The Meaning and Symbolism of Colour & Creative Colour Education

色彩的意義與象徵及其創意教學

by

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The Meaning and Symbolism of Colour

Introduction
Few things influence us as much as colour and few things engage and interest people as much as colour. Colour plays an essential role in the environment in which we live, whether it is at our place of work, in the public environment or in our home. To choose the right colour is necessary to attain the desired effect in colouring and design, both in the colouring of our environment and in the colouring of products.

The Need for Colour Theory
We see our surroundings and we see them in colour. Why? In the beginning, the ability to distinguish different colours was probably a necessary asset in the fight for survival. Colour helps us to identify different objects. Colour informs us about inedible plants, access to water, distance, whether fruits are ripe or unripe etc.

Colour has also for a long time been used as ornamentation, to decorate our environment - we like colour-, as a colour language e.g. in signals such as the traffic signals red, yellow and green, and as signs of recognition e.g. Scotch clan patterns, Indian war paint etc. Colour can mean different things. Colour has also come to symbolize different occurrences - different for different cultural fields, e.g. black-sorrow, white-innocence, red-socialism, green-envy and blue-romanticism.

The possibility of influencing the surroundings with regard to colour has increased considerably during the last hundred years as a result of the increasing availability of synthetic colouring materials. In the old days, it was expensive to paint or colour e.g. textiles except in certain natural colours. The objects received their natural colour, which was determined by the material.

Modern industrialism and a well-developed technology have made it possible, even necessary, to colour our surroundings. We now use colour everywhere as an environmental factor similar to e.g. shape and pattern. This has also necessitated some systematisation of the colours to be used. The number of colours, i.e. the number of perceived colours which can be distinguished from each other can, under favourable circumstances, amount to 10 million, but even if a colour world of about 100,000 colours is sufficient for practical use, it is easily realised that a simple system to overview all these colours is necessary if we are to be able quickly to find the colours required.

The Colour Vision and how to Communicate Colours
In work with colour, whether it concerns interior decoration, clothing, picture painting, textile compositions or other fields, there is often a very large and varying material to choose from and it is necessary to be able to have an overview of the material - it is necessary to be able to sort the colours in some way.
The first condition for any experience of colour in the ordinary sense is light radiation. The source from which the light comes can vary - the sun, a light bulb, a candle, a fluorescent tube etc. What we call light is a small part of the electromagnetic energy spectrum, where we have X-radiation and ultraviolet radiation on the one hand and infrared radiation and radio waves on the other.

The colour experience is dependent on the amount and composition of the radiation reaching the eye. The human eye is very sensitive to variations in radiation within the visible part of the spectrum and can distinguish between different stimuli (radiation) with great certainty. If the light from a source which emits light radiation of all wavelengths, e.g. the sun, strikes e.g. an object which is painted with paint, the following happens in the surface layer of the object:

1) Part of the radiation, i.e. that of certain wavelengths, is absorbed.
2) Radiation of other wavelengths is reflected.

The most important thing that has happened is that the reflected radiation no longer has the same wavelength composition as the incident radiation from the light source (here the sun). The reflected radiation is caught by the eye and strikes the retina of the eye. The wavelength distribution of the light is there "read" and a message goes via the optical nerve to the optical centre in the brain. Here the observation takes place (we perceive) that the illuminated object has a colour (e.g. red). The colour experience is dependent on the composition of the light radiation when it reaches the eye. A different composition of the light thus gives rise to a different colour experience.

Many colour systems and colour atlases have been developed, but these are based on different conditions and different theories, and have added to the difficulty of communicating within this field. It is not sufficient just to identify a colour in terms of pigments and their mixtures or in terms of wavelengths and physical stimuli.

How the colour is mixed, as well as the measurement data, is necessary for production, but to communicate colours you need a system in the way people see colours.

A perceptive colour system such as NCS, Natural Color System begins with colour appearance according to the perceptual attributes of hue, chromaticness, whiteness and blackness, which makes it possible to use the system within different areas of colour design. It is a logical colour system which builds on how the human being sees colour. An NCS notation represents a specific colour percept and says nothing about what pigments, lights rays or nerve signals have given rise to this perception.

**Colour Preferences and Colour Meanings**

Small children like high chromatic colours according to some Swedish investigations. Eyseneck 1972 put together all colour preferences studies and find out that we prefer colours in this order: blue, red, green, violet, orange and yellow.

Colour is considered to be of great importance in our milieu. You will be calm in a green room! Is it so or not? However psychologists have tried to explain to what extent people react similarly to different colour stimuli and whether colours have any specific effect on human behaviour.

In commerce, colours have more or less been used to attract attention, and to a certain extent in order to gain a company and product identification. Colours are also used as symbols in different contexts. One question is whether colours have a fixed significant liaison to certain semantic concept. Starting from a purely perceptive colour order system you can map out the co-variations between
semantic variables and perceptive colour variables (Sivik). The intention of this study was to try to find out what colours signify to different people. The opposite of words used were like-dislike, loud-discreet, old-fashioned-modern, positive-negative etc. (a total of 26 pairs of opposites). This method can be used in practical industrial design when analysing a colour concept.

In a study carried out by Hård & Sivik the colours you connect with different scents were investigated. Scents like lavender, vanilin, mint, citrus etc. It is important that you can produce a perfume package with the “right colour” associated with the actual scent.

Creative Colour Education

Introduction

The colour science is a part of many different educational fields. This means that it is treated from many different aspects and according to different disciplines. If one considers the interdisciplinary features of colour science and the different angles of approach and the different facets of colour which exist, unexpected opportunities open up for the treatment of colour in an education context. The purpose of this paper is to show how the colour education can develop creative environments where creation, communication and exchanges of experiences between different disciplines are the central point and also to show the role of the AIC Study Group on Colour Education in this matter.

What does Creative Colour Education mean? Creativity is the ability of a person to solve problems by new methods or to create new products in art or technology, for instance. Creativity has been the subject of intensive research in psychology and pedagogy since the mid-1950s. I found this in my encyclopaedia. The act of creation is an important factor in colour science, and this is what we must develop in order to stimulate the interest in colour and in the importance of colour. Without inspiring and interesting colour education, there can be no good breeding ground for colour research. I want to do my best to give a few angles of approach to how more creative colour education could be achieved.

Traditional Colour Education of Today

Traditional Colour Theories

What first comes to mind when discussing creative colour education are these three colour theories:

- Goethe’s colour theory in which several of his experiments on the influence of colours can be made in colour education. The experiments are not aimed at proving anything, but are merely a way of becoming acquainted with colours and making one’s own observations as regards light and the perceptions of colours (Sällström 1966).

- Itten’s theory of colour harmony in which harmonious combinations of three and four colours are created in a colour circle designed for this purpose. The geometrical figures can be turned to any initial position. Itten does not define his colours other than by colour words and printed pictures. Analysis of these will reveal that yellow corresponds to Y20R, orange to Y58R, red to Y96R, violet to R55B, blue to R72B, blue green to B13G, green to G18Y and yellow green to G40Y. Itten’s colour harmony system is expanded here so that one mixing series with white and one with black accompany every chromatic colour. The colours of the arms of the star give harmonious combinations if they are arranged symmetrically in accordance with Itten (Sisefsky 1995).

- “Interaction of Color” by Josef Albers is a description of an experimental way of studying colour and of teaching about colour. The objective of his colour theory is to employ practical colour experiments
in order to develop a sense for colour and learn to recognize the influence of colours on each other, and about the variability of colour impressions. They are aimed at opening our eyes and making us better able to see. It is only what you see that is correct (KG. Nilsson, 1981).

These three colour theories are obviously important in developing our attitude to colours, to seeing colours, to being inquisitive, to being fascinated by colours and choosing to go further. But is this enough? There are great opportunities for developing colour education further.

