

Theoretical Review on Color in Interior Space: An Experimental Assessment of Iranian Houses

Nazanin Sadat Behbahani

Submitted to the
Institute of Graduate studies and Research
In particular fulfillment of the requirements for the Degree of

Master of Science
In
Architecture

Eastern Mediterranean University
July 2011
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Elvan Yılmaz
Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Architecture.

Assoc. Prof. Dr. Ozgur Dincyurek
Chair, Department of Architecture

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Architecture.

Asst. Prof. Dr. Banu Tevfikler Cavusoglu
Supervisor

Examining Committee

1. Assoc. Prof. Dr. Mukaddes Fasli

2. Assist. Prof. Dr. Banu T. Cavasuglu

3. Assist. Prof. Dr. Nil P. Sahin

ABSTRACT

People are surrounded by color in the daily life, which can define a style, culture and design all around. Color externalizes human-being's tastes and styles; its use in the choice of clothes and/or living environments is a proof. This master thesis study attempts to contribute to the general understanding of the nature of color by addressing the relevant theoretical information, and extracts perspectives about color in terms of interior architecture. Therefore the main objective is to add to the importance of understanding color within interior space in regards to the quality of the space, and provide positive knowledge and awareness to both users and designers.

Through a careful attention paid to how and where the color is used in the built environment is crucial in terms of successful interior design. Color is inseparable, yet difficult to define issue of interior architecture. The effect of color, regarding human attitude, in the interior context differing in functional cases, is very important aspect of psychological setting of an interior. Color used to define the elements such as walls, ceilings, floors and all the other relevant elements of space in general, and living environments in particular, are within the main concern of this study. In doing so, the principles of color for living rooms are tried to be analyzed by an analytic observation method, applied to examples chosen from the Capital city of Iran, Tehran. Tehran is a huge city, having different regions and economical, social, and cultural varieties of people living in. Therefore, because the subject of house is the basic spatial requirement for human-being, who spend most of the time in, the subject of color has a crucial effect on the mood manifested out of the design of the living environments.

An experimental study on color regarding the living environments by selecting varying examples from Tehran's different regions and types of houses through random sampling will be done based on knowledge gathered. Within the vast field of color, this is thought to be very important in terms of both physical and psychological aspects that may be varying according to the life style, character and emotional needs of the users.

Keywords: Theory of color, color perception, meaning of color, house, living environments, color in interior space.

ÖZ

Günlük hayatta herşeyi sarıp sarmalayan renk, bir tarz, kültür, ve yaşamın çevreleyicisi olan tasarımı da tanımlar. İnsana ait zevk ve tarzları dışa vurur; kılık kıyafet, ya da yaşam çevrelerindeki seçimler bunun kanıtıdır. Bu mater tez çalışmasında, genel olarak rengin doğasını anlamaya yönelik uygun teorik bilginin derlenmesi, ve iç mimari bağlamında renge bakış açılarının ortaya konulması hedeflenmiştir. Amaç, mekan kalitesi bağlamında iç mekanda renk konusunun anlaşılmasının önemini vurgulamak, ve kullanıcılarla alana yönelik tasarımcılar için katkıda bulunacak bilgi üzerinden farkındalık yaratmaktır.

Başarılı bir iç mekan tasarımı, ancak rengin yapılaşmış çevrede nasıl ve nerede kullanılmış olduğuna yönelik bir konsantrasyonla mümkündür. Renk, iç mimarinin ayrılmaz, ancak tarifi zor, bir konusudur. Farklı fonksiyonlar barındıran değişik mekan türlerinde insanın bürüneceği tutuma rengin önemi büyüktür, bud a mekannın psikolojisi bağlamında çok önemli bir unsurdur. Duvarlar, tavan, döşeme, ve tüm bağlantılı mekansal öğeleri tanımlamak için kullanılan rengin ele alınışı, genelde tüm mekanlar, özelde de yaşam alanları bağlamında bu çalışmanın kapsamındadır. Bu amaçla, yaşam alanlarında renk kullanımına yönelik prensiplere yönelik, İran'ın başşehri Tahran'dan seçilen örnekler üzerinden analitik gözlem metoduyla analizler yapılmıştır. Tahran, farklı bölgeleri, ve bu bölgelerde yaşayan ekonomik, sosyal ve kültürel değerleriyle farklı insanlarıyla çok büyük bir şehirdir. İnsanın temel mekansal gereksinimi karşılamaya yönelik olması bakımından konut konusu, renk açısından da çok önemlidir, çünkü insan evinden fiziksel ve psikolojik beklentiler içerisindedir.

Renk de evin mekanlarından, özellikle de yaşam mekanlarından açığa çıkan ruh halinin en önemli belirleyicilerindendir.

Bu çalışmada, yaşam çevrelerine yönelik renkle ilgili, teorik bilgiye dayalı deneysel bir çalışma amaçlanmaktadır, bu da farklılıklar barındıran Tahran şehrindeki konutlardan düzensiz örneklem yöntemiyle gerçekleştirilecektir. Bu çalışmanın özgünlüğü, iç mimari alanında geniş bir yer tutan renk konusuna, yaşam şekli, karakter, ve duygusal ihtiyaçlara yönelik farklılıklar gösterebilen fiziksel ve psikolojik unsurlar üzerinden bakılmasıdır.

Anahtar Kelimeler: Renk Teorisi, Rengin Algısı, Rengin Anlamı, Konut, Yaşam Çevreleri, İç Mekanda Renk.

To My Family

ACKNOWLEDGMENTS

First of all, I thank the almighty for the mercy he has given me and everyone else. I would like to express my utmost appreciation to my supervisor Assist Pro.Dr. Banu T. Çavasuglu, that without her patient, guidance and effort this thesis could not be completed. I thank my parents for their financial contribution and their moral supports have done more than I can fully express.

Secondly, my sister, Shahrzad for individually encouraging me the best way she could and more. And also I would like to say special thanks to Theofanous family for their kindness, concern and outstanding hospitality.

I would like to express my appreciation and gratitude to all my friends' specially Maral Saffariannour who shared my happiness and support me in hard periods of my life during this long stay in TRNC.

In addition, I would like to acknowledge my gratitude, deepest respect to all members of Faculty of Architecture and particularly of Department of Interior Architecture for the warm, friendly atmosphere.

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Chapter 1

INTRODUCTION

Color is an integral part of the world, and is inseparable of what people perceive around them. However, just because color exists all around the people does not mean that it cannot be controlled. Color humanizes the space, makes it welcoming and creates a sense of space, scale and meaning and it makes the space come alive. Color can be natural or artificial, permanent or transitory, used for effect or emotion. Human life is surrounded by color, shades and light. Each of them influences mood. Each color has a meaning and link to human mind. Color for personal requirements can be chosen according to the mood and can be changed them so often; but the color of the space cannot be changed so easily. Therefore it is important to choose right color for the space (Russell, M, 2006).

Color is universally one of the aspects of vision. Although almost everyone sees the colors of the sky, earth, grass, flowers, and all other visible objects, and although there seems to be general agreement about what these colors appear to be, exactly what color can be somewhat confusing. People tend to think of color as a characteristic of an object or a surface but usually the same object can appear different in color under various situations (Pile,J, 1997, p. 16).

