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ABSTRACT BOOK

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ORAL SESSION I

A COLOR CHOICE FOR A GOOD HOUSING ENVIRONMENT : A RESEARCH ON A REPAINTING COLOR OVER A WALL OR ROOF IN HOKKAIDO

Koya Sakahara

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O - 01

In '95. '96. '97, we had made a research on the sense of inhabitants at a townscape by owned house residents in Sapporo and the suburbs of 3 cities. 22.2% of families accepted the questionnaires. We got 6368 effective data and recovery rate is 89.6%. We consider the question "If you repaint on a roof(a wall), which color do you choose? Please choose a color in the attached color sheet." We made this color sheet using the color chips on the market. As we thought that there are some color differences among each color chips, we sampled 50 color in random, measured each value for CIELAB with colorimeter(Minolta CR-200), and calculated the mutual color difference and these median. The largest color difference is 7.45. And then, we wrote a color name under each color chips. Therefore, if we use this color sheet on the condition that the largest color difference is about 10 and there is a color name in each color, we think no problem.

We take notice of a color on a wall. We consider the color on a wall which is chosen with a higher rate and the color on a roof which is chose by the same people who choose the wall color. In the majority of cases, We choose an achromatic color of a higher lightness as a color on a wall. But we sometimes choose achromatic color. We consider the top 3 in chromatic colors and chromatic colors.

A SURVEY OF MEASURES OF TOWNSCAPE ORDINANCES AS TO COLOR ENVIRONMENT - ANALYSIS BY TOWNSCAPE ORDINANCES -

Shoji Iijima

Okayama Shoka University

O - 02

The aim of this paper is to provide with information on details of townscape ordinances in Japan, and their classification by the scale of local authorities and region concerning color environmental policy. This paper intends to describe a outlines of the townscape ordinances about color control in Japan.

About 200 townscape ordinances were analyzed concerning zoning mechanism, color guideline, citizens' participation and so on. As the result, detailed aspects of townscape ordinances were cleared under current legal system, and quality of Japanese townscape ordinances were identified as to color environmental policy.

This paper discussed the situation of color environmental aspect as to townscape ordinance under Japanese present townscape color condition.

In expectation, townscape ordinances will play an important role in the near future to keep and create comfort color condition in Japan.

“COLOUR WORDS” LANGUAGE FOR URBAN PLANNING AND ARCHITECTURE

Michel Cler
Colour Consultant

O - 03

In the daily life, colour aspects completed tactile effects are used permanently; “Color words”, being parts of a “Tool” e.g. Chromatic Chart, which have to be used, purposely or not, by each of us. -Colour words, where did they come from? do we perceive them conscientiously? - Colour appearance and industrial material or hand made expression? - Urban planning, architecture what is the Chromatic development, the Chromaticscape?

General Aspect(Just to remember); Vision as one of the various perception supports, provides information in accordance with different aspects : cultural, social, symbolic, commercial, poetical messages... Colour as a Media, same colour aspect may have a lucky or unlucky effect, it will depends from message, context or surrounding. We perceive most of those Colour words messages, located in urban spaces and on architectures. - Public spaces in daylight and during the night, are over flooded by “messages” building advertising, signs, street furnitures, plants, mineral, cars, people, fashion. -Private expressions on architecture, for various reasons, have less opportunity to appear either perennially or temporarily.

From geographical and cultural site to urban council and private use: How to practice and suggest colour appearance use in development and estates? - Practical Chromatic tools for urban maps, estates, industrial areas...France- West indies - Survey from site impact : study analysis, then synthesis. France - Hue - Hong Kong Next step being the industrial aspect of material issued from the survey, and how to provide the information and consultancy to architects, developers, urban planners. In this part some questions will be suggested: Tradition and heritage(Facadism) - Does a Chromatic range needs to be limited in “Colour words” and in futur? What means to import a “Colour word” in a domestic range? How to transmit Colour identification? An international “Colour word” vocabulary(NCS) is used and we practice from some years in various areas. Too frequently, colour is studied on an abstract aspect only, which in a sense is important, but not on practical daily reality. How to use it, or to provide people some information on its meaning, on the way to use it with council, material, architects. How to

O - 03

propose to enrich an individual, or group of inhabitants Colour vocabulary? how to suggest its further developments,(import, modified meanings...)? Those questions have no receipt, a long term practice helps to find some directions some answers adapted to each project.

PLEASANTNESS AND FREQUENCY OF SOME BI-COLOUR COMBINATIONS: AN ITALIAN - INDIAN CROSS - CULTURAL STUDY

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O - 04

A long series of research already pointed out the main factors determining the pleasantness of colour combinations of different hues: for most authors lightness relationship between colours is the main variable affecting the pleasantness of the combination; in addition from a more modern point of view, a larger set of aspects like whiteness, blackness and chromaticness is proved to be relevant as well. Personality traits and cultural differences are seen to emerge in the preference for inverted combinations (whiteness and blackness are in this case reversed as regard to the natural lightness ratio of the involved hues), while general appreciation is usually shown for the correspondent combinations, and disfavour for the vague inverted ones.

Starting from the results of previous studies, we wanted to discover whether the more or less frequent presence of some colour combinations in the environment might affect the degree of their pleasantness; secondly we aimed also at showing possible differences between populations under this respect. Therefore four groups of 50 subjects each were investigated, two in Milan (Italy) and two in India (Delhi); they were from 18 to 30 years old and studying in humanistic faculties. Stimuli were 45 cards representing pairs of colours obtained by combining ten hues (red, green, yellow, pink, blue, light blue, orange, brown, ochre, violet).

One group of Italian subjects and one of Indian subjects had to rate in a 1- 7 scale how much familiar they considered each particular colour combination of the experimental set, being familiarity a subjective evaluation of the frequency of that combination in the environment. The other groups of subjects had to rank the colour combinations from the most to the least agreeable ones.

The first results concern the familiarity estimation: unexpected high correlation was found between Italian and Indian values. This means that the same combinations are judged to appear with almost the same frequency in both the Italian and Indian environment, and this might mean that the city environment is probably not so different in the two countries (other explanations can be considered). Secondly, also judgements of pleasantness resulted highly correlated between the two countries: this

outcome can be expected independently of the role of the environment, as the colour combinations were of the correspondent type; but we found also that pleasantness and familiarity scales are highly correlated independently of the country, and this result confirms the hypothesis that similar environments involve similar preferences. A more detailed statistical analysis reveals some differences between males and females: Indian males substantially differ from Indian females and Italian males in evaluating colour pleasantness, while the two Italian male / female subgroups are highly correlated under this respect; moreover Indian males also show relatively low correlation with Italian males in assessing colour familiarity; lastly pleasantness and familiarity judgements differ in the two Italian female subgroups; all other subgroups appear to be highly correlated. In conclusion the results stress more the similarity than the difference between the two populations, although new findings like some sex related differences deserve further investigations.

COLOUR DESIGN IN URBAN PLANNING - AN ENVIRONMENTAL FACTOR

Berit Bergström

Scandinavian colour institute AB

O - 05

The individual's perception of what is ugly or beautiful is based on experiences gained over many years. One learns to see, understand and appreciate the colours in nature in all their variations and one gets used to the fact that houses usually have certain types of colours. New impressions are interpreted and evaluated against the background of the references which one already has. What one recognizes and can interpret is usually perceived as beautiful. Anything which is difficult to interpret, on the other hand, may be perceived as ugly - or sometimes as exciting.

The references differ between different countries, different cities, different cultures and different types of nature, and people's opinions of what is "beautiful" are stamped by the places in which they grow up. These differences between different places are worth noticing and preserving since the colour character is an important part of that quality which is difficult to define but which is called "mood" or "atmosphere" and which is the basis for how we perceive our environment to be good or not. Colour is as important a factor in city planning and architecture as the interaction of volumes, the shape of details and the changing nature of the materials and one cannot merely "colour" something which is already regarded as a finished work. In order to fully interact with other active factors, colour must be introduced at an early stage of the work process and become a self-evident aspect in the creative process with sketches, reassessments and alternative solutions. "Genius loci" - the soul of the place - is a concept which has stamped a lot of the colouring debates of the 1980s and 90s. Another way of expressing approximately the same thing are the words "local colour". What is it that gives a group of buildings, a city, a suburban district or a part of the country its particular character? It is completely clear that colour plays a central role, and to understand "the soul of the place" must therefore include the understanding of its colour character. The colour character is unique for the place and is dependent on its conditions. Colours cooperate in a total environmental experience of a region and the colours must be carefully analysed and documented. Which colours do we perceive to be beautiful and which are ugly? How large are the cultural differences which exist?

O - 05

References :

Fridell Anter, K. & Enberg K. Utvändig fargsattning (External colouring)
Janssens, J. & Kuller, R. Fargsattningens betydelse för upplevelse av
stadsbilden (The impact of colour on the perception of urban space.)

CONFERENCE ON THE STATE OF THE ART OF POLYMERIZATION

ON THE KINETICS OF POLYMERIZATION IN THE PRESENCE OF
EMULSIFIERS AND SURFACTANTS

Edited by J. Smid, Department of Chemistry, University of
California, San Diego, La Jolla, California 92037, U.S.A.
and J. D. Hoffman, Department of Chemistry, University of
Illinois, Urbana, Illinois 61801, U.S.A.

ORAL SESSION II

The first of the two papers in this session is by J. Smid and J. D. Hoffman. They discuss the kinetics of emulsion polymerization in the presence of surfactants. The second paper is by J. D. Hoffman and J. Smid. They discuss the kinetics of emulsion polymerization in the presence of surfactants.

The third of the two papers in this session is by J. D. Hoffman and J. Smid. They discuss the kinetics of emulsion polymerization in the presence of surfactants. The fourth paper is by J. Smid and J. D. Hoffman. They discuss the kinetics of emulsion polymerization in the presence of surfactants.

INVESTIGATING PARAMETRIC EFFECTS ON COLOUR DIFFERENCE EVALUATION OF CRT DISPLAYED COLOURS

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O - 06

This paper investigated five types of parametric effects in assessing the colour difference using CRT generated colours. The visual assessment experiments were conducted in six phases, one reference phase and the other five test phases in which the viewing conditions are different from the reference phase. The viewing conditions of the test phases include the separation of the samples in a pair, the size of the sample pairs, the background colours and hairline colour. Totally 87 sample pairs were used in the experiments.

These 87 colour pairs belong to five colour centres, namely, orange, yellow, grey, green, and blue. The average colour difference of the sample pairs is about 5.0 CIELAB units. Grey scale method was used for colour difference assessment with 20 observations for each pair (10 observer repeated twice). It was found that if the sample pairs were assessed with a 3-inch gap between them, the parametric effect was around 30%. The small sample pairs (0.6-inch square) have a parametric effect of 26% in comparison to the large (3-inch square) sample pairs. The mean parametric effects for green and blue colour backgrounds are 27% and 26% respectively. However, when considering green colours under the green background and blue colour under the blue background, much larger parametric effects of 73% and 64% were obtained. When the hairline separating two samples in a pair was changed to grey, the discrepancy was found to be 20% in comparison to the reference phase, in which the hairline colour was black.

STUDY OF NEW REGRESSION MODEL FOR INTER - INSTRUMENT AGREEMENT

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O - 07

In previous studies, colour measurement results vary from 0.1 to 3.0 CIELAB ΔE units by using different spectrophotometers. Because of this poor inter-instrumental agreement, different mathematical models were developed to improve the agreement. In this study, empirical models are studied and developed. The "Lab Model" developed can improved the inter-instrument agreement between spectrophotometers up to 42%. The other model was also developed, which is based on the analysis of the spectral data from 400 - 700nm using regression method. Applying those models to the measurement of the coloured samples, the reproducibility can be improved accordingly. The reproducibility in spectral data should benefit the global colour communication between designers, coloration companies and buyers, etc.

HUE CHANGE OF CHROMATIC LIGHTS IN THE PERIPHERAL VISUAL FIELD

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O - 08

It is commonly accepted that the peripheral vision is different from foveal vision particularly in color appearance. Therefore quantitative measurement of the appearance of colored lights at different eccentricity is important for both basic and applicative vision science. Sakurai et al.1) measured the change of color appearance of red, yellow, green, and blue stimuli from fovea to periphery along the horizontal meridian using hue and saturation judgments.

In this study, we measured the color appearance of pink, red, orange, yellow, greenish yellow, green, bluish green, pale greenish blue, blue, and violet lights of CRT display at the locispaced across the horizontal meridian using the same method. All the stimuli were presented in equal luminance of 20cd/m² with 2deg X 2deg square surrounded by a gray of about N5. Stimulus locations were at the fovea and at horizontal eccentricities of 20, 40, and 60deg on the temporal, and 20, and 40deg on the nasal field for the observer's left eye.