**A Study on Colour Research in Architectural Education**

In a study carried out by Janssens & Mikellides (1998) the knowledge of architectural students about perceptual and psycho-physiological aspects of colour, colour nomenclature, existing myths and beliefs, and how colour is used in their everyday work in studios was investigated. A comparison was made between five schools of architecture, three in Sweden and two in United Kingdom. Colour is considered by all involved to be an important subject matter in the education of environmental designers. This point of view seems nevertheless to have little influence on the educational situation in most architectural schools.

The success of education is dependant on many factors: the overall goals, methods, and resources; the engagement and competence of the lecturers; the quality of the teaching materials and other educational media; as well as the students’ own personal resourcefulness, interest, and motivation; all these factors combine to play a decisive role in pedagogical accomplishments. Most of the students complained about the lack of coverage of the subject area in lectures, seminars, or studio work, with very little theory and only few practical exercises. Because students perceive colour design as their own future responsibility and basic design education seems to be the main source of colour information, the problem of this deficient knowledge should be seriously addressed by researchers and educators.

From the Swedish part of the study you could find out that schools educating interior designers spent more time on colour related subjects, as compared to schools of architecture. They treated colour more as individual subject with their own teachers, giving opportunity to a both broader and deeper penetration of the subject. In schools of architecture, at the initial stage, the departments of theoretical and applied aesthetics were responsible for colour education. Here, due to time scarcity, colour was often integrated into other related subjects, thus obstructing a more thorough treatment of the colour subject itself. Student projects at architecture schools were only seldom presented with careful colour accounts, more often at schools for interior designers. Interior design students also dealt with colour questions during the entire project work, from start to finish, while architecture students often tended to skip colour problems until the final stage of the design process. However the design process should be reversed; you should start with the colour and form together.

**The Interdisciplinary Nature of Colour Science**

Because of its interdisciplinary nature, colour science has no natural home and is therefore part of many different educational fields. This means that it is treated from many different angles and according to different disciplines. Colour science is dealt with in phenomenology, physiology, physics, psychophysics, psychology, philosophy and aesthetics. It is therefore treated from a variety of different angles and by different disciplines, which need not be disadvantage. On the contrary, it can create exciting meetings since, to many people, colour gives rise to many different notions of what it can be. Physicists think in terms of radiation and wavelengths, the chemist thinks in terms of pigment and material mixtures, the physiologist thinks in terms of anatomy of the eye and the behaviour of receptors, nerve cells and brain centres. The psychologist thinks of colour as perception of the senses and human influence, and the painter thinks of his palette or the expression of the colour. The architect and designer think of colour as a property and experience related to objects and their function in the environment.
If one considers the interdisciplinary features of colour science and the different angles of approach and the different facets of colour which exist, unexpected opportunities open up for the treatment of colour in an education context. It is possible to develop creative environments where creation, communication and the exchange of experiences between different disciplines are the central point. In this respect, colour science is unique in the field of education. There is no other branch of science which concerns so many and which can create so much involvement from the students.

Colour science often falls within an artistic subject and it is often the artist who teaches about the colour in the picture. This education often deals with how to mix a colour, the practical details of how to paint and how to use colour in the creation of a picture. This type of education does not, however, give any practical instrument or unambiguous way of communicating colour.

It is important for the colourist with a sensitivity for small differences in nuance to choose colours with great care. It is therefore important to have an unambiguous colour language from idea to result. A perceptual colour description system which describes colour as we see it, can lead to different proposals for experimenting with colour compositions. Trials in which colour combinations corresponding to the concept of beautiful have been investigated (Hård & Sivik 1989) have suggested that similarities and relationships between colours are aesthetically highly valued.

A colour system does not necessarily give pretty colour combinations, but it does provide a tool for experimenting with different colour harmonies. It is possible to test the effects of different colour compositions and colour combinations and then perhaps to build on this. Colour compositions can be analysed and documented with the help of the colour system. Starting from a given colour, it is possible to investigate possible combinations with other colours. This gives an overview of the possible choices, which exist. It is possible to see which choices lead to a new content and which choices are less important. It must be reasonable to be able to develop one's colour concept by observing what the colours look like and how they relate to each other.

Some Examples

Metamorphoses – a Study in Colour Compositions

The purpose of the Metamorphoses study by Jörgen Lindgren (1993) is intended to demonstrate in a simple and lucid manner how the form characteristics of a composition can be changed by consciously playing on the various properties of colours and, on the basis of the same formal basic pattern – or the same colour range – compositions can be created with entirely different expression values. Jörgen Lindgren was professor at the School of Art and Design at Gothenburg University. He used the NCS system as an analysis instrument in studies of different types of colour compositions, for which it proved to be very useful. In Metamorphoses – a study of the formation properties of colours – he reports on two different series of colour compositions, one of which is based on the same form structure and the expression of the composition is changed by different colour choices. The second series is based on a certain range of colours comprising five recurrent colours, but where the form structure is changed and gives the various expressions. It can be observed spontaneously in the two series how the form and expression changes take place when the colour relations are changed from composition to composition. In most cases, we should perhaps be content with the “immediate” experience through the senses, but a “tool” is needed in other cases for analysing our experience. What means has an artist used for achieving the expression values that we, as observers, take in through our eyes? This may apply, for example, in an educational situation, artist education, art science studies, etc.

The Rich Colours of Savannah
When Byron Mikellides from the Oxford School of Architecture was lecturing at the Savannah College of Art and Design he started a project which aimed was to record in a systematic way using both visual images and scientific notation, the rich colours of Savannah’s natural and man-made environments. The students did notate the colours for certain points – for example, the different ways one can look at a building – and different contexts, such as the different seasons. The NCS notation was determined for each observed colour. They recorded the colour from roofs to floorscapes but also the colour of the native plants and trees. During one weekend almost 50 students where collecting “natural colour samples” in different materials. They collected stones, sand and earth. They took photos of wrought-iron goods and plaster facades. They picked up beautiful flowers like magnolias and azaleas. This “nature colour samples” where then analysed in NCS and the result was a fan deck of the colours of Savannah. A project like this can be the basis of several proposals not only in conservation but also in upgrading and revitalising local areas. This kind of project can also be utilised in all disciplines in colour education like in architecture, interior design, textile design (folk costumes, fabrics) and graphic design (signs and symbols).

The students have to learn the basic systems to be able to communicate colours and they also have to have discipline and practise their technical skills so the result will be a clear and structured proposal or idea. Limitations activate student’s creativity. Much would be gained if knowledge and creativity could be combined, but not at the cost of artistic quality and a feeling for colour. It is all about getting to know your means of expression. And this is the task of colour science: To train one's sensitivity for colours so that one can play with them like a skilled musician on his instrument, but you also need the musical notes, a colour language with which to communicate and document colours.

References


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伯斯庄女士（Mrs. Berit Bergström）任职于瑞典斯德哥尔摩的北欧色彩学院（Scandinavian Colour Institute—NCS），并担任 NCS 附属的北欧色彩学校（Scandinavian Colour School）的研究与教育负责人。主要职责包括色彩教育和发展色彩理论、色彩设计、专业涂料技术等课程。她是 NCS 最重要的讲师之一，也是瑞典色彩基金会与色彩科学基金会的秘书，负责研究计划与课程预算。

现任国际色彩学会（AIC）色彩教育委员会的研修组（Study Group）主席，经常为文推荐 NCS 色彩研究的成果。

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I-1 不同颜色在黑白背景下色知觉变化之研究

本研究主要在探讨同一色彩在黑色背景上，相对在白色背景上时，
其亮度及彩度的色彩差異。

本研究以電腦萤幕所呈现之自发光源色作为实验用色彩，利用影像处
理軟體 Adobe Photoshop 中的 HSB 色系系統，挑選出紅、黃、緑、青、藍、
紫等六個代表色。為了探討黑白背景對色彩所造成的色知覺變化，將各色
配置在黑色與白色的背景上。受测者参考白背景上的色彩，操作 Photoshop
中之色相、飽和度、亮度调整桿，調整黑白背景上的色彩以至目視相同為止。
實験结果如下：