In addition, memory, experience, and cultural background all affect the way a color impact can differ from individual to individual. This is not to say that the color will be perceived differently, but that perception will mean different things to different

people. In most western cultures, for example, black is associated with death, but in china and India white is regarded as a symbol of death. (Freinser,A, 2006, p. 5)

As a matter of fact, various researches, carried out throughout the years, established that the role of color in every aspect of human life is considerably more significant than one might imagine (Corrodi,M, 1999).Color may become a major factor within man made environment, as its physical impact further affects human being's psychological responses and emotional affections. In trying to understand the important influences of color on people lives, color theorists have people from ancient times to the present, attempt to explain the physiological impacts of color and its reaction. In doing so, they devised systems for dealing with colors.

The term color theory brings to mind for many people only Newton's theory, where colors are created by the refraction of (white) light. Along this line, although the ideas of Aristotle, who approached reality in a more experimental manner, the color theories of the previous philosophers were incomplete, had comprehensive ideas on color (Benson,J.L, 2002).

Aristotle adopts four elements of Empedocles was the Greek philosopher that wrote about the color. He combines them with four primary qualities, taken from the realm of touch: cold, warm, dry and wet. The earth is cold and dry, water cold and wet, air warm and wet and fire warm and dry. Mixing the four primary qualities gives rise to the secondary qualities (Corrodi,M, 1999).

Furthermore, Sir Isaac Newton and the other theorists developed the color theory in terms of scientific and psychological means. In doing so, numerous physiological studies detected that color may influence human organism, blood circulation heart beat and the like (Mahnke,F, 1993, p. 1).The physical effect of color on the human organism will bring psychological reactions.

As John Ott writes, “behinds the psychological responses to color are more basic responses to specific wavelengths of radiant energy”(Birren,F, 1988, p. 27). A person may feel cheerful on a sunny day or depressed on a rainy one. Conversely, psychological attitude through the color will affect to the peoples responses. Red may seem exciting and blue subdue. In other words, the human being as a whole, his/her body, mind, emotion, spirit, represents a unity, and color presents all aspects of it (Birren,F, 1988, p. 27).

Besides, the use of color is noticeable every single time people turn around. All people have opinion on the colors used in designing an interior space, but the attention must be paid to how and where the color is used. Therefore, it can be stated that the understanding of color, people and nature relationship is one of the requirements for people who consider to their surroundings (Lancaster,M, 1996, pp. 8-9).

In addition, if Iranian life style is considered, it can be said that, most of the things have been changed after the revolution. The way of living is changed in new generations’ lives and people follow the modern life style by using modern decoration and follow the interior designers. The interior space has been considered more by architects and interior designer. The construction and modernity raised up once in the city. This diversity has emerged from the special needs of people in different times. Although in most of the modern houses it can be seen that the cultural habits are kept alive by using old decoration items like “poshti” or using colorful carpet and texture to the wall in some part of the house to make cozy and warm place for themselves. This is evidence that shows peoples connection to the field of color in terms of cultural connotations.

By and large, psychological reaction to color may differ among individuals of different gender, various age group and diverse personality types. These facts might be

of basic importance if color scheme is changed specifically for residential spaces. Indeed, color selection for the personal living units must follow primarily individual taste and somehow preferences of space occupant.

1.1 Determination of Problem

Design is the process of solving problems, and good solutions have the power to make people feel positive and happy about their surroundings and thus themselves. When designer products are bought or designers hired, people are buying solutions to problems, because they themselves either cannot or do not want to solve them themselves. By doing so, the good feelings that come from beauty of design, are also bought.

All the things surrounding the people like the buildings, interiors, clothing, electrics, automobile, furniture, books, magazine and all everything for life have been made by the creative talent of a designer. The success of each design depends on how well the designer has solved various problems.

In a sense, each and every person is a designer, and they gather and analyze information, consider option, study, make choices and suggest solutions to all kinds of problems. People have made poster without consulting a graphic designer, they may have design house without the help of an architect, and more people have decorate their own home than consulting an interior designer, this is because the space where people live is very important for them.

There are many design disciplines. Every designer in each design field including architectural or interior design, must solve many very different kinds of problems. For instance, architectural designers plan every conceivable kind of building, from stadiums to shopping malls and houses. Designing a building that is beautiful to look at is not enough; the relation between the functions and the life

proposed within by the use of color, material, texture as tools of creating spaces aspects of great importance in interior design that people and designers should consider. As a result, aesthetics dominate the use of color. In doing so, designers consider the people's psychological requirement together with the spatial requirement when deciding upon the color combinations. Consequently, the limited amount of literature in the subject of color in interior design may lead to inappropriate color suggestion and bring risky results.

Therefore, the current study is aimed to analyze the effect of color in human perception and their responses to the environment. In this case, this research is planned to collect and organize the most essential data in case of color schemes.

It should be also noted that, this study is focused on theory of color, the effect of color to the people psychology and then concentrated on the interior design of houses. The cases of Iranian houses have been taken into consideration. Iran is the home country of the author of this thesis. The cultural, habitant, connotative aspects in terms of color that stayed to be unconscious up till now, have been tried to be putted to a conscious level of analyzing color. Along these lines, the thesis is structured in a way that it might be divided into three major parts: In doing so, in order to become familiar with terminology, some theoretical information about color, essential information which is related to the physiological properties of human eye and color vision are given. Furthermore, the most important part, which is the psychological aspect of color are discussed with references. And the last section is concentrated on discussion of color in interior design of Iranian houses, which are based on the experimental studies.

As a method random sampling, based on experimental studies regarding analytic observation.

1.2 Aims and Objectives

In today's societies globally, life is often filled with stress, due to the changes of life styles. People were more outside their houses. Although regional or cultural varieties are comprehensive, this fact can be generalized. In such a current status, houses become very valuable for people as an example of personal space, where they purify themselves from all the traces of stress. As an object here of this study the importance of house interiors is tried to be opened up.

Besides, the major aim of the research is to investigate the role of color in human environment, which is based on psychological aspect in interior spaces. The principles of color within interior space. The subject is to explore the human reaction in terms of various color stimulation and resultant alternations in behavior, attitudes and performances and analyzing Iranian houses, firstly by representing Iran (Tehran), the types of houses in different region and evaluating of people life style and at the end analyzing the interior design of Iranian houses.

1.3 Methodology

This study is basically characterized as an investigative research in order to provide theoretical foundation for research and understanding the color relationships, as well as getting knowledge of psychological basis of color perception by human being.

In general the research process involves three major parts, which are data collection, analysis and synthesis. This study is organized by investigation of various documents like books, publications, journal articles, internet sources and the like., recently researches and experimental investigations are examined and analyzed regarding major effects of color in connection to human experiences as well as man

behaviors' and psychological condition, explanation about the effect of color in interior spaces will be accomplished.

As a final stage, the effect of color on human will be analyzed within interior space of Iranian house by considering the social condition, space requirements and the user profile.

As a result, all the research results will be summarized in the concluding part, by providing practical suggestions for the future proposal.

1.4 Outline of the Study

The general approach of the study is to distinguish the impacts of color on human perceptions. Further, psychological influence of color is planned to be analyzed in terms of color suggestions through the interior spaces according to the people's needs.

Consequently, according to these approaches, the structure of the research is as follow:

Chapter 1: This chapter describes the subject in introduction part; aims and objectives of the study, outline of the study and limitations.

Chapter 2: This chapter is intended to provide general explanation about theory of color. In this part, the numbers of theorist are introduced. Accordingly, it includes brief explanation about their theories, related to the classification of color system, and the examination of color, how color is formed, how colors are arranged, and how they interact.

Chapter 3: The chapter is intended to concentrate on psychological aspects of color in terms of humans need. Throughout this chapter, the author is explaining the secondary colors which have relationship between the geometrical shapes because color can shape the space, diminish the volume or it can make it more pronounced. In doing so, color form relationship is one of the aspects in a design.