The results show that hue of the pink, red, greenish yellow, green and greenish blue stimuli shifts toward yellow, and that of the violet shifts toward blue in periphery in both temporal and nasal visual field. Hue of the orange, yellow, pale greenish blue and blue does not change with eccentricity. Saturation for the ten stimuli all decreases from fovea to periphery with different slope of decrease in different stimulus. The present results are compared with the results of previous studies obtained using monochromatic lights.

1) M.Sakurai et al.: Color appearance of peripheral vision: Effects of test stimulus and surround luminance, *J. Illum. Engng. Inst. Jpn*, 84, pp.83-91, 2000.

COLOR IDENTIFICATION UNDER MESOPIC LIGHTING ENVIRONMENT: EFFECT OF STIMULUS SIZE

Masaru Ryuchi, Taiichiro Ishida

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O - 09

To use colors effectively as an aid for a visual task, we need to know how colors are identified under various lighting environments. The purpose of this study is to examine the effect of stimulus size on color identification under mesopic illuminances. The subjects identified color chips by naming them using one of preselected color terms: red, orange, yellow, yellow-green, green, blue-green, blue, purple, pink, brown, white, gray, and black.

The color chip was viewed through an square aperture of 4, 2, 1 or 0.5 deg in size against N5 background. The illuminance levels tested were 1000, 10, 1 and 0.1 lx. It was found that colors of four sizes were identified in the same manner at 1000 lx. The effect of stimulus size began to appear at 10 lx; the smaller stimuli were not identified consistently at 1x. The results will provide useful information for evaluating the validity of color usage in the living environment.

ASSIMILATIVE COLOR SHIFT INTRODUCED BY CHANGE IN PERCEIVED SIZE

Hiroyuki Shinoda, Mitsuo Ikeda

Department of Photonics, Ritsumeikan University

O - 10

Assimilation is a well-known phenomenon which occurs in a color pattern: individual color in a pattern appears to change toward their neighboring color. The smaller or finer a color pattern is, the larger such color shift is. Does perceived size have anything to do with this phenomenon? Or just retinal size of a pattern defines it? Even if the retinal size remains unchanged, the perceived size can be changed, for instance, by manipulating an observer's vergence. Shinoda & Ikeda (1998) have shown that the perceived size affects the visual acuity: when a target is perceived larger (smaller), an acuity goes up (down). Here we address a question whether the change in the perceived size (or fineness) of color patterns causes the assimilative color shift. In the experiment, appearance of color gratings was assessed for several perceived sizes while the retinal size was kept constant. We used a stereoscope-like apparatus with two mirrors and two CRTs.

The gratings made of light gray(L) stripes and one of color stripes, red(R), green(G), blue(B), or dark gray(D) were displayed at various positions on the CRTs in order that subject's vergence angle should be varied. Color of constituent stripes was matched with that of solid square presented below the grating. The perceived size was also measured as a function of vergence angle by size matching procedure. Our results clearly showed the dependency of assimilation on perceived size. When the vergence became larger, the perceived size became smaller and the color of constituent stripes change toward a spatially averaged color, in spite of constant retinal size. Our results imply that assimilation might occur not at retinal level but at cortical level in the visual system.

Reference :

H. Shinoda & M. Ikeda, Visual acuity depends on perceived size, OPTICAL REVIEW, 5-1, pp.65-68 (1998)

ORAL SESSION III

THE DEVELOPING OF COLOR TASTE SCALING AND THE APPLICATION IN COSMETICS

Kyung-Suk Song, Hae-Sun Lee, Jong-Il Kim, Soo-Kyung Park, Hyo-Bin Lim
Pacific Corporation

O - 11

The purpose of this study is as follows ; 1) To develop the method measuring korean's emotions by modifying the taste scaling method developed in japan. 2) To know korean's emotions by classifying consumers into groups according to their life styles, purchasing patterns and tastes, especially for men's cosmetics. 3) To utilize it on the market research and the receptacle design. Taste research with the visual boards of a basic and combination color order system, and others(12 ones) - each board has at least 12 pictures or maximum 25 pictures - was done on consumers who have experienced of buying men's cosmetics. Data were analyzed on computer by use of the frequency analysis, the taste factor analysis and the cluster analysis to classify 8 consumer's groups, according to the emotional taste factors.

As result, 8 kinds of consumer's groups were evaluated as "Ideal oriented romantic" Group A 20.6%, "Safety oriented traditional" Group B 7.2%, "Emotional enjoy cute" Group C 18.8%, "Noble Elegant" Group D 11.3%, "Humble proud dandy" Group E 7.8%, "Mature splendid gorgeous" Group F 6.6%, "Clearly sporty" Group G 10.9%, "Ability innovative modern" Group H 16.9%. The results of study was reflected on the developing of receptacle design for men's cosmetics.

* This study had been guided by Mr. Tohru Hirasawa of Image Marketing Institute with his own knowledge of the taste scaling method.

PSYCHOLOGICAL STUDY ON THE PREFERENCE FOR FAIR SKIN IN CHINA

Miho Saito

School of Human Sciences, Waseda University

O - 12

The sales figures of whitening products”, which make skin fairer, brighter and clearer soared to an annual total of approximately 1.7 billiondollars in Asian cosmetic market last year. Some old proverbs in Asian countries are actually telling that girls with fair skin have the benefit of covering their bad sides both in their personality and their appearance.

These facts above show that the fair skin has been preferred for many years in Asian countries.

Saito (1996) has reported a comparative study on the preferences for fair skin among Japanese and Indonesian women to understand their strong aspiration for fairer skin psychologically and culturally. For each of 52 words, the subjects were to rank in order four color samples representing fair skin to dark skin. The study showed that fair skin was preferred with its images of weakly, delicate and aristocratic.

In order to research Chinese women psychological images of the fair skin, nine pictures of the skin (cheek) were used as stimuli in this study. The pictures involved both information on color (three stages of L-value)and texture (three types of the texture) of the skin. The subjects were asked to choose three most appropriate words from the list to each stimulus. The list was consisted of 25 words representing the personal images.

The main results are as follows:

- 1) Dark skin with rough texture made negative impression in general.
- 2) In spite of its rough texture, the fair skin gave favorable, soft and feminine impressions.
- 3) Generally, fair skin made the impression of weakly and quiet however, it made the images of healthy and beautiful when the texture was fine.
- 4) Dark skin with fine texture made positive impressions, such as eye-catching and merry.
- 5) While fair skin presented feminine image, fine texture made healthy, cute and beautiful impressions.
- 6) The results of binominal test also indicated that the images, such as beautiful, cute, likable, clean, and healthy were determined not only by L-values but also by the texture of the skin. As the rough texture made unhealthy impression, it was suggested that the texture of the skin played an important role for the image of healthiness.

O - 12

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PREDICATION OF THE DEGREE OF POLLUTION OF REACTIVE DYEING EFFLUENT BY USING COMPUTER COLOUR MATCHING TECHNIQUE

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O - 13

The concern over the condition of the environment has grown tremendously in recent years. Most industries use water at some point in their processes producing wastewater in various composition and concentration. The textile dyeing industry is no exception, using extremely large quantity of water in various stages of production.

Effluents of dyes and their associated chemicals are usually considered as the source of water pollution. In order to reduce the environmental pollution at the source, an attempt has been made in this study to assess the environmental properties, for example, COD and TKN of various dyes before dyeing and the feasibility of combining colorant recipe calculation with pollution prediction by using computer colour matching technique that commonly adapted in textile dyeing industry for recipe formulation. The program for predicting the degree of pollution from the dyeing effluent of Cibacron dye series was found to be satisfactory.

NEW EFFECT PIGMENTS FOR THE ENVIRONMENT AND THEIR GONIOCHROMATIC QUALITY CONTROL

Peter Gabel
Merck KGaA

O - 14

During pearlescent pigments have become a staple among the colourants of stylists and designers for many years now, a new generation of effect pigments has become more and more popular. They are based on innovative substrates, like silica flakes or alumina flakes, ultra-thin multilayer interference film flakes and crosslinkable liquid crystals silicones. The goniochromatic colour shift of these pigments is extremely high. Improved (interference-) colour strength and a very high lustre are produced by this new effect pigment generation. Because of their composition the resulting multiple reflection of light and strong angular dependency colour measurement and colour measurement management will play a key role in quality control in the paint industry in the next years. This presentation describes test methods for typical colour measurement problems, as well as test results from goniospectro photometers with different measurement geometries and concepts. Explanation will be given for the correlation of instrumental data versus visual assessment. Furthermore, the need for continuing improvements in instrument performance to allow colour measurement techniques for new effect pigment generation will be discussed.

DIGITAL COLOR PALETTE FOR SPECIFIC USE GROUPS

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Dept. of Information Design, Ewha Womans Univ. & Moon Color Design

O - 15

This study aims to construct a practical digital color palette which is convenient to use and interchangeable enough not for universal usage but for specific use groups in digital era. It was based on study the needs of color users in specific fields. It is increasing that digital color palettes for particular usage instead of numbers of universal version of digital palettes for everyone. However, it has been true that we do not have any systematic digital palettes for particular usage. It has been also a problem of absence of accurate conversation and color representation due to lacking of standards and interchangeability among color names, RGB value, or LAB value in specific area.

In order to use colors in computer environment, based on a research, analysis, and arrangement by color value via RGB code, this study provides two palettes which help to represent accurate colors by regulating the numbers of colors and arrangement rules for the each demand of various fields such as medical industry, architecture and simulation, and product design. It is without question that this study was done by a survey of the people in the each practical field.

The palette is composed of two different combinations : 20 basic colors and 400 applied colors. It was made by choosing the most frequently needed colors according to the ISCC-NBS color namings, Korean standard color dictionary, traditional Korean colors.

The major competence of the palettes this study suggests is that it is composed mainly of the most frequently used colors, and represented by color names which helps linguistic conversation for specific use groups possible.

ANALYSIS OF THE FASHION FABRIC IMAGE UNDER CONTROL OF FABRIC COLOR AND TEXTURE

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O - 16

The purpose of this study is to analyse of the fashion fabric image. In this study, hypothesis is that the varied image of fashion fabric is changed as design elements of fabric. Among the design elements of fabric what is controled in this study are color and texture of fabric.

10 hues are selected by Munsell's system of color notation and 12 tones by PCCS color notation which is used for fashion industry. Finally selected color variables are 120 colors, black and white. Texture variables are classified as luster, prominence and depression of surface, thickness, density of fabric. Total 126 fabric samples are used for the survey from 20 to 50 years old graduate students and the specialists in the fashion companies.

The results of this study are as follows;

1. Fashion fabric images are classified as 5 main images; 'elegant', 'comfortable', 'characteristic', 'light' and 'simple'.
2. 5 main images are varied as hue, tone and texture of fabric. Elegant color are YR and R in hue light grayish and dark grayish in tone. Thin and low density fabric is the texture property of elegant image.
3. Preferences of the fabric color and texture varied as season, gender, years of age, clothing items. Color is most significant variable for the selection of fabric to season. In texture, thickness and density variables are varied as season.

QUANTIFYING COLOUR APPEARANCE FOR PROJECTED IMAGES

Young-Shin Kwak, Lindsay W. MacDonald, M. Ronnier Luo
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O - 17

The purpose of a colour appearance model is to predict changes of colour appearance of a visual stimulus under various different viewing conditions. Such a model can provide industry with a quantitative measure for assessing the quality of colour reproduction and enable more rapid and accurate proofing simulations of colour images. During the past decade colour appearance models have been developed that predict the magnitudes of perceived attributes for a wide range of viewing conditions. These models were derived from several sets of experimental data. However, most of these data sets were based on reflection (nonluminous) and monitor (luminous) colours. There have been relatively few experimental investigations of the appearance of colours projected onto a screen. The experiment result by M. Ronnier Luo and etc. using 35-mm slide projector as a part of LUTCHI data set (1993) found surprisingly large perceptual differences between the projected and reflected or luminous viewing conditions. More comprehensive and reliable experimental data is required to investigate relationships between the instrumental measurements and perceptual attributes of colours in projection media under different viewing conditions.

In this study, colour appearance data for projected colours by LCD projector was accumulated under three different viewing conditions; grey and black background with white luminance level of 154 cd/m² and grey background with 19 cd/m². Experimental conditions were controlled to get a compatible data with LUTCHI data set. Lightness, Colourfulness and Hue of 42 test colours for each viewing condition were assessed by a panel of 21 observers using a magnitude estimation method. The accumulated data will be used to evaluate the predictive accuracy of various colour appearance models; CIELAB, CIECAM97s, LLAB, RLAB, Hunt96 and CAM97s3. The performance of these models for projected media will be discussed in the final paper.