一、黑色與白色背景影響色彩所造成的亮度差異，红色的亮度差比黃、紫、
青三者来的小，青的亮度差比藍和红来的大。受黑與白背景影响所造
成亮度差異，青色最大，紅色最小。

二、黑與白背景影响色彩所造成的視彩度差異，紫與藍的視彩度差比其他
四色大，青色視彩度差比其他五色之視彩度差小，黃與紅的視彩度差
比藍與紫來的小，受黑與白背景影响所造成视彩度差異，紫色最大，
青色最小。

三、受到黑與白背景影響色彩所造成的色差量而言，紫與藍的色差均
大於紅、青、黃、緑等色。

關鍵詞：色知覺、亮度對比、色差、HSB

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A Study on Variation of Color Perception for Different Colors at Black and White Backgrounds

The main purpose of this study was to investigate the variation on brightness and chroma of different colors at black background against white background. In this study, the authors applied the “HSB color system” of the Image Process Software, Adobe Photoshop, and selected six colors which were red, yellow, green, cyan, blue, and purple as the representative colors. For investigating the effects on the variation of color perception, each of the six colors was arranged on the black background as well as the white background. According to the colors on the white background, the observers operated the adjust bar of hues, saturations, and luminance to make some adjustment to the color on the black background and tried to make them seem like the same color. The result of this experiment are listed as follows:

1. The issues of the discrepancies of brightness: The experimental results show that the discrepancy of red color is smaller than that of yellow, purple and cyan colors. The discrepancy of cyan color is larger than that of blue and red colors. With regard to the discrepancy of brightness when colors are presented on black background and white background, cyan color has the most discrepancy and red color has the least discrepancy.

2. The issues of the discrepancies of colorfulness: The experimental results show that the discrepancies of purple and blue colors are more colorfulness than that of the others (which are red, yellow, cyan and green colors). The discrepancy of the cyan color is the smallest than that of the other colors. The discrepancies of yellow and red colors are smaller than that of the blue and purple colors. With regard to the discrepancy of colorfulness when colors are presented on black background and white background, purple color has the most discrepancy and cyan color has the least discrepancy.

3. The issues of the discrepancies of color differences: The experimental results show that the discrepancies of purple and blue colors are larger than red, cyan, yellow and green colors.

Keywords: color perception, lightness contrast, color difference, HSB
I-2 資料探礦法在個人色彩喜好之應用研究

本研究旨在利用調查法以電子問卷方式，在經由控制之環境條件下進行色彩喜好的相關調查。之後並透過資料探礦之機制，查驗其中之關聯性。調查之色彩樣本依 NCS 之色相分計有紅、橙、黃、黃綠、綠、藍綠、藍、紫等 8 色；物件則有杯子、T 恤、椅子、機車、磁片及背包等 6 種商品影像，並加入分別代表季節(8 幅)、地形(8 幅)、時序(6 幅)、水果(12 幅)、花卉(12 幅)等彩色影像五大種類，共計 12 變項。由受測者分別就螢幕上顯現之變項，其最喜好與最不喜好之色彩或影像加以選定。本研究調查對象為中國文化大學大學部學生計 309 人，其中女生 166 名、男生 143 名。研究所得結果分述如下：

一般而言，藍色商品最受到青睞，其次為紅色及橙色。不喜好的色彩，則以紫色商品最不受歡迎，其次為藍綠色與綠色。此外，藍綠色椅子的不喜好度遠高於其他色彩，而綠色磁片的不喜好度亦相當高。

研究結果並得知，當掌握人口特質因素，且在適當的條件下，便可推測其色彩喜好的比例，茲將其較具代表性的結論模式呈述如下：

1. 主要生活在北部的男生，有 45.24% 最喜愛藍色的機車。
2. 自認為個性內向的男生，有 44% 的人最喜好藍色的椅子，亦有 44% 的男生最不喜愛的紫色 T 恤。
3. 自認為個性外向的男生中，有 42.65% 的人最喜好藍色機車，而有 48.53% 最不喜愛的紫色 T 恤。
4. 最喜歡運動的男性中，其中有 40% 的人最喜愛藍色的椅子；而最喜歡旅遊度假的女性，則有 48.72% 不喜愛綠色磁片。
5. 就讀四年級且喜歡聽聽娛樂的學生，其中 42.50% 最不喜歡紫色的杯子；而就讀四年級的男學生中，有一半的人最不喜歡紫色的杯子。

關鍵字：色彩喜好、彩色影像、資料探礦

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I - A Study of Exploring College Students’ Color Preferences by Utilizing Data Mining Technique

In order to find out whether there are relations between color preferences and other color images (color environment and products), this study investigated the color preferences as well as preferences on color environmental settings among 309 college students of Chinese Culture University. The whole survey was conducted by an electronic format in a controlled environment with calibratable monitors. The subjects of the research were asked to choice their most favor and the least favor colors or color images (products) on the monitor screen. Based on NCS, there are eight testing colors - red, orange, yellow, yellow-green, green, blue-green, blue, and purple were chosen. Objects such as cup, T-shirt, chair, motorcycle, floppy disk, and backpack with same 8 colors coated on surfaces were also used as color commercial products. There are 5 categories of color images were generated to represent seasons, geography, time, fruits, and flowers. All together 12 variables with favor and least favor choices were asked during the survey. After collecting data and performing statistics for general description, the study utilized the data mining techniques to explore the relations between color images attributes and color preference.

In general, blue color and blue products are the most preferred ones, while red and orange products are the followers next to blue. Purple color and purple products are the least favorite color and color products; followed by turquoise and green. Other than that, turquoise chair was found as the least favorite color product significantly then any other colors while green floppy was selected as least favorite disk color.

The relational patterns among demography and its color preference found are:

1. 45.24% male students who live in northern Taiwan prefer blue motorcycle.
2. 44% male students who are introvert will prefer blue chair and dislike purple shirt, while 42.65% extrovert male students prefer blue motorcycle and dislike purple shirt.
3. 40% male students who like to exercise will prefer blue chair.
4. 48.72% female students who like travel will dislike green disk.
5. 50% senior male students least favorite purple cup.
6. Among those senior male students who like recreation, 42.5% of them dislike purple cup.

Keywords: Color Preference, Color Images, Data Mining
I-3 幼稚園兒童之烏龍茶色味共感覺研究

人體某一感官受到刺激時可引起其它感官的知覺。這種並生的感覺稱之為「共感覺」 (synesthesia)，可將之定義為一種兼具多種形式組成而不由自主的感官體驗。共感覺可為自發性的，某些人天生即能感受到共感覺；或因後天之生活經驗、學習與認知而得。

受到特定的色彩刺激會產生特定的味覺，稱之為色味共感覺。本研究探討此現象之反向作用，亦即給予不同的色彩刺激時，對同樣的味覺刺激是否具有相同的味覺反應？本研究以 30 位 4-6 歲之幼稚園兒童為樣本，藉由實驗調查對於正方盒色彩之喜好度及飲料包裝色彩的喜好程度是否有所不同？另在飲用相同飲料、不同顏色飲料包裝後之色彩喜好程度上是否有所不同？

由實驗結果，得之幼稚園兒童對於正方盒不同色彩之喜好度，因性別而有些許不同，不論男生或是女生都偏愛黃色。在飲料包裝色彩的喜好程度上，男童對黃色偏好高於紅色，黃色及綠色的偏好高於紫色。女童對黃色、紫色及紅色偏好高於藍色。在飲用相同飲料、不同顏色飲料包裝後之色彩喜好程度上，男童對綠色及藍色的偏好高於紫色。女童對黃色、紫色及綠色的偏好高於藍色。

關鍵詞：共感覺、色味共感覺、色彩偏好

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I -3 An Investigation of Synesthesia in Kindergarten Children on Oolong Tea

The stimulation in another sense can be caused when people simulate on sense. The joining of sensations is called synesthesia. It can be defined as an involuntary physical experience of a cross-modal association. Synesthesia may be idiopathic (developmental), meaning the person has experienced synesthesia since he/she was born, or non-idiopathic, the synesthesia was produced by personal experience, learning and recognition.

