in meat recipes such as stuffings and meatball in some regions, authenticate the culinary habit.

The pink rose gives its color to rose jams and sweets like *gülengübin, gülbeşeker*, *gül hâmiresi, güllaç* and rose sherbets, syrops and julebs that were confectionned in Court. Then they were presented as prestige products, later available to the general people. Consequently, in food context the color of rose is a *rose color (gülrengi)*, therefore it is pink. Terms such as *gülgün* (rose color), *gülabi* (rose colored, pink), *gülgüli* (pink), *şeker pembesi* (sugar pink), generate a special color corpus. The color of Pink rose and *gülbeşeker*-the jam made of rose-, take place at the limit of the scale. This corpus, even limited, permits to valorize this field as a cultural pink. And the red variations of the rosewater where 45% of it is used in food are within the limit of red.

Eventually, most color of the sweets is equivalent with the qualification of the *inherent color*. The historical, cultural and regional observations as well as written sources will provide us the colored evidence of this color identification. Color matches in gouache from the pink rose itself and assorted products like jams, sherbets, desserts and comfits, nearby some other product designs related, and the representations as miniature painting, give us the natural origin of this color.

The comparison of the color samples as the *perceived color* within the exterior context during the last forty years with their authentic source, the *inherent color*, will show us how this color field is applied in cities, and how much of it is either conventional or perceived. Thus, within the context of food and drink transmitted to the west since the crusades, the French terms such as *eau de rose*, *rose bonbon*, *dragée*, and the English ones such as *sugar candy*, and *barbie pink* will be understood. Ultimately all of these will serve to determine a palette and a system which is the reflection of various rose products.

INFLUENCE OF PACKAGE COLOUR FOR MINERAL WATER PLASTIC BOTTLE TO CONSUMER'S PURCHASE MOTIVATION

Poster presentation

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The aim of this study is to know the influence of the package colour for mineral water plastic bottle to consumer's purchase motivation. We conducted two pilot surveys and four sensory tests for the aim in this study.

In the pilot surveys, in order to discover a problem and determine the direction of the study, package colours of mineral water plastic bottles sold on the Japanese market, which were 52 bottles made in Japan and 49 bottles made in other countries, were measured by a spectrophotometer. The investigation of consumer's consciousness was carried out through questionnaires.

In the colour measurement, the base colours of the photograph images of 101 mineral water plastic bottles were measured instrumentally, and their RGB values were calculated and converted to XYZ and L*a*b* values. The tendency of the package colours used for the mineral water plastic bottles on the market was analysed using the colorimetric values. We found some tendency, for example, that the colours for around 60% of the mineral water plastic bottles are blue in the hue area of greenish blue to purplish blue. In the consumer's consciousness survey, for example, the relationship between the colours and preference of the mineral water plastic bottles was investigated by two questionnaires.

In the sensory tests, at the first, two visual evaluation experiments using PCCS colour samples were conducted to know the relationship between colour impression and three colour attributes L*C*h, lightness, chroma, and hue. One of the experimental results was that the package colour of the highest purchase motivation is pale greenish blue $p16^{+}$. Secondly, in order to investigate the influence which package colour has on consumer's purchase motivation and taste sense, two experiments were conducted using the same colour sample, blue, pale blue, red, pink, white, and grey. One of the results was that the tastiest water is one packed into a white package plastic bottle even using same water.

Through this study, the data about the impression, and influence on consumer's purchase motivation and taste sense by package colour of mineral water plastic bottle were analysed and some characteristics on relations among those were found.

COLOR-COMPOSITION RELATIONSHIPS OF SEEDS FROM TWO RED GRAPE VARIETIES

Poster presentation

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Grape seeds are waste products of the winery and grape juice industry. The seeds contain lipids, proteins, carbohydrates and 5-8% polyphenols depending on the variety. Grape seed extract is known a powerful antioxidant that protects the body from premature aging, disease and decay.

In this study, seeds samples from two red grape varieties (*Vitis vinifera*) were screened for their polyphenolic composition and, the tristimulus colorimetry was applied to evaluate the color of the extracts from seeds.

Total phenolic content was analysed by Folin-Ciocalteou method, color parameters were analysed by spectrophotometric methods and the different phenolic compounds were analysed by high performance liquid chromatography (HPLC). They were identified according to their order of elution, retention times of pure compounds and characteristics of the UV-Vis spectrum published in different studies.

The identified compounds were mainly hydroxycinnamic acids (m-coutaric, *m*-coumaric), benzoic acids (gallic and protocatechic acids) and flavonoids (catechin, epicatechin and quercetin). The phenolics compounds quantified by spectrophotometric method were related to chroma (C^*_{ab}) and lightness (L^*). Certain differences were observed for the color extracts from different variety, although other important factors have to be taken into account such as the degree of ripeness or soil type. The differences with respect to the results reported by other authors in relation to polyphenol profile were attributable to climatic differences in the areas where the different studies were performed, in our case very hot summers with very high environmental temperatures.

EXCITING ARCHITECURE FOR EXCITING FOOD

Poster presentation

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For the consumer of the so called "evolved society" the food has loosened every reference with its origin and with all the processes staying between production and goods. The nature and the primary environment where the food come up are very far from the supermarket shelves. On them are placed exciting (hyper)colored objects coming from a reality re-creation planning, filling this new reality by an aesthetic (sur)plus, finalized to make the products fascinating and easy to buy. The food shown here is simply a lifeless object and its simple watch must give pleasure. In this context the lighting and the colour are strategic. But the container, the building where the goods are sold has also a big importance than the products.

This new heathen temple celebrating the food market, but not only this, casket, victual warehouse, food vital spring, is strategic for the new reality interpretation. It's a new reality because completely different from the true real one. In this contemporariness containers, of people and goods, it take place the rite allowing everybody to get the food with low effort, where the great number of people exalt the sharing of fashion, of messages, of communications and of all the signal apparatus needing a specific architectonic contemporary typology.

These contemporary coloured market temples have opening and presence time-tables surely wider than every other business. So they must live by day and night, under the sunshade and the artificial lighting, they need to be easily visible and identified, because they must be easily to join, eliminating most of the obstacles present in the city, from where they moved away. Every city has traffic circulation and car parking problems. A mall, a supermarket, or a generic commercial centre must be free of this kind of problems. It need to be exciting, have friendly appearance, familiar, pleasant, at most banal, a building in which bowels everybody feel well. It must be market pull or marked driven oriented, for everybody tranquility. So the external color of these sites need to have dramatic visibility from far away, to be a people/consumer/user attracting pole, and the interiors need to be a magnet from which you cannot detach, capturing bodies and spirits, driving you along the business designed roads. The color used inside is prevalently that of the food, or nature simulating, at most fantastic.

The paper will report about this attractiveness of colour due to some contemporary technologies, externally and inside the malls, above all of those where is prevalent the feeding, always present inside the commercial architectures, because it seems to be a must in every (pseudo)socializing site, provoked or not by trade.

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