COLOR MODIFICATION FOR THE EXACT COLOR PERCEPTION IN PHOTOGRAPHS IN DIFFERENT ENVIRONMENTS

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O - 18

When an observer sees a scene under an incandescent light and takes a picture of the scene, he/she can not perceive the same impression of color in the photograph if it is displayed in an environment illuminated by a white fluorescent light rather than the incandescent light, but sees the picture to appear much reddish. Some color modification is necessary for the observer to see the exact color impression that he/she experienced before. We obtained the amount of the modification in this experiment. A subject stayed at a learning room illuminated by an incandescent light of chromaticity (x_l, y_l) for five minutes. We can express the situation as the subject constructed the recognized visual space of illumination, R_l in his/her brain and he/she perceived the color of the room based on the R_l . The subject then moved to a test room illuminated by a white fluorescent light of (x_t, y_t) and observed photographs of the learning room in succession which were prepared beforehand under the ceiling light of various colors between (x_l, y_l) and (x_t, y_t) . We can say that he/she was looking at the photographs with his/her newly constructed recognized visual space of illumination, R_t instead of R_l . The subject was instructed to choose a photograph which gave the same impression of color for the various objects in the learning room as he/she experienced minutes ago with R_l . It was found that the subject chose a photograph taken under the light of the chromaticity coordinates at about a half way from (x_t, y_t) to (x_l, y_l) . This amount of the modification can be explained by the shift of the recognition axis of the recognized visual space of illumination from R_l to R_t .

DIMENSION-UP FROM 2 TO 3 IN A PHOTOGRAPH TO YIELD COLOR CONSTANCY FOR THE ENVIRONMENT

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O - 19

We recognize the outside world as a three dimensional space in spite of its two-dimensional retinal image. This fact suggests that a two-dimensional photograph can be perceived as a three-dimensional scene if only the photograph is given to the retina as incoming outside information. If we can succeed in this dimension-up process the concept of the recognized visual space, RVS predicts the color constancy in the environment produced by the photograph. A photograph taken for a room illuminated by incandescent lamps was hung on a wall of an experimental booth which was illuminated by fluorescent lamps of daylight type. If a subject looks at the photograph with one eye and only the photograph without any other objects in the booth, he/she could see a 3-D scene of the room. When the photograph was seen in a normal way in the booth, that is when it was seen as a photograph placed in the booth, the subject saw a very yellowish color in it. But when it was seen in the way of the dimension-up method the color perceived for the space was much desaturated. In the experiment a test patch was placed in front of the photograph and the subject was asked to judge its color by reporting yellowish, or bluish, and so on. It was found that a little bit yellowish patch was perceived as neutral to show that the color constancy is realized at least in part in the photograph. This result shows that the RVS for the scene illuminated by incandescent lamps in the photograph was constructed and the test patch was perceived as an object in the environment. Another photograph for the room illuminated by daylight type fluorescent lamps was prepared and the color judgment was also conducted. In this case no shift of the color was observed for the test patch, namely an achromatic test patch was observed as neutral as expected from the concept of the RVS.

DETERMINATION OF BORDERS OF OBJECT COLOR MODE AT VARIOUS ENVIRONMENT ILLUMINANCE

*Rumi Yamauchi, Y. Thiangthangtum**, *P. Pungrassamee**, *A. Hansuebsai**, *M. Ikeda***

*Chulalongkorn Univ., Thailand **Ritsumeikan Univ., Japan

O - 20

When the luminance of a particular surface of an object is gradually increased by spot lighting, the color changes but the appearance remains natural in the environment keeping still the object color mode. For a further increase of the luminance, however, the surface begins to appear unnatural as an object placed in the environment. This situation was expressed as that the luminance of the surface became too high and the surface went beyond the border of the recognized visual space of illumination, RVSI. The appearance then becomes luminant to indicate the light color mode. To know the border points of color charts is useful when one wants to make a certain color object conspicuous by selectively lighting the object by a spot light in an environment. The present paper determined the border points for 38 color charts covering hue and saturation while keeping lightness at middle range and for three different illuminance of the environment, 1, 10 and 50 lx. The border luminance was high for yellow and purple blue color charts while it was low for red and blueish green color charts. The difference in luminance between the two groups was about 0.3 in log unit implying that two times of spot light strength was needed to make yellow and purplish blue color objects conspicuous similarly as red and greenish blue color objects in environment. To investigate whether the brightness of the color charts determines the border, the brightness matching was conducted for all the color charts against a reference chart of N7. There was a close relationship between the border points and the brightness for most of the charts but there was some exceptions, for which some other determining factor(s) should be existing.

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COLOR CHANGE IN THE CONSTRUCTION PROCESS OF RECOGNIZED VISUAL SPACE OF ILLUMINATION FOR A NEW ENVIRONMENT

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O - 21

When an achromatic test patch of N4 placed in midair of a test room illuminated by a main ceiling light is additionally illuminated by another colored light without being noticed by a subject, the illumination thus being called the hidden illumination, he/she does not see the patch as the achromatic patch illuminated by the colored light but as an object colored itself. This phenomenon is immediately explained by the concept of the recognized visual space of illumination, RVSI1). The subject constructed the RVSI for the ceiling light in his/her brain and perceives the color of the patch based on the RVSI. However, if some other objects are inserted into the area of the hidden illumination as the initial visual information, IVI, the subject begins to notice that the area is illuminated by another light and to construct a new RVSI for the area. Consequently the subject begins to recognize the original color of the patch. In other words, we can investigate the process of the construction of the new RVSI for the hidden illumination area by measuring the change of color of the patch when IVI is gradually increased in the area. Four different colors, red, yellow, green and blue, were employed as the hidden illumination with the illuminance 400 lx. The ceiling light was of a daylight type kept at 60 lx.

The IVI was composed of various objects such as a desk, a sofa, a potted plant and so on arranged in a miniature room. They were gradually inserted to the hidden illumination area by movable stages and the subject judged the apparent color of the test patch by the color naming method. It was shown that while the apparent hue did not change but the chromaticness decreased from 75% to 10% for increase of the IVI for the red hidden illumination. Similar results were obtained for other colors of hidden illumination to imply that a new RVSI was gradually constructed with more IVI.

1) Rumi Yamauchi, Mitsuo Ikeda, Hiroyuki Shinoda, Apparent Lightness of an Object Determined by the Immediately Surrounding Recognized Visual Space of Illumination, AIC Midterm Meeting ,1999,pp75-80

A MATHEMATICAL METHOD FOR CLASSIFICATION OF COLOR COMBINATIONS BASED ON THE FUZZY COLOR ZONES

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O - 22

The aim of this study is to present a new mathematical method for classification of color combinations.

The method uses both the fuzzy set theory and the combinatorial theory. A color space is partitioned into a finite number of color zones that have fuzzy boundaries. A selection of a set of zone names out of all zone names makes one color combination pattern. Several patterns are grouped into one color combination type, according to some equivalence relation based on the geometrical locations of the patterns in the color space. The classification algorithm of color combinations of a color image can be described as follows: (1) An image is scanned and stored in a computer system. (2) A finite set of representative colors are then extracted from the image. (3) The values of membership functions for every color zone are computed to generate the membership values of all color combination patterns. (4) Finally the membership values of every color combination type are computed.

The method was applied to two kinds of design plates: "Exotic Floral Patterns in Color" by a French designer, E.A.Seguy, and "Japanese Patterns" by Sakura Horikiri. From the result of the computation the common features and the unique features of color combinations used in the above two sources were emerged, which proves the effectiveness of the method.

CONFERENCE ON ENVIRONMENTAL AND DEVELOPMENTAL TOXICOLOGY

A ROLE FOR TWO CLASSES OF ORGANIC POLYMERIC COMPOUNDS IN THE ENVIRONMENTAL IMPACT OF POLYMER LITHIUM

ORAL SESSION V

ORAL SESSION V

The first paper in this session is by Dr. J. H. Drexler, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The second paper is by Dr. R. M. Waymouth, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The third paper is by Dr. J. H. Drexler, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The fourth paper is by Dr. R. M. Waymouth, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium.

The fifth paper in this session is by Dr. J. H. Drexler, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The sixth paper is by Dr. R. M. Waymouth, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The seventh paper is by Dr. J. H. Drexler, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The eighth paper is by Dr. R. M. Waymouth, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium.

The ninth paper in this session is by Dr. J. H. Drexler, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The tenth paper is by Dr. R. M. Waymouth, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The eleventh paper is by Dr. J. H. Drexler, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium. The twelfth paper is by Dr. R. M. Waymouth, University of California, San Diego, who will discuss the role of two classes of organic polymeric compounds in the environmental impact of polymer lithium.

CONFERENCE ON ENVIRONMENTAL AND DEVELOPMENTAL TOXICOLOGY

A TALE OF TWO CITIES : COMPLEMENTARY CONTRAST IN THE ENVIRONMENT OF MOROCCO'S IMPERIAL CITIES

David Buss

Kent Institute of art and design, UK

O - 23

The Lonely Planet Guide to Morocco states that 'just as the colour blue is synonymous with the city of Fes, so red has become the colour of Marrakech. A local Berber legend has it that when the Koutoubia was planted in the city's heart, it poured so much blood that all the walls, all the houses and all the roads turned this colour'. Red is indeed the predominant colour in Marrakech. Almost all the buildings, whether in the medina (old city) or the ville nouvelle, are red. This may be the natural redness of sandstone, or the red colour washes used to tint the city's walls. Throughout the city, this ubiquitous redness is contrasted with its complementary colour, green. Doors, window frames, fences, grills, the street furniture of lampposts and bus shelters all complement the predominant red.

By contrast, the blueness of Fes is discreet to the point of being almost secretive. But where it occurs, it too is complemented with its opposite hue of yellow/orange. The complementary red/green contrasts are evident everywhere in Marrakech and are reinforced by the national flag. Fes, however, presents a more subtle and restrained series of manifestations of blue complemented by yellow/orange.

The author of this paper is a photographer and this presentation will be illustrated with many slides taken in Marrakech and Fes to illustrate the deployment of complementary contrast in the environment of these two ancient and vibrant Imperial Moroccan cities. The contrasting impact of the two Moroccan cities is explored and illuminated through the series of images.

**ANKARA 1980-2000 : ARCHITECTS' APPROACHES TO THE USE COLOR IN
BUILT ENVIRONMENT**

Susan Habib
Gazi University

O - 24

Nowadays artists naturally include space, temporality and dynamics in their fields of expression. On this adventurous ground, forms are invented and new processes likely to renew environmental creation are set up. Crossing disciplines such as visual communication, design or scenography, new artistic practices give birth to works with singular poetic dimensions. Light and colour nurture this poetry.

Abstract Translated by Rozenn Etienne

A DEVELOPMENT OF MULTI - MODAL COLOR STUDIES FOR CREATING BRANDING STRATEGY WITH A CASE OF HERBAL COSMETIC BRAND

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*Dept. of Industrial Design, KAIST, **Beuty research team, Marketing division, Pacific Co

O - 25

The newly emerging paradigm emphasizing human's emotions and sensibilities has made it possible to expand the scope and methods of color studies from the visual-oriented study to the multi-modal one. Creating a new cosmetic brand implies more possibilities to investigate the role and function of color studies than any other product development: A shorter life-cycle of creating new cosmetic brand and the it's multi-sensory features makes the color study as one dominant research and communication tool for developing its brand strategies.

This study is designed to develop a methodology to integrate quantitative and qualitative research methods by investigating the multi-modal characteristics of color. A case of herbal cosmetic product is used to study the multi-dimensional factors of interaction between herbs and people. By identifying the visual and tactile meanings and values of herbs, this study creates color image maps and provides a holistic approach of creating its brand strategies.

ENVIRONMENT, LIGHT AND POETRY

Yves Charnay

Ecole Nationale Supérieure de Arts Décoratifs

O - 26

The decorative arts have long been a uniting force for many artistic media. Unfortunately they have often evolved outside of the industrial world. Today's modern economy sets a rhythm with new work methods using, for example, visual communication or design.

Undoubtedly bridled by the idea of "efficiency" the result of a narrow view of design, the handling of color in the environment has recently evolved in a very unadventurous way. Esthetic choices have often been a function of the adaptation of architectural materials namely surface coatings and coverings.

Perhaps we should now call upon other synthesizing areas "to set up a public or private space that would represent a person or community while expressing their values from the point of view of form". The recent evolution has opened up to plastician creators new spatial dimensions, experiences with diversified materials and the use of contemporary technologies.