It is known as colored-gustation that stimulates a specific colour can cause a taste. This study explored its backward function. Does it taste the same under varied colour stimuli? Thirty children aged 4 to 6 years old in kindergarten were chosen as subjects to investigate the difference between the preference of box colours and the box. It also tested that the preference level between different package colour for the same drinks.

The results show the gender influence is significant in colour preference. Both of boys and girls prefer yellow. The colour preference of package has different result. The boys like yellow more than red. They also prefer yellow and green than purple. The girls like yellow, purple and red more than blue. After tasted the same drinks in different coloured packages, the boys preferred green and blue than purple; the girls prefer yellow, purple and green more than blue.

Keywords: synesthesia, colored-gustation, colour preference
II-1 埃及的色彩觀與應用

人對世界的認知，往往取決於所處的環境。地理條件、人文、氣候及歷史等因素都會影響並外顯於文化中。文化的外顯現象由許多角度可以觀察的到，宗教通常是為明顯的。日、月、山、川、動、植物以其在生活中的重要性，而在其神格上各有高低的排列，也各賦予不同的象徵性的職掌與圖騰。另一方面，色彩也因日常生活中接觸的事件及所衍生出來的意義，而與其他的事物結合，以加強及延伸他們所代表的意義。在觀察色彩的應用的同時，文化也自然的揭露了它的另一個層面的面紗。

四大古文明之一的埃及，因為特有的時空，而發展出的色彩學。埃及人生活在每日面對著酷熱的太陽及充滿著死亡意象的沙漠中，逐漸地發展出他們獨特的生命哲學與宇宙觀。埃及人將落在地面上的身影視為身體的一部份，而色彩被視為物體增添生命力及獨特性的主要方式。色彩也如同影子一般，跳脫了視覺上單純的認知，而具自然特性的實存。因此，在埃及的文字中，「色彩」以動物的毛皮或缺少人體毛髮的符號來表達，意涵著色彩與外觀及人類的關聯。

關鍵詞：古埃及、色彩學

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II -1 The Hidden Meaning of Colors in the Ancient Egypt

In the construction of their vision to the universe, human beings are greatly influenced by their surrounding. Geographical conditions, activities, weather, history and etc. are factors, which will be clearly demonstrated in the outcome for the specific culture. This state of affairs can be observed from many different aspects. Aboriginal and local religion is the most visible example. The sun, moon, mountains, rivers, animals, vegetables and so on can be treated as deities and ranked according to their importance in the daily life. Each of them is in charge of certain related task or tasks and holds various symbols as tokens to their power and duty. In addition to that, colors are combined with these symbols to strengthen and extend their descriptions and power. During the discussion of the meaning and applications of colors, the culture reveals itself, which was deeply concealed under layers of cover.

As one of the earliest cultures, ancient Egypt due to its unique temporal and regional conditions has developed a very distinctive ideology in appreciating colors. Living under the cruel sun, in the deadly desert, annual flood and lively river have created Egyptians the environment to develop their philosophy and view about universe and life-and-death. Egyptians take shadow as part of the body and color as the major approach to fuel energy and uniqueness into objects. Color is presented by the symbol as animal hair or a human without hair, which implies the close relationship between color, appearance and human.

This paper focuses on the material and applications of colors, and Egyptian philosophy to discover the meaning of colors in ancient Egyptian culture.

Keyword：Ancient Egypt 、Meaning of Colors
II-2 漢以前之漢字字書色彩表達調查研究

本研究以漢以前出現的《倉頡篇》、《爾雅》、《急就篇》等字書為調查對象，藉以理解漢之前的色彩文字表達狀況。結果發現三書之色彩表達字數，依序為 13、73、32 個字。《爾雅》成書時間較長，字數也較多，詳細有形容馬毛色的 36 字，其他如紅色系 9 字，黑色系 9 字，光線明度 8 字，青色系 4 字，白色系 3 字，黃色系 2 字，多彩色系 2 字。《爾雅》裡出現特別的‘蘭、丹、黃、玄等詞，蘭是淺的古字，意義也相通。《倉頡篇》中有 9 字和「光線明度」有關，被歸於「日」或「火」部。證明對古代生活而言，光和火是很重要的。《急就篇》「系」部有 14 字是在表達色彩的，也說明了色彩表達和染色行業的關係。

關鍵詞：色彩字、字書、漢字

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This research is designed to understand how color words were used before the Han Dynasty, by analyzing several word books which appeared before Han Dynasty, such as “Cangxie Pian (倉頡篇)” “Erya （爾雅）” “Jijiu Pian（急就篇）”. It is found that the number of color words used in these three books is 13, 73, and 32 respectively. Of these three books, “Erya” is the longest existing book and has the color words at most. It has 36 words describing the color of horse hair, 9 words for red, 9 words for black, 8 words for the brightness of light, 4 words for green, 3 words for white, 2 words for yellow, and still another 2 words for mix color. Special color words are found in “Erya”, such as “stealing blue”, “stealing red”, “stealing yellow” and “stealing black”. “Stealing”(竊--to be pronounced as “Qie”) is the ancient word of “light”. They both shared the same meaning. In “Cangxie Pian”, there are nine words related to the brightness of light, and are grouped into the radical of “日(sun)” and “火(fire)” of Chinese character. This proves that light and fire were very important for ancient lives. Among the 32 words found in “Jijiu Pian”, 14 of them are under the radical of “糸”, which also shows the close relationship between color expression and dyeing industry.

Key words: color word, dictionary, Chinese word
II-3 中國色彩學與子平命學喜忌服飾配色應用

現代隨著社會、人文及宗教心靈的重視，對生活品質舉凡食衣住行等之要求相對提昇，而外表感官視覺的需求亦隨著漸受重視。尤其在服飾上而以日式或韓式整個流行趨勢為前端，受到流行與款式不斷的變化，服裝設計師們對色彩資訊掌控須特別的敏銳。

在傳統子平衡的配色方法中，均以陰陽配為主，在傳統色彩學陰陽配色理論中，即是喜忌與用神中扶抑、調候、通關之應用。

人類生活與大自然的關係，如何配合、應用，既能盡萬物之用。又不致於破壞大自然的和諧，是一套很完備的人生自然科學。以中國五色的色彩觀念，是最符合中國傳統的美學，若能導入配色概念則用神架構則更臻完美。

關鍵字：木、火、土、金、水

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II -3 Color matching application For Chinese color preference and Ze-Pin Astrolog

The origination of Chinese chromatics can be traced back to 3000 years ago where the Chinese take red, yellow, blue, white and black as five main colors. Furthermore, the Chinese combine the five elements of material - representing four direction points and central point - with respective color and attribute. Such as blue is classified into “Muh” located in the direction of east, white is classified into “Jin” located in the direction of west, red is classified into “Huoo ” located in the direction of south, black is classified into “Shoei” located in the direction of north, and yellow is classified into “Tuu” located in the center.

The Chinese Aspects: The Aspects which are really angular seperations are an extremely important part of the astrologer's analysis. Every planet has an angular seperation with another, but astrologers pay particular attention to specific ones.