Chapter 4: This chapter is intended to present general definition related to process of perception, where the emphasis is the sense of vision. The main goal of the chapter is to provide psychological structure, possessions of human's visual system in general terms, which are regarded to color.

Chapter 5: This chapter proposes the basic principles for color implication within the spaces which differ in functional requirement. Generally, chapter 5 is based on author's discussions about nonresidential house and different part of the house for wellbeing of user space and occupant.

Chapter 6: The main goal of the chapter is to investigate aspect of color from psychological standpoint on Iranian house. Accordingly, in chapter 7 includes brief overview about Iranian culture, society and the comparison of the life style between the inside and outside of the house.

Chapter 7: This chapter concludes the result of the study, and proposes suggestions for the future investigators.

1.5 Scope and Limitations

In regards to the examination of the subject of color, the current research follows certain limitations. First of all, the study is focused on the major aspects of color in terms of the hue, value, saturation, color scheme and combination; which all constitutes the theoretical information part of the study. In addition, relationship between wall surfaces and contents of the space, furnishing, and textile have been studied. Furthermore, general explanation about the Iranian culture and life style, and observation about color in interior design of Iranian houses which is the case study of the research have been analyzed the capital city of Iran, Theran has been chosen to represent the culture. Thus 15 house examples have been selected as the limit of the thesis. The method of choosing house was in random sampling, based on experimental

studies regarding analytic observation. The cases are chose according to different types of the houses in all region of the city. In addition, the colors which are used in the surface and specific element are analyzing. The end the conclusion part with result suggestions for the future investigations is within the scope of the study.

Chapter 2

THEORY ABOUT COLOR

2.1 Introduction to the Chapter and the Theoreticians of Color

The first hint of color theory was mentioned by ancient Greek philosopher Empedocles. In order to understand the importance of colors, the theorist tried to explain the color psychology and how it reacts in people's lives. In doing so, he has created a systematic structure and rules for color. Therefore the knowledge of how color theory has been developed helps to use various aspects and facts about color, where appropriate, in working with color (Freinser, A, 2006, p. 13).

Among the series of theories, Aristotle was the one who focused his work on objects; he believed that all the variations within colors are the results from mixtures of darkness and light. He determined five unmixed colors as purple, crimson, leek green, grey, deep blue and yellow. He believed that color should be seven hues and it should run from white to black in analogy with musical octave. Although Aristotle's theory was misleading, it predominated in many centuries (Gage, J, 1995, p. 13).

Due to the remarkable development of the artistic field, a great step toward the color was taken during the Renaissance period. Nevertheless, while varieties of color effects were discovered to apply in art works of that time, the true nature of many color-related phenomena still was not revealed and understood. Hence, no efficient efforts were made to arrange colors until more than another century had passed.

As a matter of fact many attempts have been made to establish methodologies to evaluate color thus it is important to indicate the most prominent theoreticians who

have contributed to the field of color involving examination, suggestion, and utilization of color. Such names as: Leonardo Da Vinci, Sir Isaac Newton, Moses Harris, Johann Wolfgang Von Goethe, J.C.Maxwell, Ewald Herling, Albert Munsell, Wilhelm Ostwald, CIE, Johannes Itten, Josef Albers, and Faber Birren, will be following to make it clear how each of them developed unique specifications in the field of color theory in a chronological order (Freinser,A, 2006, p. 13).

Leonardo Da Vinci

In 1651, Color theory was invented in terms of three "primary" colors by Leonardo Da vinci who was an Italian artist and engineer. He used Aristotle's color theory and he developed the technique of 'chiaroscuro' (light-dark),by using light and shade to depict 3-dimensional objects (Joseph,D, 2007).Leonardo Da Vinci indicated that black and white were indeed color and assigned white,yellow,green,blue, red and black as the primary color, but he didn't arrange them in a color wheel. The theorist concludes that certain responses took place when colors were placed next to each other. This was become known as simultaneous contrast. And step by step he worked by modeling and shading by using light , shadow and sfumato (it accomplished by close grading of value of colors) effect. Besides, he also interested on "perspective". This described the tendency of forms seen at the distance to become uniform in hue and value (Freinser,A, 2006, p. 13).

Sir Isaac Newton

Color studies begin with the interaction of light and color, for without light no color, shape or space would observe. The understanding of color and light was created by Sir Isaac Newton's discovery that white light contain all visible color (Vodvarka,F, 2008).

Before Newton, there were other way of regarding light; some with a long history, some rooted in a comprehensive philosophic system; most apparently finding some support in experience (Devons,S, 1975). Newton began experiment with reflected light. Concisely a glass prism was set in a dark room and a narrow beam of light was directed to pass through it, thus splitting into spectral components. Additionally, Newton point out that any object takes on its color as some spectral colors are absorbed while other reflected by a surface (Muller,C, 1972, p. 128).

In doing so, by using the prism he discovered that by passing the white light through the prism array of colors are resulted; (Red, Orange, Yellow, Green, Blue, Indigo and Violet).Newton did not see seven colors in rainbow. In fact, he saw only five in 1669, but later he raised the figure to seven in 1671, adding orange and indigo (indigo means Indian dye), to relate the spectrum to the seven notes of the diatonic scale and the seven known planets (Freinser,A, 2006, p. 14).

The range of spectrum experiment was followed by Newton attempt to arrange color in to rational progression, in other word color circle. Basically, circular color organization seems to be rooted in medieval ages (Gage,J, 1995, p. 162) However most of the color wheels derived from that period were represented as a sequence of yellows and red running from black to white, Newton offered a new color arrangement, innovation of which was in bending prismatic spectrum into color mixing circle (see figure 2) Moreover, whereas, in physical terms red and violet were

the opposite ends of the spectrum, Newton provided connecting link between them by utilization of purple which, though did not take a place in visible spectrum, could be seen in blender of red and violet (Birren,F, 1988, pp. 9-10).

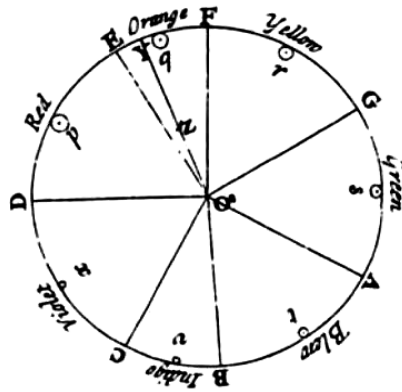


Figure 1. Newton's color wheel
(URL1: Boker, 1995)

[.http://www.google.com.tr/imgres?imgurl=http://people.virginia.edu](http://www.google.com.tr/imgres?imgurl=http://people.virginia.edu)

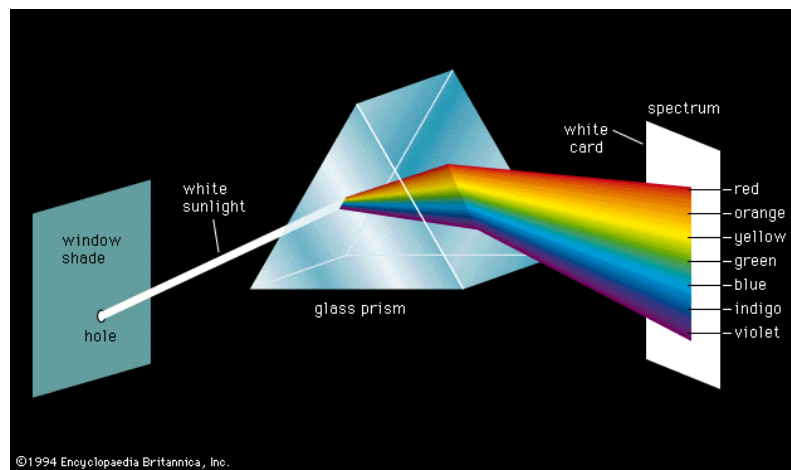


Figure 2. Newton by passing the white light through the prism array of colors achieved; (Red, Orange, Yellow, Green, Blue, Indigo and Violet)

Source: (Feinsler, 2006, p. 4)

Note that Newton chose a circular geometry in order to explain light mixture, specially the quantities of red, yellow, green and blue colors of light produced white

hue, which represented in the center of the circle. And he concludes that white light is a combination of all hues. Newton found that when mixing pigments of opposite hues on this wheel that some anonymous color resulted. Newton was never able, in his experiment, to mix pigment of two or three of his hues to obtain white, because his theory was based on the mixing of light, while the mixing of hue pigment is based on subtractive color. Newton ideas was based on circular, organization or visual color sequence and spacing of spectral hues (Birren,F, 1988, pp. 9-10).