Abstract : Translated by Patricia Gavignet

EXPANDING COLOR DESIGN METHODS FOR ARCHITECTURE AND ALLIED DISCIPLINES

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O - 27

What the color design professional brings to the architectural design team is not only an expertise devoted to supporting the guiding design concept of a building, but also a richly diverse sensibility made up of broad awareness and a finely tuned visual perception. This includes a knowledge of design and its history, expertise with industrial color materials and their methods of application, an awareness of design context and cultural identity, a background in physiology and psychology as it relates to human welfare, and an ability to respond creatively to design concepts with innovative ideas for color, light, form and space. Not only is the color designer responsive to all of the visual stimuli related to architecture, the colorist is also aware of present and future color trends and materials and their potential influence on contemporary and historic structures. It is just such a broadening of the definition of the colorist's role in design that provides architecture and the allied disciplines with a dynamic and significant educational and professional world to experience and explore.

The role of the color designer striving to complete the work of the architect did not really appear until the 1950s, shortly after the end of the second world war. Historically, in Europe, it was industrial architecture that made use of and supported the work of colorists. A little later, around 1960, the appearance of huge apartment complexes that tended to be somber and repetitive in appearance created the need to personalize these buildings with color.

In France, since about 1970, new multi-disciplinary teams have come together to build new cities: urban planners, architects and colorists. What methods have the colorists been able to adopt to respond to the needs of various programs? It became evident that colorists had found themselves in a new, experimental territory and there was no formal education nor school for color applied to architecture. Colorists and architects used different methods in a way one could describe as fumbling and speculative that, with experience, progressively became more concrete.

In demonstrating, through many examples of significant approaches;

the process of the work of visual artists and designers, theoreticians, and those of a more analytical and rational method, included in this presentation are discussion of the practical role of color in landscape, architecture and the design of our time. As demonstrated throughout previously published works on various aspects of color including Color Model Environments; Color in Architectural Illustration; Color Consulting; and Color Forecasting; shaping the future of color professions and color education and giving definition to color-design professions is a continuing process of growth and development.

ORAL SESSION VI

The basic colors in the Hering's opponent process

are few experiments using color chips Color Order System

introduced an survey on the differences between the color system of Munsell and Munsell. Participants were 20 Japanese and 20 Koreans for each color system. They were shown 19 color chips and were asked to give their visual perception for each color chip in their respective native language.

The paper applied the color naming technique which is used in Color Order Test instead of using the standard light. The experiment used three groups of light and study was done 40 days before of testing with four fundamental hue categories and a total color. The test pictures judgement of the color chips at a response with the use of Munsell System.

Munsell is composed of five basic hues which are arranged in the circle. It's a little difficult to recognize them. This is because the distribution of the hue category becomes irregular and it is not clear that the result of each level color chip stands in 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360. However, as different as it was the existence of the typical hue of each basic color terms were recognized. Then, results were shown and found out that it almost corresponded with the test picture of Munsell.

There was hardly a difference in the judgment result in both languages. The test picture of color chips was categorized the four basic color groups (red, yellow, blue, and green) and was named. It is not clear that the test picture of color chips was perceived like and same color perception with the test picture of color chips in both languages.

There are differences in the judgment of the basic color terms between the test picture of color chips and the test picture of color chips. The test picture of color chips was perceived like and same color perception with the test picture of color chips in both languages. The test picture of color chips was perceived like and same color perception with the test picture of color chips in both languages. The test picture of color chips was perceived like and same color perception with the test picture of color chips in both languages.

A COMPARATIVE STUDY OF THE BASIC COLOR CATEGORIES IN JAPANESE AND KOREAN : ON THE NCS (NATURAL COLOR SYSTEM)

Jung-Yi Choi

JOSHIBI University of Art and Design, Japan

O - 28

The basic colors in the Herig's opponent process theory, there are many experimental examples judged by using the spectrum light. There are few experiments using color chips Color Order System.

I conducted the survey on the differences between the two hue circles of NCS and Munsell. Participants were 200 persons, 50 Japanese and 50 Koreans, for each color system. They were shown both systems' hue circles and were asked to report their visual perception; how different each color appeared in their respective native language.

This paper applied the color naming technique which Boynton & Gordon did but instead of using the spectrum light. This researcher used color chips and then, the study was done 40 hue circle of both systems' four fundamental hue categories and a focal color. The respondents' judgment of the 40 hues almost corresponded with that of NCS System.

Munsell is composed of five basic hues which contain purple. Therefore, it's a little difficult to recognize them. This is because the distribution of the hue category becomes irregular, and it can't be said that the result of each focal color corresponds to 5R, 5Y, 5G, 5B, too. However, as different as it was the existence of the typical hue of each basic color terms were recognized. Then, as for each hue, it was found out that it almost corresponded with the four fundamental hues of NCS.

There was hardly a difference in the judgment result in both languages. As for each four basic color terms, it was ascertained that four color terms are perceived similarly and same meaning. Moreover, as for these four basic color terms, it could be regarded that the same color perception is a characteristic found generally common human beings.

There are derivation categories where in the four basic color terms intersected such as orange between yellow and red, purple between red and blue. An intersection between blue and green or green and yellow is also possible. The derivation categories are certainly recognized. But, it is not agreed yet whether these derivational color terms can be considered as basic terms in both Japanese and Korean.

THE RELATION BETWEEN AFFECTIVE MEANING OF COLOR AND COLOR CATEGORIES

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O - 29

The purpose of this study is to clarify that the difference, the structure of the color-affection between Korea and Japan, influences color name and color categories.

According to the research, it was confirmed that there were a lot of common point in the affective meaning of color between Korea and Japan. However, the result showed some differences resulting from the cultural character of their respective racial and national backgrounds.

It is thought that perception and affective sentiment towards a color there are common basic feelings exist in human being. At the same time cultural differences affect emotional feelings strongly.

Especially noteworthy is that the color-affection tend to be affected by hue in Korea, while Japan are influenced by PCCS tone.

Our hypothesis is that, the difference, which was confirmed between both countries in color-affection, also makes effect to color categories.

The relationship between color-affection and color categories was suggested by our research.

OPPONENT COLOR RESPONSES AND VISUAL COMFORT

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O - 30

Previous studies showed that mean CIE1976uv saturation over an image of a ordinary scene presented in a CRT. Display had a negative correlation to the visual comfort to the image meaning that the lower the mean saturation the more comfort is felt when viewing the image (Col. Res. Appl. Vol.24;1999, 313-321). In the present study, the color opponent responses that constitute the saturation i.e. red-green and yellow-blue components were investigated in relation to the subjective evaluation of visual comfort. Two psychophysical methods were employed. One is the direct estimation of the four color opponent components, i.e. redness, greenness, yellowness, and blueness, of a the image.

Direct estimation of visual comfort of the image was also obtained and this was compared with the color opponent estimations obtained. The other method was to directly change each of the color opponent components of the image by using specially developed image processing software to find the most comfortable point along with the continuous change of each color opponent component and the amount of change was correlated with the direct comfort estimation of the image. By using 40 images taken by the digital camera in an urban area of Japan and presented on a CRT display, it was found that the redness and the greenness were more influencing the visual comfort than the yellowness and the bluenesses of the image

THE MYSTERY OF ISHIHARA PSEUDOISCHROMATIC PLATES

Yasuyo G. Ichihara

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O - 31

Most people can see six or seven colors in a rainbow, and few people can see less than three. The former is so called normal color vision and the latter is called usually color vision deficiency. These variations have been linked to differences in the photoreceptors in the eye. The Ishihara pseudoisochromatic test is the most widely used screening test for red-green color deficiency. The full version contains 38 plates. Plates 18-21 are hidden digit designs. For example plate 20 that has 45 hidden digit designs cannot be seen by normal trichromats but can distinguish by most color deficient observers. In this study, we have measured the Ishihara pseudoisochromatic test. The Minolta new 2D-colorimeter system, CL1040I that can be all pixels on 4cm*4cm, was used to take measurements. From the results, all 9 colors in the Ishihara plates 18-21 can be seen on isochromatic line of CIE-xy color spaces.

The form of number are composed the 4 colors and the background colors are composed the remaining 5 colors. Normal trichromats can distinguish these 9 colors one another but can not detected the form of number. For normal trichromats, it is difficult to found the difference of the 4 colors group of the form of number and the 5 groups of the background colors.

We conclude that for normal trichromats, the colors of like orange and red that are highly salient and are included the warm color group, are distinguished from the cool color group of blue, green and gray.

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APPLICATION OF NUMERICAL EXPRESSION OF COLOUR EMOTION

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O - 32

In order to analyse the software mechanism of colour perception in brain, it is needed to make quantitative scales. Word is the output of the colour perception and the most useful key for colour communication. We are paying attention to words and languages, and we tried to derive visual scales based on psychological sensations. The scales were expressed as empirical formulae of colour emotion through colorimetric method.

In this paper, we would like to introduce a few applications of the numerical expression. One of them is an attempt of translation of colour emotions among four languages of Japanese, English, Thai and Cantonese. Another one is a colour emotion display on a computer monitor for colour communication through Internet.

HEAT INFLUENCE OF COLOR UNDER STANDARD SOLAR

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O - 33

When light incident on the material, the reflection light cause various color. It thus appeared that difference of spectral reflectance means that of reflective energy. Therefore in this paper we dealt with heat influence of color with the spectral reflectance of the book of JIS (Japanese Industrial Standard) color standards and the conventional data on the solar spectral irradiance under standard solar in Japan. The book of JIS color standards founded on Munsell color system. Spectral reflectances in a wavelength range from 300 to 2500 nm were measured by spectrophotometer. Result reflectance tended the higher Chroma and Value was, the higher reflectance was. Also it was different from Hue though Value and Chroma was same. Reflectance of Green-Yellow was the lowest, and it of Red-Purple was the highest. Reflectance of color in same Value be thought same rate, but the fact was different

STUDY ON MEDICAL AUTHORITIES AND THEIR RESPONSIBILITIES IN
CANCER ENVIRONMENT OF THE TROPICS - FROM THE INTERNATIONAL
AGREEMENT ON ENVIRONMENTAL POLICY

POSTER SESSION

The present study is a part of a larger project on the
environmental health problems in the tropics. The
purpose of the study is to investigate the
responsibilities of medical authorities in the
tropical countries in the prevention and control
of cancer. The study is based on a survey of
the medical authorities in the tropical countries
and on a study of the environmental health
problems in the tropics. The study is
conducted in the tropical countries and
the results are presented in this report.

**STUDY ON LOCAL AUTHORITIES' AESTHETIC CONSCIOUSNESS OF
COLOR ENVIRONMENT ON TOWNSCAPE - FROM THE QUESTIONNAIRING
ABOUT COLOR ENVIRONMENT POLICY -**

Suguru Sato

Okayama Shoka University

P - 01

The importance of color comfort in townscape is recognized. Many local authorities are endeavored to keep and create the beauties of color condition on townscape in Japan. So, they plan landscape ordinances, and enact these ordinances.

Now, local authorities mainly guide their townscape condition in the path of the beauty and comfort. So, they fix townscape policy. But, a few landscape ordinances touch upon color control sufficiently. The aim for this study is to gain a proper understanding of local authorities' aesthetic consciousness of color environment on townscape.

The questionnairing was conducted on 100 local authorities in Japan. As the result of the questionnairing, local authorities comprehend color environment on townscape as the component part of other townscape environments. And, we discuss the effect of ordinances and difficulty of policy on townscape color environment to keep and create the beauties of color condition on townscape in Japan.

**ANALYZING OF AN IMAGE AND MAKING OF A COLOR PALETTE FOR
COLOR PLANNING OF THE CITY - A CASE STUDY ON THE COLOR
PLANNING OF DAEJON -**

Jin-Sook Lee, Mi-Jin Lee, Young Kang, Hyuok-Il Kwon
Chungnam National University Dept. of Architectural Engineering

P - 02

The purpose of this study is to present the color palette of each administrative area by the results of the analysis of the color characteristics on image types for the color reaction that harmonizes with the existing natural environment after analyses and characterizes the image of Daejeon's administrative area as case study.

The process of this study is composed of four steps ; 1) The existing natural environment and artificial environment in Daejeon is surveyed. 2) The target image of each administrative area is established by analyzing results of investigation. 3) For analyzing color characteristic by image types, the evaluation experiment is performed by using a Color Image Processor. 4) Finally, the practical color palette for planning is made by the results of the color characteristic analysis.