Keyword：Muh、Huoo、Tuu、Jin、Shoei
Ⅱ-4 二十世紀末灰色服飾流行現象之探討

自 1998 年風行至世紀末的「灰色」，儼然流行舞台不可或缺的色彩元素——由「極簡 / 低限」風格引渡至對於「未來」風格的想望，在「跨流行」的場域中，「灰色」聯結起不同的流行主題，卻又能不顯突兀地「使兩種不同的聲部達成同體共鳴」。「灰色」向為安靜而隱然存在的色彩，在服裝設計的運用上，通常居於陪襯的地位，而非要角，然而，在此世紀相交的時空節點上，「灰色」為何能夠凝聚服裝設計師、時尚媒體以及消費者的關注焦點，造成普遍而廣泛的熱烈討論，這是本研究的重心所在——希望藉由對於「現代性」以及「後現代」的時尚文化以及思潮推演，搭配圖片資料的蒐集、時尚媒體的報導，以及對於整個環境局勢的關心，對於「灰色調」的世紀末流行現象，進行解讀與剖析，重新詮釋「灰色調」的世紀末流行意義。

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The color gray has become indispensable in the world of fashion since 1998. From the style of extreme simplicity/minimalism to the expectation of the style in the future, gray indiscernibly connects various themes of fashion by symphonizing two different vocals into a chorus. For a long time gray has symbolized an existence of invisible quietness, and it has seldom been the leading color in the design of fashion. The color gray nevertheless becomes foregrounded as a significant issue, enthusiastically discussed by the designers, the media, and the consumers. With the presentation of pictures and the reports of the fashion media, this article aims at analyzing and interpreting the meaning of the trend of gray in fashion, through which the evolutions of the culture of fashion and thoughts in the modern and postmodern periods are shown.
III-1 不同光源下色差公式對視覺色差評估效能比較之研究

一般而言均勻色彩空間對於基於此色彩空間之色差公式在評估視覺色差上是非常重要的。CIE 國際照明委員會在 1976 年已推薦均勻色彩空間，即為 CIEL*a*b*色彩空間。在過去二十年間，有很多研究之結果曾指出在視覺色差之評估上 CIEL*a*b*色差公式表現最差，而 CIE2000 則表現最佳，例如: Luo and Rigg (1987), Kuo and Luo (1996), and the Luo, Cui and Rigg (2001)等研究。在本研究中，以一系列在不同光源下進行的視覺色差判定實驗之結果對於前述的研究結果作進一步的印證。另一方面，在本研究中並採用不同人造光源如 D65, A 和辦公室所使用的熒光燈(OFF)。

本研究所探討的色差公式有 CIEL*a*b*, CMC(1:1), BFD(1:1), CIE94(1:1), LCD and CIE2000 等。研究結果顯示色差公式 CIEL*a*b*與 CIE2000 在預測視覺色差上分別在 D65 與 A、OFF 光源下各有最好的表現。

關鍵詞: 均勻色彩空間、照明、色差、色差公式

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Ⅲ-1 Comparisons of Performance of Various Colour Difference Formulae on Estimating Visual Colour Difference with Changes in Illumination

In general, a uniform colour space that colour difference formulae are based on is extremely essential for estimating visual colour difference. The uniform colour space CIEL*a*b* has been proposed by the CIE since 1976. In the past two decades, a lot of researches, such as the Luo and Rigg (1987), Kuo and Luo (1996), and the Luo, Cui and Rigg (2001), indicated that the performance of the CIEL*a*b* colour difference formula in estimating visual colour difference was the worst among those usually recommended to industry while the CIE2000 the best one. In this study, a series of experiments of colour-difference assessment with changes in illumination are carried out to further verify those findings. The colour difference formulae investigated in this study are CIEL*a*b*, CMC(1:1), BFD(1:1), CIE94(1:1), LCD and CIE2000. The results indicates that both colour difference formulae CIEL*a*b* and CIE2000 have the best performance in estimating visual colour difference under D65, and A and OFF light sources respectively.

Keywords: uniform colour space, illumination, colour difference, colour difference formula
III-2 三次元色域對映技術的設計方法

色彩管理系統(Color Management System，簡稱 CMS)的設計是以裝備獨立色(Device Independent Color)為基本概念，藉此，可以使色彩在不同的媒體間做準確的色彩訊號傳達，但在同一照明、同一輝度的環境下，仍不能解決色外貌的不一致問題，這是因為兩不同媒體間色域能表現的範圍並不一樣，其中以螢幕和印表機之間的例子尤為明顯。要解決上述問題，需在 CMS 中加入色域對映技術。

以數學演算法來解決因色域大小不一致所產生之色外貌(Color appearance)問題，稱為色域對映演算法(Gamut Mapping Algorithm，簡稱 GMA)。

GMA 可分為三種類型，分別是一次元、二次元以及三次元對映方法。一次元對映方式是調整影像明度或彩度的輸入與輸出的相對關係；二次元對映方式是將色相角固定，在明度-彩度平面上實行色域對映處理；三次元對映方式則是在三次元色度空間中直接做色域壓縮。三次元對映方式是目前仍在發展的新技術，也是本文研究重點，它被期望能夠解決一次元及二次元 GMA 中，因效率低落以及偽輪廓等不良現象所產生的劣化結果。

本文除了探討在色域對映的過程中，各種影響色域壓縮品質的因素之外，並設計出最佳化的多重壓縮方向之方法，來獲得最佳的色彩再現品質。

關鍵詞：色域對映演算法、集中收斂點、裁切法、線性壓縮法、非線性壓縮法、裝置獨立色、裝置從屬色、裝置從屬性、影像從屬性

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Ⅲ-2 The Design for 3-D Gamut Mapping Technology

Currently, the design for Color Management System is based on the concept of Device Independent Color. However, two image I/O devices, like CRT monitor and hardcopy printed by inkjet printer, may present different color gamut sizes even if they are observed in the same surround. To solve this problem, we must apply the Gamut Mapping Technology on the CMS process.

Gamut Mapping Algorithms (GMAs) can be classified into 1-D, 2-D, 3-D GMA. 1-D GMA is applied to adjust the relationships of image’s input and output dynamic ranges. 2-D GMA means that under the constant hue angle condition, gamut mapping is performed on lightness-chroma plane. 3-D GMA is to make GMA working directly in 3D color space.

3-D GMA is a new technology that can solve low efficiency and false boundary problem in 1-D and 2-D GMAs. It is the issue in this article.

Keywords: Gamut Mapping Algorithms, Focal Points, Clipping, Linear Compression, Non-Linear Compression, Device Independent Color, Device Dependent Color, Device-to-Device, Image-to-Device
III-3 GCR 應用於彩色印表機的色彩特性演譯模式化之研究

隨著數位科技資訊及網路的普及化，導致彩色影像系統的蓬勃發展，在正式印刷前，數位打樣機，或數位印表機已被廣泛應用於打樣，以便與客戶事先的溝通、校樣，但往往打樣機或印表機與印刷機表現色彩的特性不同，導致相同的 CMYK 數值在不同的設備下可能有不同的顯色表現。本文主要研究目的在於研發打樣機、印表機或印刷機的色彩特性演譯模式，以使得同一影像在不同設備能達到顯色效果一致，達成色彩管理的目的。

本文中研究彩色印表機色彩特性的演譯模式，採用的方法為諾克伯方程式(Neugebauer equation)，其有三種主要的形式，分別為寬頻的，分格狀的，窄頻的；並且應用灰色置換(Gray Component Replacement)的概念，將印表機中構成中性灰的 CMY 三原色，以黑色取代，目的在減少彩色顏料成本的浪費，以及強化影像暗部層次的表現，最後採用 CIEL a*b*、CMC、BFD、CIE94、CIE2000 的色差公式，作為評估加入灰色置換方法之後的色彩表現能力。

關鍵字：色彩特性演譯模式、諾克伯方程式、灰色置換、色彩管理、色差公式

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The Application of GCR in Calibrating and Characterizing Printing Devices

As digital technology has developed widespread, in printing industry color printers and color proofpress are practically used to make proof before produced by printing press. However, one problem can occur. That is-- the same CMYK signal values produce different appearance between different printing devices. Therefore, color management plays an important role. The aim of this study is to derive reliable printer device characterization models by means of Neugebauer Equations. Base on Neugebauer Equation, and the modified types of Neugebauer Equations, including Yule-Nielsen Modified Neugebauer Equation, Cellular Yule-Nielsen Modified Neugebauer Equation, and Spectral Yule-Nielsen Modified Neugebauer Equation. Furthermore, the GCR (Gray component replacement) approach is also applied in the field of characterization to both reduce the use of three pigments in producing neutral components, and enhance the detail of shadow reproduction image. For evaluating models’ performance, four color difference formulae of CIE L*a*b*, CMC, BFD, CIE94, CIE2000 are adopted here.