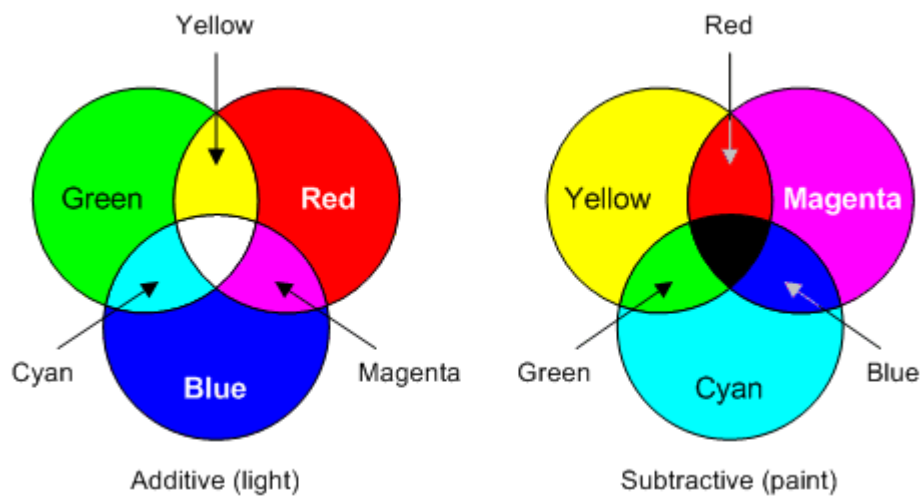


Figure 3. Additive and subtractive color combinations
Source: (Feisner, 2006, p. 23)

Moses Harris

In 1766, one hundred years after Newton's separation of white light through a prism, an English entomologist, by stumble on the color wheel systematic, he presented red, yellow, and blue as the primary hues, and by mixture of primitive hues he produced compound hue, like orange, green, and purple in a prismatic circle. In fact, Harris did not mean the spectral colors observed by Newton after light had passed through his prism and then arranged in a circle; he meant the unmixed pigments (Freinser,A, 2006, p. 14). A mixture of the three basic colors will result in the three intermediate colors. Orange, green and purple, which appear in the prismatic circle and they are also in the nature, like: fruit and flower.

According to Harris, the three main colors, red, yellow and blue, are: "the greatest opposites in quality to each other and naturally take their places at the greatest distance from each other in the circle" (Freinser,A, 2006, p. 14). This wheel was divided into 18 equal hues and each division was graded by value, light to dark, and he assigned a number to each of the hues according to their relative's luminosity.

In his system, with the six colors, Harris preferred to mix each adjacent color in such a way that one of these two components will dominate in each case. 18 colors will thus arise to complete the circle in the sequence red, orange-red, red-orange, orange, yellow-orange, orange-yellow, yellow, green-yellow, yellow-green, green, blue-green, green-blue, blue, purple-blue, blue-purple, purple, red-purple, purple-red. As he subdivided each of the three initial colors into 20 different saturation levels; his method creates a total of 360 hues in the prismatic circle.

Briefly, a main aim of Harris system is that he attempted to integrate the effect of lightness and darkness into the system. Harris step by step removes subtraction. As an example: If yellow and blue are placed one above the other, only the medium

wavelength will remain, and our brains will see the color green. If red and blue are superimposed, only the short-wave end of the spectrum will remain, it gives violet. If all three come together, the black appearing in the centre of the prismatic circle. Consequently, the Harris system was quite prominent for color theorists in 18th and 19th centuries and it was used by many painters.

Harris believed that when three basic colors were mixed together in equal proportions, they “work in opposition and destroy each other” producing black color (Lowengard,S, 2006).Accordingly, Harris generally dealt with pigment colors and indeed at the center of the circle he introduced what presently known as subtractive color mixture. From the other hands, Harris could not properly locate white in his system and, while Newton maintained that white is an ideal mixture of all colors, Harris considered white as a result from deficiency or full absence of color (Lowengard,S, 2006).

To sum up, a significance of Harris system is that he attempted to integrate effects of lightness and darkness entirely into the system and besides supplied his color wheel with recommendations and explanations of complementary contrasts and relationships (Lowengard, 2006). Thus the Harris natural system of color became important for color theories of 18th and 19th centuries. It was used by many painters and influenced development color wheel (Macevoy, B, 2005).

Johann Wolfgang Von Goethe

In 1810 Von Goethe published a book, which contains some of the exact explanation of phenomena such as colored shadows, refraction, and chromatic distortion. Unlike Newton, who explored color as purely physical phenomena, Goethe recognized that perception play a great role in shaping color sensations within human brain and confidently stated that color is a matter of perception. According to Goethe:

“That I am the only person in this century that has the right insight into the difficult science of colors, that is what I am rather proud of and that is what gives me the feeling that I have outstripped many” (Feisner, 2006).

As he had some mistake in his experiments, he incorrectly thinks that these experiments show Newton to be wrong.

Goethe formulates the new system of color. He realizes that the sensations of color reaching our brain by the mechanics of human vision are shaped by the perception and by the way that the brains process information. Therefore, according to Goethe, what we see of an object depends on the object, the lighting and our perception.

In 1740, Louis Bertrand Castel published a spectral description of prismatic color of Newton (Betrand, L, 1740), he observed that the colors of white light which is split by a prism it depends on the distance from the prism (Thomas, L, 1995).

According to the Goethe:

“Along with the rest of the world I was convinced that all the colors are contained in the light; no one had ever told me anything different, and I had never found the least cause to doubt it, because I had no further interest in the subject” (Feisner, 2006)

The two dimensional wheel he developed was based on a triad of primaries; red, yellow, and blue with the secondary as complements of the primaries. In addition to his color wheel, he formulated a color triangle which he felt further reinforced color

relationships. He assigned a number to each of the hues according to their relatives' luminosity. For example: yellow = 9 and the other color like orange, red, green, blue, violet was less. (White was the most luminous at 10 and Black the least at 0).

Experimental studies of Goethe were followed by the development of its color diagram, represented by hexagonal shape, where orange, violet and green are representative in the three transition of color, white, yellow, blue and red present the primary. In addition Goethe produced a color wheel based on color temperature, emphasizing that blue hues is the coolness while reddish and yellowish hues are warming. So, by following to this concept, he divide colors into two set, where first represented the "plus side", (running from red to yellow) and the second "minus side" are the hues that they are running from green to blue (Freinsler,A, 2006).

According to the Ribe & Steinle: "For Newton, only spectral colors could count as fundamental. By contrast, Goethe's more empirical approach led him to recognize the essential role of magenta in a complete color circle, a role that it still has in all modern color systems" (Ribe, Neil; Steinle, Friedrich, 2002).