COLOR FACTOR IN ENVIRONMENTAL EFFECT EVALUATION IN BURSA

Nihal Centinturk, Susan Habib
Gazi University

P - 03

Bursa is a city in Marmara Region of Turkey, with an original and still living traditional color scheme. The city is famous also with its silken textiles and colorful and quality ceramics (Iznik).

According to a theory, the houses originally were not coated, because bricks, as filling material, were arranged in a decorative manner and such a careful decoration should not be plastered. But it seems that during 19th century, when the Baroque influence was at its height in the Turkish provinces including Bursa, houses started to be coated with different colors. This tradition continued till our time in old regions, but in other new neighborhoods, new buildings are following the international fashions and individual tastes. Same is valid for architectural colors. And Bursa, as many other cities in Turkey, is losing its original urban texture and color scheme. Although life conditions have being changed, so the life style, architecture, urban pattern, etc., still, since traditional color scheme of a city is a historical phenomenon, we think that trying to develop a range of paint colors of traditional architectural color scheme of Bursa can be a step for binding the past and the future of the city.

In our study, we will try to consider all information about colors, by which we mean colors of natural and built environment, used in traditional civil architecture of Bursa, not subjectively but with scientific detachment, in order to develop a range of paints in architectural colors of the city.

THE CHARACTERISTICS OF ENVIRONMENTAL COLORS AND COSTUME COLORS IN THEME PARK

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P - 04

The purposes of this study are as follows :

1. To develop the concept of 'Theme Park Costume'. 2. To analyze the characteristics of environmental colors and costume colors in theme park, based on the color data of Festival World, Tokyo Disneyland, and Disneyland Paris. 3. To analyze the relationships between the concept and the colors of the given theme area. 4. To suggest the colors of Theme Park Costumes for the each theme area in Festival World. To analyze the features of costume colors and environmental colors in theme park, the comparison has been made between the colors of costumes, facilities, attractions in Festival World and COS(Color System). The colors of costumes, facilities, attractions in Tokyo Disneyland and Disneyland Paris were initially compared with DIC Color Guide, based on the photographs which were taken by researcher with the memory colors, and then converted to COS.

The results of this study can be summarized as follows : 1) Theme Park Costume is of mixed concept of stage costume and uniform. It is not only a creative art work to visualize the specific theme of each theme area as a stage costume but it can satisfy employees considering of working conditions and seasonal factors in terms of uniform. Eventually it can make the employees serve the customers in their best conditions. 2) In case of costume colors and environmental colors in theme park, the distributions of colors were similar, but the features of tones were characterized quite differently. Tones of costume colors were mostly shown in middle and high saturation fields, but environmental colors were in middle and low saturation fields. As a environmental factor Theme Park Costume stands out clearly from environment, harmonizing with it. 3) The color characteristics of theme areas in Tokyo Disneyland, Disneyland Paris and Festival World are analyzed in the same category by its thematic nature, such as : For Bazaar theme which backgrounds the Victorian Age, the main color distributions were especially in YR, R, Y and partially in BG, PB, B. Dark tone was used appropriately to symbolize the classical and noble image.

For Western theme, YR color group and dull, soft tones were dominantly used, and strong tone was also used to express the theme. For Fantasy theme, it was proposed to use B, BG, PB and dull, grayish, soft tones with strong, bright tones as an emphasis to symbolize the theme

effectively. For Adventure theme, warm colors such as YR, R, Y and dull, grayish, soft tones were most widely shown, using strong tone as an emphasis. For Space and Future theme, silver was mainly used with primary colors in Tokyo Disneyland, but gold was widely shown with subdued tones to visualize the ancient and old-fashioned Future images in Disneyland Paris. It is distinctly noted that Disneyland Paris is well characterized its cultural identity based on his history and traditions differentiated from that of, for example, Tokyo Disneyland in its custom of color selection. 4) Based on the results, color palettes for the costumes in Festival World were presented relied on the careful examination and findings through the actual surveys made for the Disneys over the world. At first the colors used frequently in costumes were selected. Secondly the colors were selected shown in adequate hue and tone fields related to the each theme image. Finally the colors were included which were not currently used in costumes, but could effectively symbolize the theme image.

“THE TREE OF LIFE” - FIRST CHROMATIC SCULPTURE POWERED BY SOLAR ENERGY : CONTEMPORARY EXAMPLE OF COLOR DESIGN IN THE ENVIROMENT

Silvia Rizzo

Lieco Artistico N. Barabino, Genova, Italy

P - 05

A retraining on color is fundamental if we really believe in the need of people for a more complete inner balance and a more positive life in “gray and anonymous” environments.

The subject matter of my paper is based on contents rooted in the historical culture of city spaces in Genoa, the city where I live. Genoa, by tradition, has always been a “chromatic city on the sea”. Its ancient splendor came in the past from its climate and special light.

A project for chromatic reconstruction is currently in progress. Some old palaces have already been individually restored. However, owing to the sensitivity of the Department for City Quality of the Municipality of Genoa, through the restoration of all the buildings along a semi-elliptical route overlooking the waterfront (the old Ripa Maris built from the 12th century), the entire area will resume its original colors. Color will meet the sea, and the natural light of the sea will be changing the color shades, depending on the weather and the time.

With regard to my personal research work on color design and the environment, in addition to previous aesthetic interventions to highlight the various frescoes on the facades of ancient buildings and the reconstruction of related drawings through color, today my work focuses on contemporary design to make our city habitat richer. Within this line, I also designed the “Playground of colors” and I devised a new teaching method “Play with your Eyes”, etc. aiming at a re-training on colour in its widest sense; color which is part of life and our daily environment, like a bridge between color design in the past and in the present.

This latter color-design project of the first sculpture powered by solar energy falls within this line. “The Tree of Life”, to which I have collaborated, was designed by Alessandro Picasso, a young artist and student at the School for Architecture of the University of Genoa.

The 4.5 m high sculpture has since March 2000 been located in the Porto Antico (Old Port) area. Horizontal shapes, like colored signals, interspersed with other aluminum shapes are vertically interconnected and revolve around an axis, powered by photovoltaic solar panels, which changes depending on the weather, the time, and the season. The entire

assembly is contained inside a steel structure. A point of dynamic attention is thus created in the environment by means of an ever changing perceptive motion. The design, despite its minimalist nature, acquires variability and vitality by reflecting environmental light. Owing to the essential nature of its color design shapes and the direct involvement of solar energy, the sculpture is projected as a shape of the future, through its visual information within the environment, as well as with the ethical and poetic content of the solar energy which powers its motion.

The sculpture, which has become a meeting point, draws the attention of both adults and children and develops their aesthetic imagination of color and scientific awareness.

**A COLOR DESIGN OF ELEMENTARY SCHOOLS IN KOREA - A CASE STUDY
ON THE TWO SCHOOLS OF JINMAL AND HAJUNG**

Myung-Sup Shim

Daelim college

P - 06

A color design depends upon hue, value, chroma plus coloring materials and building shape. Junmal and Hajung elementary schools, built in Yunsung building development district 1, 2, Siheung, Kyungki province, are surrounded by high-rise apartment buildings.

Schools, environment is the first consideration in the education of children to develop their emotion and intelligence. Using five colors (red, yellow, blue, white and black), Korean traditional colors, this color design aims at expressing the image which children will be able to feel the home comforts that their mother can offer.

COLOURS FALLEN FROM HEAVEN

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Ecole Nationale Supérieure de Arts Décoratifs

P - 07

«Colours fallen from heavenl» is the title of an environmental creation which uses a particular lighting device. The site is a baroque chapel which has now become the concert hall of the Music School of Apt, a town in France.

One of the properties of the works realized with this device is to be set in front of openings such as stained-glass windows. They take part in the expression of an architecture. In some versions, the lighting is composed of one or several sources of artificial light.

Abstract Translated by Rozenn Etienne

CITY AND COLOR

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P - 08

City environment can be characterized by many different physical and psychological factors.

Among these color is of paramount and of defining space, for example. It can also establish symbols and give identity.

The presence of color can make every day life pleasurable, but on the other hand it can create a chaos, lacking order in its structure and form, without a concrete plan to strengthen the use society makes of factors like form and color.

By taking into account all these factors any given city in the world could be approached and in this case the city is San Miguel de Tucuman, placed in the northwest of Argentina.

NATURE COLOURS IN TRADITIONAL FOLK-ART ON THE BALKANS

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P - 09

Colors play an important role in traditional folk - art. Colors' symbolism bears special significance as the aesthetic and artistic influence of their combination with subjects forms and texture does.

Ancient technologies for natural coloring agents extraction and use function on the Balkans almost until the middle of 20th century. Present expose describes formation of regional color peculiarities thanks to the usage of natural coloring agents, based on traditional pottery and textile examples. The usage of local clay for subjects making as well as for their decoration paints preparation is one of Balkans traditional pottery basic features. The use of natural coloring agents is a characteristic for Balkan traditional textile too.

The observations on local coloring agents extraction, their usage, as well as ready products aesthetic influence for traditional home environment building up permit to make several conclusions regarding natural colors role in Balkans folk art decoration and artistic system.

COLOR PHILOSOPHY IN KOREA

Ok-Hyun Kim

Dong Duk Women's University

P - 10

In Korea, three main colors, red, blue, and yellow represents heaven, earth and human. Ancient people used these colors in decorative jewelry ornaments-Dea Samjak Norigea.

Also, five main colors, red, blue, yellow, black, and white represnts direction-north, south, east, west and center. These directional colors were used in many cultural assets. -pouches, wrapping cloth, and wedding rope.

THE OUTSIDE COLOURS OF THE TRADITIONAL HUNGARIAN COUNTRY HOUSES

Zsuzsa Karman

Administration office of Budapest

P - 11

1.1. I make a study on the colours of Hungarian country-houses. I'm taking photos and slides of the houses, drawing them and measuring the colours of the various parts of the buildings / pedestal, wall, ornament, door, window etc /in Coloroid Colour System.

1.2. The walls of the houses were made from mud, adobe or burned brick and these were painted after plaster-work. The roof was reed generally. The colouring tradition of the country-houses is some hundred years old. It is based on people's impulsive colour choice. People created harmony in colouring.

2.1. Coloroid Colour System has been developed specifically for environment colour design -lead by Antal Nemcsics in Hungary at the Technical University Budapest. In this system the colour space is continuous, the members of the colour space are aesthetically the same distance from each other. In Coloroid colours are treated as being mixed from tristimuli of boundary colour, black and white.

2.2. What is colour harmony? The harmony is partly subjective and depends on cultural background. The members of the harmony are together in an orderly system and are preferred. Colour-harmony is harmonious -defined in Coloroid Colour System- if there is a scale-like regularity between the members both in saturation /T/ and lightness /V/. The hue codes /A/ of the members of the colour-harmony are 0°, 34°, 130°, 180°, 230°, 326° distant from each other on the Coloroid circle.

3.1 I'm showing you the most characteristic types of the houses founded until this time during my search. These houses are about 100 years old. I'm defining the colours in Coloroid Colour System and looking for the connection between used colours.

3.2. There are other colour preferences at the houses of different regions of popular art. The possibilities to express relations to colours have always been delimited by known, available pigments. Originally coloured minerals and plant juices were used as pigments. Today the wide choice of paints are offered by the paint industry, but they are used only on a limited scale.

4.1. The number of the traditional coloured and designed country houses is growing less in Hungary. The painted plaster-works on the

gable were changed into grey slate in many case. The facades of the houses had more colours formerly. Nowadays they are simplified at the renovations. The materials of the roofs are changed for burned tile mostly. There are a lot of case when the original two little windows are exchanged for a bigger one.

4.2. It would be good to preserve the colouring traditions, the old buildings and the traditional environment you can find in villages yet, and to change the "colourless" environment for the traditional colour harmonies refined before.

COLOR CHARACTERISTICS BASED ON THE IMAGE OF TODDLER'S WEAR

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P - 12

Today toddler's wear is getting important in Korean infant & children's wear market. The purpose of this study is to analyze characteristics of practical colors in toddler's wear after classification the image of the toddler's wear in Korean fashion market. Then, to suggest the representative colors of each image which can be used for effective color planning. To classify the image of the toddler's wear in domestic market, the questionnaires have been made of showing 48 color prints with 30 toddler's wear image adjectives. Total 250 copies were used for survey to students and the specialists in the children's wear company. These questionnaires showed each toddler's wear image with 30 adjectives, and the results analyzed via Factor Analysis and MDS(multi dimensional scale). To analyze characteristics of practical colors in toddler's wear industry, the surveys which to collect the color samples and related reference have been conducted from March, 2000 to April, 2000. As the result, 546 color samples used by 11 brands from 1999 F/W to 2000 S/S are collected and analyzed. The collected colors expressed by $L^*a^*b^*$ and converted into HV/C of Munsell notation for analytical purpose.