Keyword: color management, Neugebauer Equations, GCR, calibration, characterization
III-4 結合灰界理論與色域對應進行光源估測之研究

本文結合灰界理論(Grey World Theory, GWT)及色域對應(Gamut Mapping Algorithm, GMA)之優點，進行不同色溫下白點之估測。光源估測之目的在於達成色彩恆常性(Color Constancy)，影像在不同光源下會呈現不一樣的色彩，此乃由於光源之色溫不同，顯色效果不同，但一段時間後人眼會適應不同光源之影響，所見之色彩將不具偏色現象，此種現象稱為色彩恆常性。取像設備若要塗取與人眼相近之色彩，就必須去除照明光源之影響，將影像調整至標準光源下，以實現色彩恆常性。

GWT 為一簡單完成色彩恆常性之演算法，此演算法在影像色彩成份分布均勻時，效果相當理想，但若色彩成份分布不均勻，會造成主色系飽和度會降低。

GMA 先建立多種光源之色域資料成為索引色域(Index Gamut)，計算所擷取影像之色域與索引色域之相關程度，以判斷擷取影像之光源，其光源估測效果十分理想，但運算較費時。

因此本文的結合 GWT 及 GMA 的優點，估測光源時自動估算影像色彩成份之比例，並選擇適合之演算法。此方法可應用於數位像機白平衡功能之設計。

關鍵字：灰界理論、色域對應、色彩恆常性、色適應、自動白平衡

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Ⅲ - 4 Hybrid Illuminant Estimation using the Gray-World Theory and Gamut-Mapping Algorithm

This article proposes an illuminant estimation method combining the merit of the gray-world algorithm and gamut-mapping technology.

The gray-world theory (GWT) algorithm is a simple way to implement color consistency under different unknown illuminants. It works well for whole scene containing the average color distributions, but this algorithm can perform less well in the case of that the scene is lack of some color component.

Gamut-mapping algorithm (GMA) is another approach of illuminant estimation. By calculating the correlation of input image color distributions and the chromaticity gamut of each illuminant, scene illuminant can be easily estimated. However, if the types of the distribution of scene chromatic gamut under different illuminant are not obtained sufficiently to represent distinct indexing of reference in a look up table, this algorithm will tend to fail.

The proposed illuminant estimation method exploits advantage of both GWT and GMA algorithms. During the estimation process, the proposed algorithm can be switched into gray-world theory methodology or gamut-mapping technique automatically according to distribution of the colors existing in a given scene and the gamut sizes of testing scene colors. It will be easily designed to the white balance compensation of mobile digital camera.

Keywords：Grey World Theory、Gamut Mapping Algorithm、Color Constancy、Color Adaptation、Auto White Balance (AWB)
III-5 適用噴墨印刷之反應性洋紅染料的合成

噴墨印刷所使用的油墨一般以水溶性(aqueous)為主，為使油墨中水份不容易蒸發，組成配方中通常含有著色劑(即染顏料)、潤湿劑、界面活性劑、抗菌防臭劑、消泡劑、增黏劑、去離子水等成份。在油墨的特性上須要具有一定的性質，如低黏度、儲藏安定性、墨匣相容性，噴於被印的基材後無色暈及斷墨的現象，最重要的是各種堅牢度要佳。

噴墨印刷技術所使用的基本顏色為 C、M、Y(青綠 Cyan、洋紅 Magenta、黃 Yellow) 及 K(黑 Black) 四色。目前，市售的洋紅色墨水色光較鈍，且牢度不能有令人滿意的產品。

本研究的目的是希望藉由導入不同的官能基，合成洋紅色反應性染料，在不影響色光的前提下提昇亮度與牢度。自製染料所配製成的墨水與二家市售油墨經 EPSON 400 Ink Jet Printing 試噴於相片專用紙、平滑紙和經前處理過之棉布上，比較其色光與牢度。

經色彩測定系統分析，自製品 A、C、D、E 及 G (共 5 支染料) 中，以 A 與 E 色光最接近 PANTONE Magenta 標準色。自製染料與市售洋紅色油墨染色牢度測試比較，發現水牢度(Water Fastness) 與日光牢度(Light Fastness) 均高出 1-2 級。

關鍵字：噴墨印刷技術、反應性洋紅色染料

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The Synthesis of Reactive Magenta Dye for Ink Jet Printing in Cotton Textile

An aqueous ink is the simplest type of inks to use. The components of ink include colorant, co-solvent, humectant, surfactant, biocide, defoamer, viscosity modifier and deionic water. The inkjet inks performance require low viscosity, long storage stability and good compatibility with printer. The printing properties must be no feathering, dry fast and good smear resistance. The most important is to promote the fastness.

The ink-jet printing technology usually use CMYK system that have four basic colorants of cyan, magenta, yellow and black. Now, the magenta color has not been satisfied all properties.

The purpose of this project is to promote the hue and fastness for reactive magenta dyes with different function groups.

Keyword: Ink Jet Printing Technology, Reactive Magenta Dye
IV-1 醫療機構環境之指標色彩系統初探

本研究以南部地區 6 所病床數超過 500 床之醫學中心級醫院為對象，了解指標色彩系統使用的現況，以提供醫療機構的指標色彩使用參考。

研究結果發現，目前各醫療機構的指標色彩系統十分混亂。即使某些醫療機構採用相同的指標色彩系統，但不同的醫療機構間也不相同，此結果顯示醫療機構環境之指標色彩系統確實有研究改善的空間。

關鍵詞：醫療機構環境、指標系統色彩

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Ⅳ-1 An Investigation of Indication Color System for Medical Institution

The present study investigates six hospitals in Kaohsiung and Tainan to comprehend the indication color system in medical institutions, so one can find the most suitable colors being used in a medical institution.

Results showed that the color indication system in medical institutions is confusion for all users. There is a need to improve the indication color system in medical institutions.

Keywords: Medical institution; Indication color system
IV-2 色彩對奧運運動標誌意象之影響

色彩因素是設計考量上的重要項目之一，本研究主要探討色彩因素對設計形式在意象上的影響，以作為設計應用時的參考。

本研究實驗樣本選自雪梨與巴塞隆納兩屆奧運的運動標誌（運動標誌）中，經前測所得較為受測者所熟悉的運動計四項，包含：田徑、游泳、自由車、舉重等，並與 Y、M、C、K 四種測試色彩進行搭配，共計 32 組測試樣本。本研究以語意問卷，針對雲林科技大學學生進行調查，計 40 名受測者。調查結果發現色彩因素對標誌意象的影響如下：

1. 兩屆奧運運動標誌之設計風格具顯著差異。

2. 雪梨奧運之運動標誌在設計風格上較巴塞隆納具流暢感、古典感及活力感。巴塞隆納之運動標誌在設計風格上較雪梨具優雅感、現代感及動感。

3. 雪梨奧運運動標誌採用黑色呈現方式，較具流暢感，而採用洋紅色較具現代感及，活力感，採用藍綠色較具動感。

4. 巴塞隆納奧運運動標誌採用洋紅、藍綠及黃三色予以顯示，其彼此間之意象與原有黑色呈現方式，並沒有顯著差異。

關鍵詞：奧運運動標誌、色彩、意象

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IV-2 The Influence of Olympic Pictogram’s Image by Color

Color is one of the vital elements in design work. This study was to investigate the effect of color elements in images of design as references in applied designing.

The samples of the study were chosen from Sydney’s and Barcelona’s Olympic pictogram. After pilot study, athletics, swimming, bicycle racing and weight lifting four sports were chosen as sample cases, which subjects were more familiar with and four test colors included Y, M, C and K. Totally, 32 test samples were used in this study. A semantic questionnaire was used in this study and forty subjects in NYUST participated the experiment.