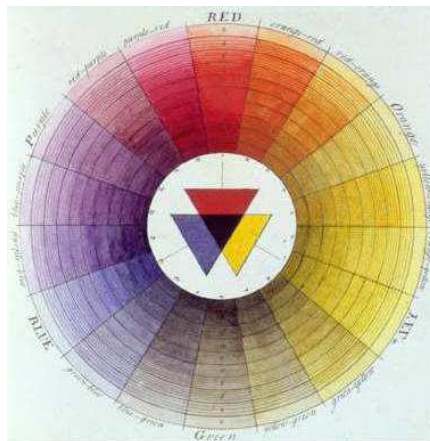


Figure 4.Harris's color wheel by charting not only pure colors, but the various shades of those colors as well and he introduce the second dimension.

Source: (Feisner, 2006, p. 14)

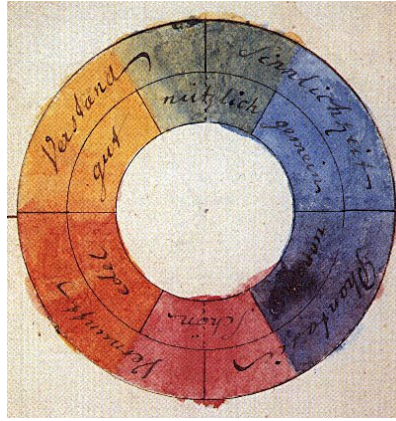


Figure 5. Goethe's color wheel is fully symmetrical, the two dimension wheel he developed was based on a triad of primaries; red, yellow, and blue with the secondary as complements of the primaries
 Source: (Feisner, 2006, p. 14)

J.C. Maxwell

Maxwell, was a Scottish physicist, in (1831-1879) experimented with the concept of additive color and its resulting color combinations, as a property of the behavior of light. His two dimensional color diagram took the form of a triangle with green, blue, and red at the points (primaries), and green-blue, yellow, and purple at the sides, with white in the center. He also experimented with rotating color disc, and discovered that when turn these color combinations formed other hues, for example: red and green, resulted in a yellow reaction (Feisner, 2006).

The sensation of color depends on mixture of white light and colored light (which in itself can be a mixture of wavelengths as in the case of purple). The colored light may have a dominant wavelength or hue and the extent to which the hue dominates is known as saturation. The saturation decreases as the hue is deleted with white light.

Maxwell's color triangle representing three primary colored lights:

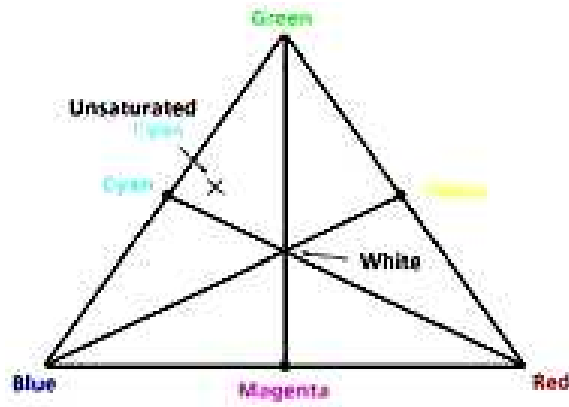


Figure 6. Maxwell's color triangle
 (URL 2: Kay, 2010)
<http://www.jimonlight.com/>

A color triangle is an arrangement of colors within a triangle, based on the additive combination of three primary colors at its corners, and the pure white at the center which is created by mixture of the light. Maxwell's work also led him to the field of color photography, in which he proved to be a pioneer of modern day photography (Feisner, 2006).

Ewald Hering

Ewald Hering was a German physiologist and psychologist in (1834-1918) whose works based on color perception. He established the primary color as: red, yellow, blue and green. The Hering color diagram was triangle in form, with hue at one point, black at another point, and white at third point. In his diagram, his work on color refers to the problem of yellow. For example: according to the other researchers, yellow was produced from a mixture of red and green, but according to the Hering theory, the sensation of yellow is elementary, and not observable by mixture. Hering further states that mixtures of red and green never happen but eliminate each other (Feisner, 2006).

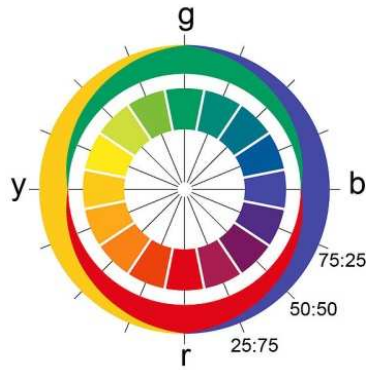


Figure 7. Hering's primaries of red, yellow, green, and blue are the same as those on the visual wheel
 Source: (Feisner, 2006, p. 17)

Hering therefore concludes that there are not three but four elementary color sensations or psychological primaries in our perception. In 1878, Hering wrote: "Yellow can have a red or green tinge, but not a blue one; blue can have only either a red or a green tinge, and red only either a yellow or a blue one" (Hering.E, 1878).

These colors placed opposite each other in the outer circle. These pairs define color contrast; in a way that they do not overlap in the outer circle to show that for example: red never mix with green. So they combined in a proportion.

In the case of color theory, which consists of all color-hues of the visible spectrum, Hering mentioned to "antagonistic types of light, which together produce white" (Hering.E, 1878). That means "they do not complement each other to form white; they just allow white to occur as pure because, as antagonists, they render each other's effect impossible". White was for him "a sensation of its own nature, in the same way as black, red, green, yellow or blue". Hering additionally proposed a white-black process in order to provide brightness. There are thus six basic color-hues in all (Hering.E, 1878).

Albert Munsell

One of the most widely method of color notation in 20 century is Munsell system. He led to his system being adopted by the United States bureau of standards as the adaptable language of color.

Munsell colors are identified in terms of three attributes: Hues, Values (lightness) and Chroma (saturation). This system serves as a starting point in understanding the complex relationship of balance, proportion, and harmony. He assumed that color could be represented by spherical form, in which color circle of saturated, purest color would be placed at the equator while white and black poles would be connected by the axis made of various shades of gray. Munsell color tree represents gradation of value along the vertical axis, and gradations in saturation or chroma as steps along the horizontal branches. The Munsell system is based on five principal hues. In this form of, the arrangement, the hues are clockwise around the wheel. They are: Red (R), yellow- red (RY), yellow (Y), green-yellow (GY), green (G), blue-green (BG), blue (B), purple-blue (PB), purple (P), and red-purple (RP). Each named hue, is divided into number, like: 2.5, 5, and 10, and they shown the outer circle of the color wheel. These numbers are using for cataloging and computer programming (Mahnke,F, 1993, p. 33).

Briefly, the second dimension of the Munsell system is the value, indicating the degree of lightness or darkness of a color in relation to a neutral gray scale. The value scale was represented by vertical axis which was divided into 10 regular steps of gradation from black to white. Therefore, the value 10 was assigned to the white pole; the value 0 referred to the darkest, black pole, white values from 1 to 9 represented grays of various shades. A green for example, with the notation 9/ would be a light green; with the notation 3/, a dark green (Pile,J, 1997, p. 35).

Finally, the dimension of saturation was represented by the distance of each color sample from the value scale. In other words, dimension of chroma started at the each step along value scale and moved horizontally outward from neural axis in the direction of each value. Chroma or saturation, indicating strength or purity of color, is

the third of the Munsell dimension. Notably, the saturation is given from 0/ for a neutral gray to 16/, which is depending on the saturation (Mahnke,F, 1993).