The results of this study are as follows:

1. This study shows that the 5 main factors of the toddler's wear images ; 'Classic', 'Romantic', 'Enjoyable', 'Casual', 'Modern'. The axes of the image scale are 'Decorative-Simple' and 'Cheerful-Serious'.
 2. For the 'Classic' image, color distribution is especially in PB, YR, Y, R, G. Dark grayish and grayish tones are used to express the traditional mood. For the 'Romantic' image, R, YR, Y, PB color group and light pale tone is dominantly used to express the image. For the 'Enjoyable' image, bright colors such as YR, Y, B, PB and pale, bright tones are most widely shown. For the 'Casual' image, grayish tone is mainly used to express the natural and comfort image. For the 'Modern' image, YR, PB and grayish tone is dominantly used to symbolize the chic and urban image.
 3. This study shows representative 9 colors for each 5 factors.
- As the result, It is distinctly noted that the characteristics of colors are important to express the image of toddler's wear.
-

P - 12

The developed image scale for toddler's wear of this study is useful for the clear and objective communication to clarify the design concept. And analysis of practical colors based on the classification the image of domestic toddler's wear market is useful for the effective process of color planning.

WILD FLOWERS : A DESIGN FOR SILK SCARVES

Kyung-Ae Jeon
Dong-Eui University

P - 13

(Purpose)

The purpose is to produce elegant, contemporary design suitable for silk scarves.

(Methods)

The variations and interpretations are developed in the wild flower motif and computer graphics are utilized to create the graphic quality of the design.

SPORTSWEAR DESIGN ASSISTED TOOL BASED ON HUMAN COLOUR EMOTION

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Kyoto Institute of Technology

P - 14

Colour is important for sportswear design. Because colour is one of factors for a customer to buy a sportswear. We collected kansei words for assessing colours of sportswear and analysed colour emotions expressed by the kansei words quantitatively. We also derived empirical formula to express the colour emotions through colorimetric method.

In this paper, we discuss about the application of the numerical expression, and also suggest an interface model to display colour emotions on a computer monitor for sportswear colour planning. We expect the computer display system will be helpful for colour planning as a sportswear design assisted tool based on human colour emotion

COLOUR MANAGEMENT IN THE DESIGN OF APPAREL COLLETION

Vera Golob

University of Maribor, Faculty of Mechanical Engineering

P - 15

The paper presents an approach to styling and colour design of a fashionable apparel collection which includes colour management and colorimetry into apparel design. The styling of dresses is inspired by "Charleston" looks and implemented in two-colour combinations. The colour design of the collection was made on advanced colour-management computer-aided equipment which includes model scanning, the preparation of colour combination and their printing out. Individual models were made in different colour combinations. The combination of colours for each model and the correct choice of textile material from paper patterns were colorimetric evaluated.

SUBJECTIVE COLORS OBSERVED FOR DEVICED BENHAM TYPE FIGURES

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Kinki University, Interdisciplinary Graduate School of Science and Technology

P - 16

A Benham type figure usually consists of a black semi-circle and arcs. When it is rotated, "subjective colors" can be observed. We use two black arcs on a white disk for observing subjective colors. One is Arc A, which is a semi-circle with thickness of D . Another is Arc B with thickness of d . Two arcs have almost similar radius.

Experiments were made, comparing with the standard color chips of Munsell renotation. The figure with two arcs was illuminated by an incandescent lamp, and rotated at the speed of 480 rpm. The standard color chips were illuminated by the standard fluorescent lamp with high Ra value. Illuminance of the figure and the standard chips were about 300 and 470 lux, respectively.

Results obtained are as follows:

- 1) In the case of only Arc B without Arc A, subjective colors can not be observed.
- 2) In the case of equal thickness, ie. $d = D$, subjective colors can not be observed.
- 3) When a difference exists between thickness d and D , subjective colors can be observed. Limits of the difference $D - d$ are 2 - 4 mm for observing subjective colors.

Observed colors will be described, changing thickness d and D , or relative position of Arc A and B.

A STUDY FOR NATURAL DYEING COLORS OF THE DYEING ANTIQUITIES OF CHINA SILK ROAD AND THE KOREAN TRADITIONAL DYEING ANTIQUITIES

Ji-Hee Kim, Young-Lan Kim

Member of Korean Society of color Studies

P - 17

- Purpose of Study

It is investigated the colors through dyeing techniques and patterns, and compared with existing dyeing antiquities in Korea. The purpose of study is to be grafted together an today with the ancient preciousness techniques, and it gives a motivation for originality of textile crafts.

- Scope of Study

It will be studied for the textiles of silk road in China and for the existing the dyeing antiquities of Korean traditional textiles rough coloring of standards(COS) and natural colors in Korea

- Results

In result, the colors used in generally between both countries were blue by indigo, Red pink by Safflowerdye, Violet by the root of Gromwel, Jade color by Madder dye. Purple by Soppan wood dye, Yellow by Cape jasmin, or Amur Cork Tree, White by own color of the Fibers, Black by Indigo composited dyeing of Rhusjavanica and chestnat shell and black Chinese ink.

THE PRACTICAL COLOR ANALYSIS FOR THE COLOR PLANNING OF TRADITIONAL CASUAL WEAR

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P - 18

Recently traditional casual wear, in Korean fashion market has grown steadily and remarkably in spite of the economic crisis. The growth of market results from these factors, the first is that its product is not so sensitive to trends. The second, consumer target is non-aged and the third is that it can be coordinated easily as its products are basic styles in varied colors. Now these brands are trying to keep their brand image focusing on changes of the practical color for intensification of merchandising. The purpose of this study is organizing of practical color information that matches to the market environment and the consumer needs.

In this study, the practical colors were collected and the color planning processes were researched by interviews with the chief designers in 10 brands from March, 2000 to April, 2000. After all, 490 color samples from '99 F/W and '00 S/S were collected and analyzed. The collected colors expressed by CIE L*a*b* by physical measurement and converted into HVC of Munsell notation for analytical purposes. The color distribution and characteristics were analyzed by brand images and seasons.

The results are as follows;

1. The distributions of hue are concentrated on YR, PB, Y. There are distinctive differences of the brand images between American and European. European image is expressed comfortable and rich feeling with YR, American image active feeling with diverse PB.
2. The overall color tone is concentrated on the low range of chrome, low & middle range of value / dkg, g, ltg. The image is soft, sober and gentle. As season was changed, p, ltg were increased and dkg was decreased. The color tones in European image were darker and showed more masculine and gentle image than in American image.
3. The noticeable seasonal characteristic in the practical colors is not appeared in value, but in tone. The varied tones are more observed in American image than European image. Therefore European image shows more diverse images.

4. Subtle, modern, warm and unified images are pursued with color combinations, and mixture of colorless color and monochromatic combination are the distinctiveness. In triad, modern and dynamic images are appeared. Also the image of color combination in American image is relatively intense and active than in European image.

5. On base of this result, the representative colors of traditional casual wear are chosen according to brand images.

ANALYZING INFLUENCE OF THE COLOR IN THE EVALUATION OF TEXTURE

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Chungnam National University Dept. of Architectural Engineering

P - 19

The visual elements composing building are mass, color and lighting. The texture as a basic element can't be separated from these elements. However, texture is a complex element dealt with a sense of touch, and sight and contain many physical attributes. Actually, these are actual condition which didn't be cleared up composed elements. Accordingly, the aim of this study is to analyze relation of quantitative characteristic and grasping qualitative characteristic by visual sensibility with considering visual characteristic of texture

The process of this study is composed of three steps :

- 1) Extracting evaluation structure by repertory-grid method
- 2) Verifying validity and boundary of C. G work and colored sand-paper through evaluation experiment
- 3) Analyzing the characteristic of color through evaluation experiment of texture and color

A STUDY ON THE EMOTION - BASED EVALUATION OF COLOR PATTERN

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KRISS, **Chonbuk Nat. Univ., * Kunsan Nat. Univ.*

P - 20

In this paper, we propose two emotional evaluation systems; one is based on the artificial neural network and the other is based on adaptive fuzzy-rule-based system, which are similar to human's evaluation system when he see color pattern. To realize the proposed systems, for a color pattern we define physical features that can be obtained from digital image processing and emotional features that can be collected from the psychological experiment and represented in the linguistic image scales. According to the Soen's psychological experiment, the two types of features can not be related with linear relations. Therefore, we propose two models to capture and approximate the nonlinear relations between the two features. The one is based on the artificial neural networks and the other is based on adaptive fuzzy rule base systems. The two models are inherently nonlinear and capture the relations according to the supervised learning.

The physical features used in the study include average hue, average luminance, Fourier frequency energies in frequency bands, and textures of color patterns. In the artificial neural networks, we used the features including L^* , u^* , v^* , DL , DM and DH as same as Soen did. But in the fuzzy model we used Va , Vb , I and C . After raining, each model provides the evaluated emotional values represented 13 linguistic image scales for the color patterns. As a result, both of the proposed two models gives the better approximation than Soen's multiple regression scheme.

The results can be applied to the areas including the design, fashion, wall papers, and pictures, and retrieval systems in cyber-gallery.

DISTRIBUTION OF SKIN COLORS OF A WORLD POPULATION AND ITS APPLICATION OF MAKE-UP PRODUCTS

Sadaki Takata, Makio Akimoto, Yukio Murui, Akihiro Munakata, Motoji Takahashi

Shigenori Kumagai

Shiseido Research Center, Japan

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The expression of skin color is an extremely important element in the evaluation of cosmetics, especially make-up. There have previously been many reports on the measurement of skin color. However, skin color differs largely depending on sex, age, or race, and it has been pointed out that the data reported so far has not necessarily been adequately quantitated. There are also large discrepancies due to a difference in measuring instruments, while reliable measurement values have been sought. Moreover, in recent years, together with the globalization of cosmetics development, products that suit the skin color of women around the world have been demanded in the development of make-up products, especially the development of foundation. However, in the development of cosmetics till now, product design by sensual evaluation has been the focus, and satisfactory quantitation has not necessarily been achieved. In this study, therefore, we attempted to test the skin color of women from around the world using the same apparatuses and under the same conditions, and applied results to product development.

The objective measurement of the color of the skin is possible if the diameter of the viewing field is taken into account. Using a CM-1000RH spectrophotometer (Minolta, Japan), we measured the skin color about 800 women from around the world (Asians, Europeans, Americans, and Africans aged from 20 to 40 years). Using a circular probe with a diameter of 12mm, we measured a visible range from 400 to 700nm at intervals of 10nm. The measured sites were the right and left cheeks and the forehead. Prior to measuring, faces were washed in order to attain a skin color that was as accurate as possible. Also, in order to minimize errors in measurement that originate from contact with the measured head and measured site, we took care to always apply a uniform contact force. Measurement results were expressed after being converted to the Munsell color system and CIE-L*a*b* uniform color space. Mean and standard deviations of the color indices in three investigated areas of a population sample are given.

To cosmetic applications, measurement of skin color of women from around the world were found very useful as an additive to improve the

appearance of the human skin. By means of factor analysis an overall characterization of the skin color was presented. Skin color among subjects ranged from Caucasian(3.1YR6.4/3.7), Asian(4.9YR6.2/3.8), and African(4.8YR4.1/3.4). From the spectral reflectance, by converting to false absorbance derived from the melanin and hemoglobin, skin color was able to be expressed by two elements, melanin in the epitheliums and hemoglobin in the blood, unrelated to racial type. The distribution of skin colors in world population in relative units ware able to be determined from our colorimetric data. Based on these results, therefore, we developed a material to control the melanin and hemoglobin color elements, and we were able to apply this to the development of new make-up cosmetic products.

THE DEVELOPING OF MAKE UP IMAGE TYPES AND COLOR PALETTES ACCORDING TO THE COLOR SENSIBILITY ANALYSIS

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Korea Research Institute of Standards and Science.

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This study is the tryout for providing further details on sensibility data using in the market. The factors of this study are make-up colors. And the factors are simulated by Color Image Processor. And then we made an experiment and analyzed.

So, we developed the predictable model of Make-Up Image Types according to the Color Sensibility Analysis. As that result, the 5 image types of 「Refined · Noble」, 「Clear · Feminine」, 「Casual · Cheerful」, 「Sober · Soft」 were extracted. And, we made the quantitative predictable model between each image and color factors.

Finally, we suggested the color palettes of each image by results.