The results of the effect of color elements in images of pictogram were:

1. There were significant differences of designing styles between Sydney’s and Barcelona’s Olympic pictogram.

2. Designing styles of Sydney’s Olympic pictogram were more fluent, classic, and active. Barcelona’s pictogram was more elegant, modern and dynamic.

3. In Sydney’s Olympic pictogram, when black color was used, the pictogram image showed more fluent, but the pictogram image with magenta color showed more modern and active, the image showed more dynamic at Cyan color.

4. In Barcelona’s Olympic pictograms, when red, yellow, cyan and black colors were used, the pictogram image showed no significant differences among these colors.

Keyword: Olympic pictogram, Color, Image
IV-3 建築色彩與市容關聯性之研究

西洋美術史上，魯本斯風格（Rubenisme）是色彩派的一大主流，亦是十七世紀末法國最主要的藝術運動。其風格於華鐸（Watteau Antoin 1684-1721）時達到最巔峰，然與他分庭抗禮的卻是普桑風格（Poussinister）的畫家們，他們認為色彩不過是一種裝飾的附屬物，素描與圖樣才是形式的根本。法國繪畫學會於 1671-1672 年，發生了一場激烈的爭辯，被稱為 色彩與圖樣之爭 （The Quarrel of Color and Design），以 1672 年政客藝術家查理 勒伯安（Charles Lebrun 1619-1690）為最，他提出有關色彩與造型的重要結論：色彩的功用在滿足眼睛，素描造型則在滿足心靈。素描在此的定義即是物象外型輪廓的描繪，由此可見，依據他的說法，素描是比色彩更具深度。

既然，色彩是模仿物象的最有力手段；亦是肉眼對物象的第一直覺，所以，建築體儘管多麼地宏偉，仍需以色彩加以包裝、美化，使建築體之表層彰顯出令人眼目愉悅之色彩，進而融入周遭生態、環境，達成統一及協調。

色彩的美醜實關乎於人的視覺感受及心理的情緒變化，所以，大都會型的城市更不可忽略其主題色彩的運用，以台北市為例，地小人稠，雖有建築體之容積與建蔽率的嚴格法規要求，但對其色彩的使用卻毫無法規的限制，任其自由發揮，甚至到令人眼目污染的可怕地步，若政府再不加以妥善管理、規劃，其後果真不堪設想，正好驗證了德國人針對台灣生活環境所說的一句話：活在豬窩中。

筆者期冀藉由本論文之探討與分析，尋找出一建築體之色彩搭配妙方，為居住於大都會區之居民們儘一點棉薄之力，使他們免於日趨嚴重的視覺污染。

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IV-3 Discussion of the Relationship between Architecture Colors and Urban Appearance

“Rubenism” has been one of the mainstream in the history of Colorism, and represented the major art movement in France. Watteau Antoine (1684 – 1721) played the most significant role in this movement. However, some other famous artists of “Ecole Poussiniste” suggested quite different opinions. They maintained that color is only a decoration attached to object. In “The Quarrel of Color and Design” (1671 – 1672), Charles Lebrun (1619 – 1690) also indicated that “the purpose of coloring is to satisfy human eyes, and drawing (designing) is to meet the demand of our spirits”. According to this statement, drawing is the profile of objects. Drawing could be in comparison with the designing of an elevation; coloring could be the coloring of elevation.

If coloring is the most useful way of describing subjects and gives the first image to human eyes, coloring should be an indispensable part of buildings, no matter how huge they are. Only appropriately colored buildings can be integrated into our living and ecological environment.

The goodness of coloring is strongly related to human’s visual and psychological stability and variance. In most metropolitan, Taipei Area for example, although there are various building codes and land use regulations, such as bulk control and lot coverage control, there is no restriction related to color usage in building design. As a result, coloring has become a disaster of our environment. As some German’s description about Taiwan: “People are just like a herd of pigs crowding in a small den”.

This paper therefore explores a systematic way of building coloring to keep people away from “visual pollution” in Taiwan.
IV-4 台灣市售顏料色名應用之現狀調查—以水彩、廣告顏料、粉蠟筆為例

畫材顏料是我國民義務教育中之美術教育所受訓練的必備工具，但市售的顏料廠牌中，顯示著色彩命名上混亂的情形，並且未見任何統一性的國家或是民間建議及研究，中央標準局也缺乏標準的規範。透過調查，了解產品命名大多是參考其他國家的色彩系統，或是在隨機的狀態下決定的。

研究步驟首先收集市面上的畫材顏料，之後加以整理比對，從中找出差異狀況。在所收集到的色名裡，其中文翻譯上，察覺同一個顏色標示，英文色名卻不盡相同。結果顯示，白色是比較明確的，各廠牌出現的差異是較少，黃色系的命名就出現有黃、鉛黃、檸檬黃等區別，較為暗的黃色色相命名則有皮膚色、黃土色，橙色系有、黃橙及朱紅，紅色系的色名有紅、洋紅、朱紅等，茶色則有深茶、焦茶，藍色系有群青、青色、水色、淡青，同樣是綠色系，則有青綠、黃綠等不同色名的問題。

關鍵詞：色名、畫材、顏料

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Ⅳ-4 An Investigation on How The Pigments Marketed in Taiwan are Given Their Color Names-aimed at Water Colors, Poster Colors and Pastel

Drawing pigments are essential instruments to art education. Yet, people are so confused by the color names the pigments at the local market indicate. It is because neither the authorities nor the masses take a note of the necessity of standardizing the color names. Even our Bureau of National Standards does little about this. The investigation shows that some of the names of color are given according to other countries’ color series, and some are even given at random.

To find the difference of color names, different kinds of drawing pigments at the local market are collected, arranged, and then compared. The result finds that a color name translated into Chinese is not necessarily equivalent to the color by its original English name. It shows that the color white indicated by different brands is comparatively definite. Yellow series has different names as yellow, chrome yellow and lemon yellow, while duller yellow has names as skin color and loess color. Orange color series includes yellow orange and vermilion; maroon color series contains umber and dun; blue color series involves ultramarine blue, cobalt blue, sky blue and pale blue; green color series has different names as blue green and yellow green.

Keywords: color name, draw material, pigments
IV-5 半 S 形影像增強之自動亮度平衡方法

視覺化彩色影像處理目前相當有效的彩色影像處理方法。使用半 S 形影像增強對彩色影像之色調處理，確實可以有效達到人類視覺喜好的結果。但有些原始影像之曝光值並不理想，需輔以自動亮度平衡功能，才能發揮此影像增強之方法。本文在應用半 S 形影像增強法下，以單轉折點、雙轉折點來比較自動亮度平衡方法；經多張彩色影像測試結果，單轉折點有較佳的效果。

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IV-5 Auto Lightness Balance Method for Semi-S Curve Image Enhancement

Vision-based color processing has become one of new trend and effective color technology in these years. Based on the vision adaptation, not only enhancement should be considered, but also brightness balance. After using semi-S curve tone processing, a color image indeed look more pleasing. But the results are not good enough for those images without good exposure. In this paper, auto-lightness is implemented into the semi-S curve tone processing system. Both one and two lightness balance transition points were set in this method. From the result, one lightness balance transition point seems better.

Keywords: Vision Adaptation, High Occurrence Color, Lightness Balance, Enhancement, and Transition Point.
V-1 色彩管理系統應用於噴墨印表機顯色一致性之研究

本研究探討不同色墨材料之兩種噴墨印表機之顯色差異，由基本設定中，檢驗一般狀況下以 IT8.7/3 之基本 182 色樣列印後之色彩差異。再透過色彩管理系統的輔助，以裝置獨立的彩色複製流程，列印並計算兩印表機之間的複製色差。研究結果顯示，色彩管理系統可降低其差異，但特殊狀況需特別處理。

關鍵詞：裝置獨立色彩，色彩管理系統，彩色複製，數位打樣

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This research explores the color reproduction difference across ink-jet printers. Two different types of color ink-jet printers (one is dye-based and another is pigment-based) are used to reproduce IT8.7/3 target under SWOP settings. A Color Management System is used to further reduce the reproduction difference. Experimental results indicate that CMS can bring down most of the difference; however, certain exceptions are applied.