Above all, The Munsell Color System to illustrate complementary colors used the hue color wheel diagram. Albert Munsell preferred the term "opposite color" to complementary color since they are on the opposite side of his color wheel. This diagram was described how complementary colors relate to each other.

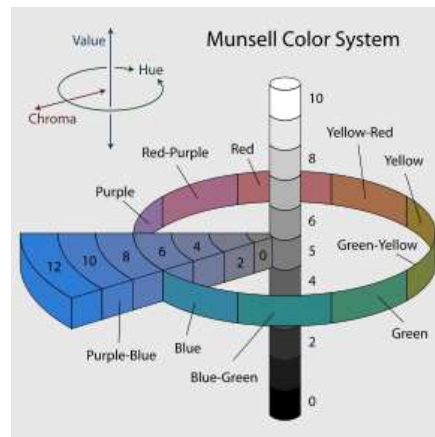


Figure 8. Three dimensional diagram of the Munsell tree. Hues are positioned on a vertical axis showing the values from light (above) to dark (below). Saturation is measured on a horizontal axis, with dull gray hues at the center evolving into the brightest hues at the outer boundary.

Source: (Feisner, 2006, p. 17)

Afterward, in 19 century, the idea of using a three-dimensional color solid to represent all colors was developed. Several different shapes for such a solid were proposed, including: a double triangular pyramid, a single triangular pyramid, a sphere, a hemisphere, a cone, a tilted cube, and a slanted double cone. These systems became more recognizing the difference in value between bright colors of different hues. But all of them remained theoretical or practical problems. Furthermore, none

was based on any scientific measurement of human vision; before Munsell, the relationship between hue, value, and chroma was not understood (Birren,F, 1988).

Wilhelm Ostwald

In 1909, Wilhelm Ostwald (1853-1932) Wilhelm Ostwald attempted to construct a perceptual color-system using non-empirical methods. He is regarded as one of the fathers of modern physical chemistry. His System succeeded in systematizing both psychologically and physically the study of color. Ostwald endeavored to create a perceptual color system by the use of non experimental approaches (Echo.production, 2008).

Whereas, the Munsell system identifies its color by hue, value and chroma, Ostwald tried to express his system in the modern technical language, in the other word; Ostwald by using non-empirical methods, he attempted to provide a perceptual color-system and in place of Munsell's three parameters, he selected an alternative group of variables: namely, color-content, white-content and black-content. Therefore, he asserted that any color could be formed by mixing full color with black and white in different proportion (Pile,J, 1997, p. 36).

The color wheel is divided into twenty-four sections; the half of the circle, it contain colors of the "cold", (from yellow through green and blue) in a way that they are complementary to the warm half, (from blue through red to yellow). The eight principle hues are designated as follow: yellow, orange, red, purple, blue, turquoise, sea green, and leaf green (Mahnke,F, 1993, p. 34).

Ostwald produced three dimensional color forms which are the combination of hue, black and white. Thus he intermediate portions of his color triangles were based on percentages of black, white, and hue. Within each of these percentage mixtures the

total was always 100 percent, which made them complete (Freinser,A, 2006, p. 18).In doing so, hues which are closer to the upper apex appeared more whitish, while those nearer to the bottom possessed more of black content. The central axis connecting top and bottom apexes represented stepped gradation between white and black extremes.

Furthermore, Ostwald wanted to create “harmony” in his color system. Therefore, so as experience he realized that some color combination could be seen as pleasant while other are unpleasant. In his experiment, Ostwald found out the harmony is created by color order and he suggest that all harmonies could be identified in unity with the geometrical rules by analyzing all the color order within the three dimensional model (Echo.production, 2008).

CIE

In 1931, the CIE "Commission International d'Eclairage" was engaged to produce a "color standard Table". The result was a precise color matching system based on light. The CIE color space was derived from a series of experiments done in the late 1920s by W. David Wright and John Guild. Their experimental results were combined into the specification of the CIE RGB color space (Feisner, 2006, p. 19).

A colorimeter was used to measure the three variable of any color: the luminance, the hue and saturation. Together, these three values determine the “chromaticity” of a color.

The advantage of this system is that it provides matching color in noticeable differences. In this way the CIE chromaticity diagram or triangle has the hue around the edge and the mixing or sum of these hues in the center, which is called E for equal energy. For light mixture E is white; for pigment mixtures E is black or a dark neutral mixture. The diagram continued twelve hues that were presented in seven gradations

from light at the center to the dark at the points. Although the diagram is termed a triangle, in fact it is a curve based on the luminosity curve (Macevoy,B, 2009).

Furthermore, the observers by creating an indirect method for establish the proportions of red, green, and the blue that they are seen in the light with a wavelength. Subsequently, any color on the CIE chromaticity diagram can be considered to be a mixture of the three CIE primaries, X, Y, and Z. That mixture may be specified by three numbers X, Y, Z. This method named as Tristimulus. However, the Tristimulus values X, Y, Z represent a perceivable hue, and different combinations of light wavelengths which give the same set of Tristimulus values will be indistinguishable in chromaticity to the human eye.

The resulting of CIE primaries and the associated color matching functions are used to calculate the Tristimulus values, representing a color by:

$$C = XX + YY + ZZ$$

The advantage of CIE system is that it provides industry with the means of accurately and consistently matching colors of perceptible differences. Such an objectives standard eliminates differences in human interpretation, as well as problems caused by the fading of painted or color swatches (Macevoy,B, 2009).

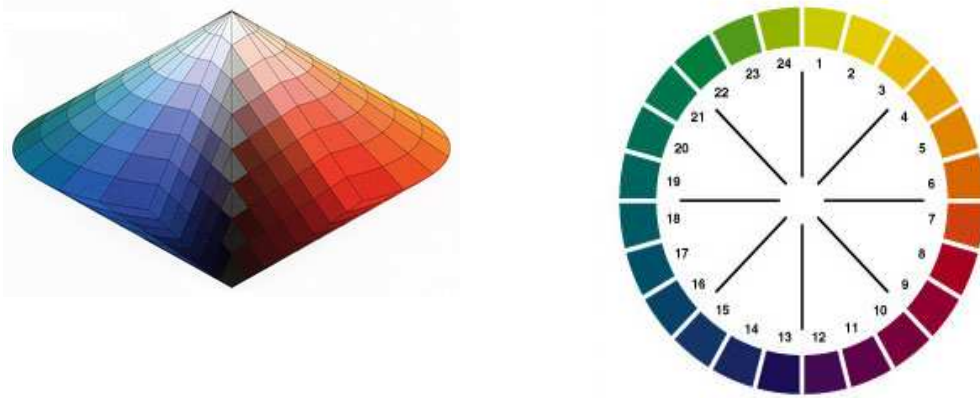


Figure 9. According to the Wilhelm Ostwald the color of an object is made up of pure color along with white and black. Then, with respect to red, yellow, green and blue

Source: (Feisner, 2006, p. 18)

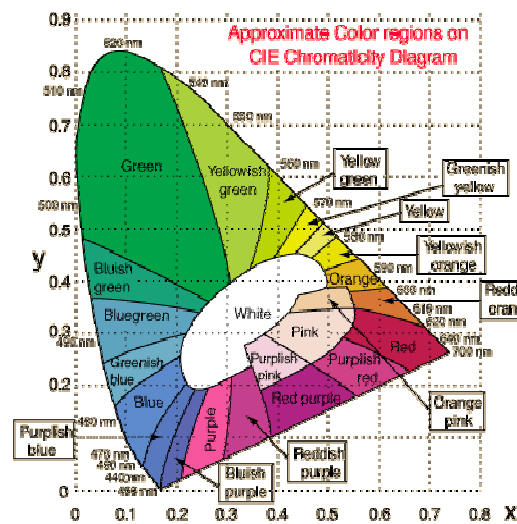


Figure 10. CIE color system which characterized color by luminance parameter Y and two color coordinates x and y which specify the point on the chromaticity diagram.