EVALUATION OF COLOUR EMOTION OF MALE AND FEMALE

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Colour is an essential component in our daily life. When we perceive a colour, an associate feeling or emotion is always induced in our minds. This feeling or emotion is termed as colour emotion. Different colours usually have different meanings to people. This study aims at evaluating the colour emotion of human and quantifying the colour emotion with standard colour specifications. Since different cultural and traditional backgrounds are considered as influential parameters in colour emotion, all the subjects in this study are Hong Kong Chinese and the semantic words describing colour emotions are expressed in Chinese language. The influences of hue, value and chroma on the colour emotions are studied, and mathematical models are then derived to correlate the colorimetric values and the colour emotions. The similarity and difference towards colour emotions of male and female are studied and reported in this study.

CATEGORICAL COLOR NAMING AND THE POSSIBLE ROLE OF THE “MISSING” 12TH CATEGORY

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Associazione Ottica Italiana

P - 24

The reaction of man to the visual environment is a complex item of multidisciplinary research, transmitted to the 3rd millennium through a plethora of papers and experimental results, which are subdivided into two groups, according to whether they belong to the sensory-perceptual or to the “higher center” processing realm. The link between the two realms is probably represented by color appearance, which is described by the mathematical models dealing with the processes of the 1st group (specialized in the detailed analysis) but it also enters the 2nd group, specialized in the global analysis. The puzzling fact is that the laws governing either group and the related response indexes are totally different from one another, although referred to the same parameters and terms specifying the physical stimulus.

The XX century research did not produce an overall predictive model. However, it offered as a link, a connection through language: the classical color-naming technique, related to color opponency and to unique colors, and the more recent categorical naming, which has been shown to be related to higher centers functions, such as color memorization and identification. The present Poster aims at considering a particular aspect of categorical color naming. The classical research, based on grouping into regions the samples of some known Atlases, established eleven monolexic basic categories, although suggesting the existence of a 12th one, labelled “missing” because only lately considered.

The point we would like to stress is that this category is abundantly represented in the set of materials which are the current tools of environmental color design; such “missed” category, in our opinion, is likely to play a relevant role at the site of global appearance of scene composition.

Our experiment consists of five parts:

- [1] Selection of observers, the normality of their color vision being assessed by the use of Dr. Hahn’s Tests Color Vision 1996 and Double 15-Hue
- [2] Records of categorical color naming using as test objects the caps of a number of known arrangement tests, F-M 100-Hue, Hahn’s

15-Hue, NCS 2nd Ed, as well as the samples of a number of catalogues of surface materials (textiles, wall paints, car paints, etc.). In every case, the region occupied by the up to now “missed” 12th category clearly emerges. [3] The role of this 12th category at the site of the area-chroma relationship, debated since Munsell’s times, is investigated under different lighting conditions (illuminance and SPD) and from the categorical and intra-categorical stand point

CHARACTERISTICS OF COLOR CATEGORIES IN FREE CLASSIFICATION OF COLOR CHIPS

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P - 25

The subjects were shown the color chips of the highest chromaticity in the color space and were told to categorize as will, and then, to reduce the number of categories, in order to search the property of color categories involved in color classification judgement. This procedure was repeated until they could reduce no more. As a result, 'ppalkahta(red)', 'nolahta(yellow)', 'noksayk(green)' and 'changsayk(blue)' showed stabletendency as the basic color name category. When the classification order was low, 'phulunsayk' showed higher appearance with more stability than 'green' and 'blue'.

Keywords: Color category, Color classification, Color representaion, Color naming, Basic color name,

COLOR CATEGORIZATION IN KOREA : TAXONOMY AND COMPONENTIAL ANALYSIS

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P - 26

This study attempts to describe the system of color categories in Korea and consider the developmental processes of the system. This purpose is carried out by establishing semantic structures of entire color terms shared in field and examining foci and ranges of color terms on the Berlin-Kay's (1969) Munsell color array. The findings on the semantic organization and development of color space in Korea are discussed in relation to Berlin and Kay's universality of basic color terms and color encoding sequence, which is one of the most important and influential theories in field of color categorization.

Berlin and Kay suggested that color categories were organized hierarchically, that is, with basic and non-basic categories. And constraints on intercultural variation of basic color categories were discovered; the basic color categories of all languages were drawn from a set of eleven universal perceptual categories composed of six equivalence classes corresponding to seven temporal evolutionary stages. Berlin and Kay presented Korean basic color terms as the stage having eleven basic categories (if considering that GREEN was subdivided into green and blue). (1969:96) But on the way of fieldwork for this study, there turned out to be heterogeneity in Korean speech community, and complexity and elaboration in rules of using color terms. And Berlin and Kay's simple methodology classifying total color terms only into basic and non-basic terms was found to have limits in acquiring systematic and consistent findings about such a complex color system. So this study used general methodology of cognitive anthropology, taxonomy and componential analysis. These methodology leads to deal with a color category as not an individual vocabulary but one within a whole system.

The general results are as follows: (1) there turns out to be variation in the lexicosemantic organization of color domain including the number and the kind of basic color terms between the older and the younger. It seems to mean that Korean color category system is undergoing change from the stage of the older to the stage of the younger, that is, from stage to stage in terms of the sequence predicted by Berlin and Kay. (2) It is found that change of focus, range, and taxonomic status of the basic color categories supports by and large developmental processes of

Korean color system are consistent with the Berlin and Kay's theory of the universal evolutionary stages, except that purple seems to evolve from not red but blue.

This study provides an ethnographically new case for cross-cultural comparison, especially relating to synchronic variation and diachronic change. At the same time it reaffirms the efficiency of taxonomy and componential analysis in color domain as well.

THE CHARACTERISTICS OF FORECAST COLOR IN RELATION TO COLOR NAMES

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The color is expressed in everyday life by using the color names which indicate the meaning of colors. The primary role of color names is not only to indicate colors in use of simple words but also to indicate the image of each color. Color names play an important role in approaching to the color image in organized and objective ways.

The purpose of this study was to analyze the characteristics of the fashion color in relation to color names and to find out the relationship between fashion color image and color names. For this research, 2,783 fashion colors forecasted in 12 fashion trend books from 1990 to 1999 were collected and analyzed. The collected colors expressed by CIE $L^*a^*b^*$ by Color Eye 1500 were converted into HVC of Munsell notation and 15 tones according to PCCS(Practical Color Co-ordinate System).

The major results show as follows :

- 1) Color names were classified into 8 categories according to their origins ; A. plant, B. animal, C. mineral, D. natural phenomena, E. life environment, F. people or place, G. abstract idea, H. original color names.
 - 2) According to the categories, the distribution components of color showed differently. For example, color names from plant were mainly distributed in mid to dark tones such as g, sf, d, and in warm color ranges such as R, YR, Y, and RP while color names from mineral were mainly distributed in grayish tone and in cool color ranges such as PB and B.
 - 3) The relationship between fashion color images and color names revealed that certain color names were used to convey certain fashion color images. For example, color names from plant were mainly used in a few fashion images such as abundant, fresh, ethnic, exotic. To convey the image of fresh, color names such as leave olive, pine green and forest green were used and they were mainly distributed in GY and BG while flower based color names such as amaranth, tulip, orchid, lavender were used to convey the image of exotic and they were mainly distributed in R, Y, RP.
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COLOUR APPEARANCE OF FLASH IMAGE ON COMPUTER DISPLAY

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P - 28

Around three years ago, many children were down with red and blue flash image of TV animation program in Japan. But the mechanism is not cleared. Our research group has carefully been trying to analyse the mechanism under the permission of patient's parents and the ethical committee of a university, and also to develop a thing for protecting children.

In this study, we are paying attention to a kind of visibility such as difficulty to see and speed of flash. We tried to analyse the relationship between the visibility and flash colours with the viewpoint of kansei engineering

WORKFLOW FOR DIGITAL PHOTOGRAPHY AND THE INFLUENCE ON PERCEPTION OF THE PRINTED OUTPUT QUALITY

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P - 29

The paper is explaining the different methods and technologies for digital photography. Especially the different image technologies will be described and the quality of colour accuracy will be pointed out. Using the IT8 colour test image for calibrating the systems and sending the compressed files to different viewers was investigated in respect of perceiving coloured images on different spots around the world for viewing and publishing. Important facts as different colour perception in different countries, and how to correct in advance these colour difference will be discussed. Digital colour photography is a global business on the other hand it has to take in consideration the different colour perception in different continents and different countries to get satisfying results. Proposals are made how to take care of this very important problem especially in future world of only digital colour photography.

THE VALIDITY ON EVALUATION OF INTERIOR COLOR BY SCALED MODEL, SLIDE AND COMPUTER GRAPHIC

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Chungnam National University Dept. of Architectural Engineering

P - 30

A color in interior is visually the most dominant factor and have many influences on the effect of interior spaces. So many studies on the interior color are being carried out but evaluation by mock-up experiment are nearly impossible. Therefore the experiment by scaled model, slide and computer graphic are unavoidable.

The aim of this study is to compare experiments by scaled model, slide and CG with experiment by mock-up, and to verify their validity.

This study was composed of four steps and was carried out as follows:

- 1) The object is determined to interior of office building and variables are selected by steps that are determined comprehensively about hue, value and chroma.
- 2) Each evaluation object by presentation methods are manufactured under same condition.
- 3) Through the evaluation experiment using SD Method(Semantic Differential Method), differences of tendency are analyzed.
- 4) The significant difference are verified by the Analysis of Variance.

DETERMINANT OF SIZE OF THE RECOGNIZED VISUAL SPACE OF ILLUMINATION IN A NATURAL ENVIRONMENT

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P - 31

Understanding of illumination, consciously or unconsciously, is necessary for the perception of color and brightness of object surface. We call such understanding of illumination the recognized visual space of illumination, RVSI. Especially we use a term size of RVSI to describe an observer estimate about intensity of illumination. That is, when an observer recognizes a room is illuminated brightly (dimly), we say the size of RVSI is large (small). When the luminance of an object surface is increased by spot-lighting, its surface is getting brighter as though it were replaced by surfaces of higher reflectance, and finally, at certain luminance, it begins to appear unnatural as an object in the environment. This particular luminance, called a border of RVSI, is a measure of the size of RVSI. The purpose of the study is to investigate what, in a complex environment, determines the size of RVSI. At moment, there are three candidates: illuminance, spatially averaged luminance across a visual field, and highest luminance in the field. In the experiment, the border luminance for the test patch (N5 gray, mat) was obtained by five subjects in a living room at five different illuminances, 3,10,30,100, and 300 lx. We also manipulated the spatially averaged luminance and the highest luminance in the field by replacing objects in a room or by presenting a bright light through a small window on a wall. The border luminance of RVSI was completely proportional to the illuminance. The effect of the averaged luminance or that of the highest luminance was small compared to that of the illuminance. Interestingly, when colors appear self-luminous mode, the observers excluded them for the construction of RVSI. Our results suggest that the illuminance is a major determinant of the size of RVSI.

COLOR APPEARANCE MAINTENANCE WITH CHANGE IN DAYLIGHT ILLUMINANTS

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P - 32

We have evaluated the variation in color when natural and artificial objects are illuminated with daylight of different days and hours of the same day. Chromaticity coordinates (x,y) and (u^*,v^*) and output magnitudes of the RLAB colour appearance model were calculated for each of the illuminants and 27 objects of different hues. Although expected changes were found for (x,y) and (u^*,v^*) coordinates which light varies, no changes were account for lightness, hue, chroma and saturation both for the central hours of the day and different days. Only slight variations were found which sunrise and sunset light were considered. Results leads to the conclusion that adaption color vision mechanisms act to maintain the appearance of the objects in nearly all conditions of photopic daylight illumination in the same location.

A QUANTITATIVE STUDY OF THE AREA EFFECT OF COLORS

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P - 33

Generally, the color selection of an architectural color design is carried out with color sample or sample book. So, occasionally(in sometimes), the finished color changed into different image to original color samples. By this reason, even though an architectural color designer who has a fluent experience can't predict exactly how the color sample will be changed in real finished color. This phenomenon is due to the color shift by the area effect of color. Such an area effect is experimentally known to color designer, but it has not been precisely studied yet how much and to which direction the color is changed. So, in this study, we'd like to quantitatively predict a color shift to propose a method to decrease an field implementation errors in architectural color planning.