Keywords: Device Independent Color, CMS, ICC, Digital Proofing
V-2 TFT LCD 平面顯示器中的彩色奧秘

台灣平面顯示器產業今年(2002)預估 TFT-LCD 面板產值可達 1,920 億元，穩居全球前三位。目前除了上下游零組件供應體系正在形成外，同時推動第五代技術研發，並成立 TTLS 聯盟(Taiwan Tft-Lcd Association)。身為色彩工作者，對未來日常生活呈現色彩的要角—平面顯示器的色彩奧秘不可不知。本文作者的博士論文為彩色主觀/客觀的信號處理模型，並從事 PC-Camera、數位相機、平面顯示技術研發多年。文中嘗試以色彩的觀點切入，淺談平面顯示器的核心：薄膜電晶體液晶顯示器(Thin Film Transistor Liquid Crystal Display, TFT-LCD) 面板畫素設計及陣列測試技術。首先引用媒體及工研院 ITIS 統計資料介紹平面顯示器產業生態，接著說明 TFT-LCD 結構及原理，藉以強調 TFT-LCD 顯示器與 CRT 顯示器本質上的不同。末了，以 TFT-LCD 面板畫素設計及測試為例，分享作者的實際經驗，及彩色工作者所能扮演的積極角色。

關鍵字：薄膜電晶體液晶顯示器；畫素設計；陣列測試；人眼視覺

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V-2 Color Engineering in Flat Panel Display of TFT LCD

Color criteria for displaying digital contented images will be specially pointed out in TFT-LCD (Thin Film Transistor Liquid Crystal Display). In this work, the experience for applying color technology to TFT-LCD pixel design and array testing were reported. Based on this, more accurate pixel design and array testing works were shown.

Keywords: Thin Film Transistor Liquid Crystal Display, Color Criteria, Pixel Design, Array Testing
V-3 不完全迴轉混色之色彩變化初探

設計者常會運用色彩的象徵意義來表達企業理念，可見色彩顯色控制的重要性。而如何控制產品在運動中色彩變化的不可預期性，將考驗設計者的專業能力。凡與速度有關之產品色彩，皆與迴轉混色有關，但在迴轉混色的相關研究中，皆以均衡之迴轉混色為原則，未考量到環境的變數（如：光源、速度、材質等），所造成「不完全迴轉混色」之色彩變化，此部分有需要加以檢討。

本研究選定環境中的光源變因加入迴轉混色實驗，係考量三波長標準螢光燈下迴轉混色變化豐富且明顯，選擇四種不同色溫光源。實驗過程中以光譜輻射計（PR-650）測量四種不同色相之彩色，搭配三種不同明度之無彩色樣本。研究發現，不完全迴轉混色的色彩搭配、配對色彩的明度差異，有一定的模式與關係存在，並且與均衡迴轉混色之間有相似與不同之處。在未來，建議可將更多的環境變數加入一同探討，以彌補此部分之不足。

關鍵字：色彩變化、迴轉混色

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V-3 A Preliminary Study of Color Change in Rotatory Color Mixture under Florescent Lighting Sources

Designers are apt to apply colors on products to symbolize enterprise’s promotional ideologies. Thus, color appearance is critical to product design. But it is unpredictable as to how colors vary owing to object moving-speed, product color- control challenges the ability of designers. As color change in moving condition falls in “rotary color mixture” study, and most have left environmental effects on color change inconspicuous variables, namely, lighting sources, object moving speed, and surface texture. This calls for further verification.

To verify the impact of environmental factors on rotary color mixture, this experimental study adopted four standardized florescent tubes as extraneous lighting causes of color variation. Test samples of color included color pairs of three different hues and grayish levels. This generates 12 color samples. A portable spectra-colorimeter (PR-650) is used to take precise color measure of these samples. It is found through the experiment that specific modes exit in color variation of test samples, and they are subjected to color temperature of light tubes, color combination, and luminosity of colors. This study concludes with detailed discussion of these modes, and recommends that additional variables be included in future studies.

Keywords: Color Change, Rotary Color Mixture
V-4 數位相機之色彩品質評估法

在數位相機日益普及的今日，對於數位相機的色彩品質評估方法雖有被廣泛的討論但仍無有一完整系統。本論文將提出一完整有效的系統來進行數位相機的色彩品質評估。本系統是採用原始分數及品質分數的方式來分析數位相機的各項品質因子，包含色度、白平衡、解析度、霧砂、雜訊等，並以雷達圖方式來顯示其結果。本系統亦可連結色彩修正、白平衡等彩色處理功能而達到色彩處理及品質測試的一貫化。

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V-4 Color Image Quality Assessment Method for Digital Camera

The requirements of overall evaluate DSC quality are increasing, but until now we have not yet seen any total solution for DSC color image quality evaluating and testing system.

Here a radar chart method using some quality factor score is provided, such as chromaticity, MTF, SNR, white balance, uniformity, veiling-flare ...etc. With this chart we can objectively evaluate DSC color image quality.

This system can be also implement color image processing function to achieve a overall DSC color image quality processing and testing system: color-correction, white-balance...etc.
V-5 以分光光譜儀調整光譜輻射計測色條件之研究

由於科技的發展，目前色彩的測量皆以精密儀器取代過去以肉眼判讀色彩的方式。就業界與色彩研究領域的需求，分光光譜儀（Spectra photometer）與光譜輻射計（PR-650）為可提供高精度之測量工具。適用於室內設計及建築專業的領域範圍，尤其以 PR-650 之可攜帶性，更利於空間色彩、照明等研究。羅梅君[1]等在「分光光譜儀與光譜輻射計色彩資料之轉換」研究中，以迴歸統計方式找出二儀器對同一色樣測得之色彩參數的轉換關係。然其研究中並未以實驗操作的方式轉換。針對此，本研究以分光儀具有較多 CIE 測色條件來調整 PR-650 量測色樣之距離、角度、光源色溫等變項。以尋求「當兩儀器測量同一色樣時，PR-650 量測值能呈現近似分光儀測量值」。研究中，限定測量距離、角度、色溫等變項範圍。依實驗數據，檢視量測值受變項影響的趨勢並以色差公式求證實驗結果。研究發現：當測量角度呈 30 度、光源至色樣的距離為 45cm、色樣至 PR650 的距離為 80cm 時。以及，當測量角度呈 60 度、光源至色樣的距離為 45cm，色樣至 PR650 距離為 65cm。以此二條件進行測色時，光譜輻射計的測色值會符合分光光譜儀的測量數值。

關鍵詞：分光光譜儀、光譜輻射計、PR650

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V-5 Rectifying Color Measurements of Spectra Colorimeter (PR-650) from that of Spectra Photometer

In the past, color measurements rely primarily on naked eyes. Since the introduction of advanced apparatus, color measurements as well as product quality can be controlled precisely. Both the Spectra Photometer and the Spectra Colorimeter are commonly used color measurement apparatuses in the academia and the industry. Yet difference in measurements between these two apparatuses requires data rectification. In her attempt to eliminate data difference, Mei-Jun Lo applied Regression Analysis technique rather than measurement procedure to rectify data.

To rectify data difference, this study designed a series of test condition for the PR-650 when measuring color samples, and determine if the results coincide with that obtained from the Spectra Photometer. The conditions include such variables as distance and angle between the PR-650 and color samples, color temperature of light tubes, and so on. It is found through the experiment that values of color parameters did vary according to the above conditions, and this kind of manipulation would be able to coincide the measurements between these two apparatuses. More specifically, the PR-650 needs to be installed at about 80cm away from the test sample in an angle of 30 degree, or 60cm away in an angle of 60 degree. Other findings include patterns of relations between hue value, luminosity and measurement conditions. The result of this study can be contributed to future application of PR-650 so that standardized color measurements may be obtained.

Key words: Spectra Photometer, Spectra Colorimeter