Source: (Feisner, 2006, p. 19)

Johannes Itten

In (1888-1967) Johannes Itten was the best known color student in his theory. Itten taught both color and design at the Bauhaus school in Germany, where his approach to education included both mental and physical conditioning. Each morning Bauhaus students did aerobic exercises on the roof of the building prior to Itten's lectures and classroom work. Itten developed his color wheel and "star" for his course in 1919. To support his approach to color theory color circle which was based on three primary yellow, blue and red which were placed in a triangle with yellow at the top, because it was the brightest of the hues and it's close to the white light red at the lower right and blue at the lower left. The diagram contained twelve hues that were each presented in seven gradations from light at the center to dark at the point. The advantage of this diagram was that the student could observe the differences in hues as well as the value of the hue simultaneously (Freinser,A, 2006, p. 19).



Figure 11. Johannes Itten color system
Source: (Macbay, 2009, p. 22)

To support his approach to color theory color circle which was based on three primary yellow, blue and red which were placed in a triangle with yellow at the top, because it

was the brightest of the hues and it's close to the white light red at the lower right and blue at the lower left.

The Itten color theory was based on three primary yellow, blue and red which are placed in a triangle with yellow at the top.

Notably, all the arrangement of color, involve consideration of emotional and mental value of various hue as well as the subjective feeling which could be linked to objective colors. He insisted that, color dominates specific characteristics which, in certain ways would affect psychological and spiritual states of any individual.

Additionally, for coordinating colors utilizing the hue's contrasting properties he created seven methodologies through his research. These contrasts add other variations to the intensity of the respective hues, for example: contrasts may be obtained due to light, moderate, or dark value. According to Itten, seven definite types of color contrasts were: contrast of hue, light-dark contrast, cold-warm contrast, complementary contrast, simultaneous contrast, contrast of saturation, contrast of extension. (These elements of contrast are going to be explained in the chapter of brightness contrast) (Itten, J, 2003).

To sum up, there are a number of notable features in Itten's work. Alongside, as a means of his work on the theory of color, to develop inner understanding and perception, which was for him the principal source of artistic inspiration, he observed a strict vegetarian diet and practiced meditation.

Itten had been the first to associate color palettes with four types of people, and had designated those types with the names of seasons which his work named as an inspiration for seasonal color analysis. Shortly after his death, his designations gained popularity in the cosmetics industry with the publication of *Color Me A Season*.

Cosmetologists today continue to use seasonal color analysis, a tribute to the early work by Itten (Itten,J, 2003).

Josef Albers

Josef Albers in (1888-1978), was a teacher in Bauhaus school; he became absorbed with how color reacts and interacts. While at the Bauhaus, he refined Itten's work. The teaching diagram he used most often was a triangle, very much like Goethe's color triangle. In his system he reversed Goethe's color star and transformed it into a color triangle by folding the secondary color points inward. He then filled the remaining three spaces with mixture of the primary and complementary colors. For example: red, yellow, and blue at one point, orange, violet, and green at the midpoints, with red- gray, yellow-gray, and blue-gray in between.

Furthermore, Josef Albers created a series of paintings titled *Homage to the Square*. These works explain how colors look when seen one at a time and how they appear in different combinations. According to his idea; the way that people experience color varies based on the individual personalities and on factors such as hue, dimension, and placement (Freinser,A, 2006, p. 20).

Albers often worked with analogue. In this work he chose the square for its neutrality, hence he applied his pigments directly from the tubes in which they came, spreading them in thin layers onto the surface of the picture. Let's supposed that we had square of red, orange within the square of red_violet. The red square will form a bound around the red-orange an illusion of red-violet will appear along the edge, and where the red meets red- violet, an illusion of red-orange will appear along the edge. So, the color seems to be subtracting its own color from adjacent color. And we can see the role of the value in this process. The middle of the square it can be the mixture

of the dark value and light value. Albert felt the quantity of area size of a color had a manner and it must be considerable for diffusion (Freinser,A, 2006, p. 103).

To end with, Albert improve the quality of modern life in all its aspects and, ideally, at every social level. His earliest works were figurative drawings and paintings. His style was abstract at the Bauhaus where he began to explore abstraction and color. And after finishing his studies at the Bauhaus, he joined the faculty to teach the preliminary course on material and design. Following the Bauhaus, Albers believed through the use of color, midnight and noon could exist simultaneously. He gives his students the advice, “Do less in order to do more.” As seen in Albers’s work, his simple lines and geometric forms create mystery and life (Josef,A, 2007).

Faber Birren

Faber Birren was study in Chicago’s school of education under Walter Sargent. Barren went on to become one of the best known, color authorities and consultant of the twenty century. In 1934 Birren designed his “rational color circle”, which group 13 colors around a grey which does not itself appear at the center. The hues are arranged in equal intervals but tended to include warmer than cool hues in its arrangement, so that the neutral gray center was asymmetrically placed. His rationale for this was that the eye sees more warm hues than cool ones. Although he retained the principle that red, yellow, and blue were primaries, within the warm area of his wheel he added a leaf green and within the cool area a turquoise. Red and green were complementary, and could function as either warm or cool (figure.5) (Birren,F, 1974).

Like Itten, Birren was interested in color harmonies; therefore he proposed a “harmony of color” as follow: Element of harmony, harmony of adjacent, harmony of opposite, harmony of split-complementary, harmony of triads, and harmony of

dominant tint. Along these lines, he developed a “triangular arrangement”, which was based on psychological aspect of color. He state that there are pure colors of hue, black and white. These three elements at the points of triangle can be combined, so that white added to a color gives a tint, black added to a color gives a shade, and black added to white gives a gray. They were placed on the triangle. The center of the diagram showed tone, which is a combination of the three elements of black, white and black (Birren,F, 1974).

Alongside with the triangle system, Birren provide second triangle which has assembled paired numbers which are separated by a decimal point. The numbers are related to the proportion of white, which can range between 100 and 0. Similarly, the number in the point shows the degree of black. So by adding both numbers and subtracting the result from 100 the proportion of color can be calculated. As an example: the combination 0.0 will be pure color; 10.50 will give a color-hue containing 10% white and 50% black, and thus 40% pure color.

Moreover, by using the “harmony of color form”, he indicated the color effect and the new perception of color. Therefore, among these color effects he approached to some aspect: the effect of luster, the effect of iridescence, the effect of luminosity, the effect of transparency, the effect of chromatic light (Feisner, 2006).

The effect of luster: luster is impression given by passive light. People can see the effect of luster in different material, such as: silk, polished wood. To achieve this effect the artist should use dark field. For example: when a dark field is used, the color on top must be appearing very bright (Feisner, 2006).

The effect of iridescence: it is usually caused by interference of light, but also by refraction and diffraction. An iridescence color appears to glitter with different colors

according to the angle of vision, whereas standard colors look the same from any angle (Feisner, 2006).

The effect of luminosity: luminosity has to do with the quality of light reflected from a surface, penetrating it, transmitted through it. For example: blue has little luminosity by itself and even the addition of lot of white causes the blue to stay blue. However, yellow, which is the lightest of the hues; it changes its character when white is added and it becomes more luminous (Birren,F, 1974).