VISUAL ACUITY VALID FOR REAL ENVIRONMENT

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P - 34

The visual acuity changes according to the illumination of environment. At high illuminance the visual acuity improves but at low illuminance it becomes poor. We are given a function to show how the visual acuity changes for illuminance in textbooks. However, the function becomes invalid sometime in the real environmental situations. We may be staying in a room illuminated with some fixed illumination and we could estimate our visual acuity for the illuminance from the function. But our eyes do not stay still and look around the room, and may see objects in shade under a table, where illuminance is much lower compared to the room illuminance. The visual acuity for the shade may be different for the lit place in the room. We investigated the visual acuity for such situation. A subject adapted his/her eyes to the room with the illuminance 500, 100, or 10 lx and the visual acuity was measured when the eyes instantly moved to the place of which illuminance was at one of the 12 different illuminance in the range from 0.2 to 100 lx. The Landolt C letters were used for the measurement placed at 150 cm apart from the subject. Both eyes were used. The result showed, for example, that the visual acuity of about 1.6 obtained for the room of 500 lx reduced to only 0.4 at the shade illuminance of 2.5 lx. For the room illuminance of 10 lx on the other hand the visual acuity changed from 1.2 for the room to 0.7 for the shade showing less reduction compared to the brightly illuminated room

ANALYZING THE INFLUENCE OF THE LIGHTSOURCE COLOR ON THE EVALUATION OF INTERIOR COLOR

Eun-Mi Jin, Jin-Sook Lee

Chungnam National University Dept. of Architectural Engineering

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These days, the usage of an office is variable, professionalized. Therefore, it is necessary to consider the comfort as the residential space not the labor space. The Colour is a important element of considering the comfort in a space. The colour is percieved differently by the characteristics of lightsources.

Therefore, the aim of this study is to measure the color shift by lightsources, analyze the characteristics of color evaluation by lightsources and propose index of interior design by image types.

The process of this study is composed of three steps ;1) Selecting lightsources using in the office interior and measuring the color shift by physical characteristics of lightsources 2)Analyzing characteristics of color evaluation by lightsources through the evaluation experiment 3) Proposing the index of color design under characteristics of lightsources by image types based on the analysis.

ASSESSMENT OF VISUAL HARMONY OF A ROOM : EFFECT OF COLORS OF LIGHTING

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P - 36

Visual harmony of a room is largely determined by relations between lighting and the interior colors. A large number of studies have been made on color harmony, however, a reliable theory for arranging colors of a room has not been established. In this study we examined effects of colors of a light source and the interior on the visual harmony of a room. The subjects observed a pair of small model rooms that differed only in colors and judged which room was in better harmony. We found that the combination of the interior colors strongly affects the visual harmony of the room. Moreover the color of the light source remarkably changed the impression of the room in some color combinations. The results were considered from several theories of color harmony.

COLOR LIGHT WORKSHOP EXPERIENCE

Grupo de investigacion "Constitucion e Interpretacion de la Imagen Artistica"

Facultad de Bellas Artes. Universidad de Granada

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The research group "constitucion e interpretacion de la imagen artistica" was founded in 1998 and between his aims was the constitution of a laboratory of light where the artists could find a place where experiencing with this.

In march 2000 we held a workshop-course guided by the artists Maribel Domenech (Spain) and Margo Sawyer (United States). The objectives of this workshop was the work with light and diferent materials inside the aparience system(CESIA). The previous work base was a empty, close space where the students could worked with electric lights and diferent kinds of materials (fabric, class, salt, mirrors, projectors....)

Before this, There was two lectures by the guest artists(Domenech and Sawyer) where they talk about their work, and different strategies to start the work.

After this the students began to discover the diferent materials and to think about what were its possibilities in order to make a visual work. The first of this confrontation between artistic aims, new materials and diferent kinds of light was a big caos. The surprise was when little time after the students began to work with brilliant ideas and the process was a success.

The conclusion of this workshop was that the students made works in a significant/esthetic level and the tecnological level was only a way to do it. They loose his fear to new materials and was a very good way to new ideas in his work. The discovering of the material is a good way to study the light and the results in its works demonstrates that the aparience system is the right way to study the sight in artistic works.

NATIONAL STANDARD TRACEABLE SYSTEM FOR THE PRECISE COLOR MEASUREMENT

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P - 38

Color is the very sensitive subject. Many factories have trouble to manage or control the color of their products. Primary standard of the color measurement is the spectral absolute diffused reflectance which are measured in national standards institutes and compared each other to conform the accuracy of their measurements. The precise spectral absolute diffused reflectance are transferred to reference spectro photometer, white standard reference plate, and standard color plates. Every color meter which is used in working field, can be calibrated with standard reference white plate and can be conform the data using the standard color plates.

INVESTIGATION OF THE INFLUENCE OF VARIOUS D65 DAYLIGHT SIMULATORS ON COLOR MATCHING

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Thirty years ago, International Commission on Illumination (CIE) recommended standard daylight illuminants for colorimetric applications. Since then, many attempts have been made to simulate CIE standard daylight illuminants. But the simulations are still not close enough to represent any those standard illuminants. It leads to the situation where various daylight simulators from various suppliers are used in the commerce and industry for color evaluation. Such variation in daylight simulators results in the lack of precision in color evaluation. This study investigates the D65 simulators influence the color matching of metameric pair. Spectroradiometric measurements of different D65 simulators were taken. The measured spectral power distributions were used to assess the quality of D65 simulator by using CIE method No.51 "Method for Assessing the Quality of Daylight Simulators for Colorimetry", and CIE method No13.3 "Method of Measuring and Specifying Color Rendering Properties of Light Sources". The visual assessment was also conducted to search match point in the D & H Color Rule under various D65 simulators. The influence of difference D65 simulators on colour matching would be evaluated

IMPROVEMENT OF COLOR REPRODUCTION BY COMPENSATION OF CORRELATED COLOR TEMPERATURE IN TFT-LCD

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Current AMLCDs(Active Matrix Liquid Crystal Display) emit less radiation, consume less power, and take up less space, thereby allowing for a more comfortable work environment. Accordingly, LCD displays have started to replace CRT displays in many areas, including monitors TV and so on.

However, although substantial advancements have been made in the development of LCDs related to the division of the view angle, resolution, response time, etc, the picture quality is still inferior to that of CRTs.

In general, a CRT has few CCT (correlated color temperature) variations as to its input levels of the gray scale and chroma coordinates of the three primary colors. In contrast, the color quality of an LCD has many CCT variations as to its digital input levels that are related to the physical, electrical, and optical characterization of the liquid crystal and color filter. As a result since the color in an LCD changes relative to the gray scale, this hinders the capacity for precise color reproduction.

At a low digital value, most LCDs appear bluish. Plus, the CCT of an LCD becomes higher when the digital value is lower [1] Accordingly, this paper investigates the characteristics of CCT as related to LCDs. In addition, an LUT(look-up table) is proposed which can adjust the digital input value of the three primary colors, to maintain a fixed value for the correlated color temperature.

The resulting LCD characteristic after compensating the CCT with the proposed LUT is examined. The LCD characteristic was maintained at about 6500k, which is the standard CCT for display systems. Moreover, the use of the LUT did not affect the original LCD luminance.

Finally, the quality of the color reproduction was tested using Macbeth colorcheck colors. It was confirmed that the color reproducibility of a LCD using the proposed LUT became much more accurate than a conventional LCD.

ULTRAVIOLET RAYS SHIELDING BY DYED FABRICS

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P - 41

In recent years, because of increasing the environmental destruction the harmful influence of ultraviolet radiation on human bodies has been discussed. This study was undertaken to investigate the ultraviolet shielding effects by colored clothing using dyed fabrics.

Fourteen kinds of direct dyes (five red dyes, five blue dyes and four yellow dyes) were examined on (1) molar absorption coefficient at the regions of 700-400nm in wavelength (visible light region : VIS), 400-320nm(UVA) and 320-280nm(UVB) respectively, (2) dye exhaustion (%) and colored effects on cotton fabrics and (3) UV-rays shielding efficiency (%) of dyed fabrics.

The results were as follows:

- 1) Even the light colored fabrics, the dyed fabrics showed higher UV-ray shielding properties than nondyed fabrics. The UV-ray shielding effects of fabrics increased with decreasing of the lightness of fabrics by the concentration of dyes on the fabrics.
- 2) The yellow colored fabrics showed high luminance reflectance even at the high concentration of dyed fabrics.
- 3) The dyed fabrics with red and blue showed effective UV-ray shielding at the condition of deep shade color, but the dyed fabrics with yellow showed high level of UV-ray shielding even at the condition of the light color.

A NEW ECONOMIC HF-AC-POWERSUPPLY FOR COLOURED LIGHT EMITTING DIODES (LED) AND COLOURED NEON-TUBES

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P - 42

A new electronic AC-powersupply with a constant high-frequency AC-current to operate very economical a large number of coloured light emitting diodes will be presented. This HF-AC-powersupply has a very high internal output impedance and additional a special circuit for an excellent power-factor-correction to reduce the harmonic content - that indicates a low distortion factor-of the line current and realize a high line-powerfactor of the device.

A large number of light emitting diodes are arranged in an antiparallel circuit configuration and can be operated by this new powersupply.

Besides, coloured cold start tubular discharge lamps so-called neon-tubes can also be operated by this new powersupply.

Applications: General advertising illuminations, advertising signs, traffic-signals, emergency-lighting, illuminated architectural-lines for building, gas-service-stations, shops, ware-houses, railway-stations etc.

COLORIMETRIC DETERMINATION OF TARTRAZINE IN SOFT DRINKS

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Tartrazine (FD & C Yellow No.5) can cause an allergic type reaction in sensitive individuals. It is reported that some population is sensitive to this dye and most of those who are sensitive are allergic to aspirin. This dye has been used to mix with the soft drinks to make color of solutions. In this work, we shall report the application of colorimetry for determination the amount of tartrazine in some local soft drinks. Wool dyeing technique was used to extract the dye from standards, unknown solutions and soft drinks. After drying the wool, color values CIE-L*a*b* were measured. It is found that with appropriate concentration range and b* values, a highly correlated ($R^2 > 0.98$) standard calibration curve was obtained.

Percentage recovery of tartrazine from unknown was around 96 to 105%; but from soft drinks spiked with the dye, the percentage recovery was around 61 to 114. However, all the local soft drinks examined contained this dye less than the limit imposed by FDA (Thailand).

EFFECT OF ULTRAVIOLET IRRADIATION ON THE PHOTODEGRADATION OF BPA POLYCARBONATE

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P - 44

Bisphenol A polycarbonate(PC) is known to degrade upon exposure to UV light. Photolysis studies were carried out on PC film exposed to short wavelength radiation(254nm) under vacuum. To reduce the photodegradation of PC by UV TiO₂ has selected as an UV blocking material. This report describes the development of spectroscopic methods to demonstrate the effectiveness of UV blocker. A phenomenological study is presented demonstrating the change in color of transparent plastic material(PC) With the addition of TiO₂ under the UV exposing condition.

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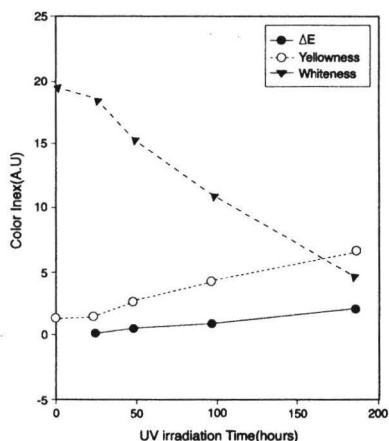


Figure. Color index change of PC film after UV irradiation

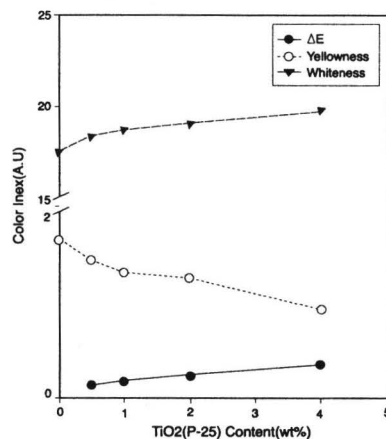


Figure. Color index change of PC film with TiO₂(P-25) particles

STUDY ON VALIDITY OF TML(TARGET MAKER LINE) OF THE CATCHER'S GLOVE - AIMED AT COLLEGE STUDENTS

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Science University of Tokyo

P - 45

This study has been focused upon validity of the TML glove, which is the catcher's black glove colored white around its mound. Comparisons have been made in the hitting ratio of the strike zone between the TML glove and the usual black glove.

The subjects are right-handed and left-handed overhand pitchers. Both of them pitch twenty straight balls twice to the right and the left-positioned batters. The catcher sets his glove in the strike zone, and the pitcher throws the balls aimed at the strike zone. The ask, the chest protector, shin guards and knee pats are all black.

Interesting and significant information has been obtained by means of questionnaire from the subjects after the experiment. According to the results of statistics (χ^2), the apparent distinction of the effect upon the TML glove has not been found. This would seem to depend upon different factors of the subject himself on a physical strength level as well as on a technical level. Several effects upon background colors should also be taken into consideration.



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