The effect of chromatic: chromatic light have varying degrees of strength or weakness. When the chromatic light strength is very pure (strong), the surface colors will require a very strong tonality of that chromatic light for giving the effect. If the chromatic light is weakened the surface color will become more predominant (Feisner, 2006).

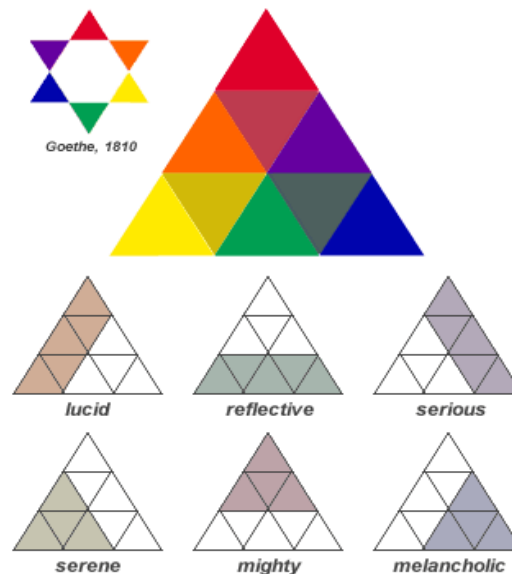


Figure 12 Abler's color triangle.
Source: (Feisner, 2006, p. 20)

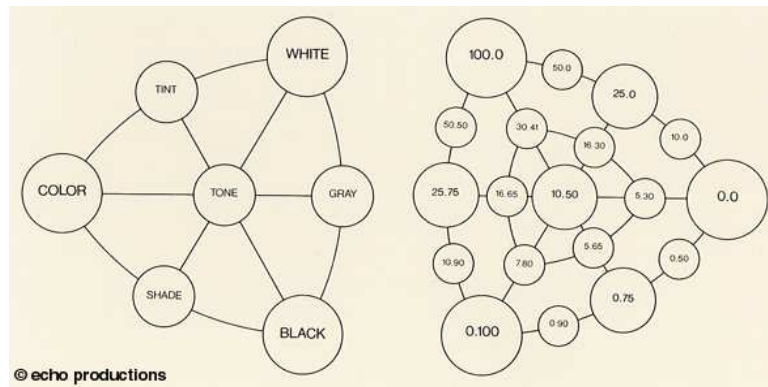


Figure 13. Faber Birren color theory
Source: (Wacknov, 2009, p. 13)

2.2 Fundamentals of Color

Apparently, the field of color theory is quite large, with a number of prominent theorists who offer observations on the issue. Color theory could be explained about a lot of things, but basically it is an examination of color, how colors are arranged, are formed, and how they interact.

Classification system began with simple geometric figures (squares, circles and triangles), showing the different hues in spectral sequence. In those based on the needs of painting, the pigment primary colors-red, yellow and blue were arranged with their secondary-orange, green and purple-in between, and likewise with the tertiary. The circular form achieved by joining the spectral edges of the rainbow, with purple between red and blue, lent itself to expansion from a basic six steps or division to accommodate over a hundred graduation of intensity of the different hues merging into one another (Grimley,CH, 2007, p. 20).

Knowledge of color theory require some understanding of basic principles about color and perception, but most of the modern color theory surrounds the way that people think about it, and interacts with colors, from those used on their walls to

the hues in a company logo. Color theory incorporates psychology, history, and criticism just as much as it does science.

Additionally, Color can also be described by two very different method or points of view _objectively by referring to the laws of chemistry, physics, and physiology; and subjectively by referring to the concepts found in psychology. Similarly, the perception of objects depends both on physical factors such as their actual hues (the name of a color: red, yellow, blue), their lightness and darkness in relationship to surroundings (value of a hue) _and on more psychological and cultural factors (Freinser,A, 2006, p. 3).

2.2.1 Hue

Color in the environment is characterized by brightness and hue, color is a general term that includes both brightness and hue, although it is popularly thought of as meaning hue (Miller, M, 1997, p. 3).

Each color of the spectrum has a single frequency. True spectral colors do not occur in nature; rather, all natural colors are hue two or more spectral colors observed at the same time.

A hue, therefore, is a variety of a color. About twenty-four hues of full intensity can be recognized by the eye, but there are an infinite number of gradations possible in between. In any color combination there is usually a dominant hue that enables a color to fit into a pure hue category, scarlet red, for example (Ladu, R, 1989, p. 52).

Along with the color organization, hue is authorized as it is associated with the basic color categories. Every hue has its own saturation or intensity, ranging from the purest, most concentrated or saturated to the most temper.

As matter of fact, utilization of hues requires their systematic organization and, probably, the circular arrangement of color, named as color circle or color wheel,

become most adequate and widely accepted. Remarkably, the first effort to bend prismatic spectrum into circle was made by Sir Isaac Newton, who organized the structure of color. This circle of color imparts information about the reactions colors have when they are actually mixed. The primary colors are red, blue, yellow, which are used in combination to form the other hues. The term primary signifies that a particular hue cannot be obtained by any mixture. In addition, when two primary hues are combined, it creates the secondary color. For instance: by combination of red and blue, violet will appear, and yellow is combination of blue and red. As result, the secondary color are appear, which are violet, orange, green. Afterward, when the secondary colors are mixed, tertiary colors are the result (Grimley,CH, 2007, p. 18).

In conclusion, all colors are arranged in systems that enable us to organize and predict such color reactions and interactions.

2.2.2 Value

Even though sunlight contains the entire wavelength required for hue vision, it is colorless. The amount of this colorless light falling on a color surface and reflect from it determines whether it will appear darker or lighter. Brightness refers to the amount of light illuminating a surface:

- The more light a surface receive, the brighter it will appear.
- The less light a surface receives, the darker it will appear.

Value is the darkness or lightness of the surface:

- The lighter or whiter the surface color, the more light it reflects and the brighter it will appear.
- The darker or blacker the surface, more light it absorbs and the darker it will appear (Miller, M, 1997, p. 4).

For example: snow is black in the darkness of the night. Hence, brightness differences enable to distinguish the darkness or lightness of color; to see light, shade, and shadow patterns; to understand the black and white movie or photo. As result, people can read the environment quite well.

2.2.3Tint and shade

Color Shades, color tints are all words related to colors, but each of them signifies different functions. It is necessary to know that there are certain basic colors and other colors are made mixing and matching these colors.

By adding or subtracting light from a saturated color we can create a tint or a shade. Lightness, determined by how much light is reflected from a surface, is a colors degree of difference from black. A colors darkness, or black of reflected light, is its closeness to black.

A color can be changed either by varying the quantity of light allowed to reach the surface or by adding light or dark to the original pigment.

Adding more light, or white, to a color produce a tint. A vast number of gradations can be produced between the saturated color and white.

Reducing the amount of light or adding black, to a color, produces a shade. Again, very subtle gradations are possible within the scale from hue to black.

A shade of a color, however, can also be produced simply by lowering the light. A neutral density filter (filter is reduce the light) can also be used to affect color to produce tints and shades (Ladu, R, 1989, p. 53).

2.2.4 Tone

What tone means in an art framework is simple. It's how light or dark a color is, rather than what the actual color or hue is.

Every color has a variety of tones; the light or dark one, it depends on the color. It's important to realize that tones are relative, so how dark or light they seem depends on what's around them. A tone that's obviously light in one context may seem darker if it's surrounded by lighter tones.

The range of tones that can be produced also varies. Lighter hues (such as yellows) will produce a smaller range of tones than darker ones (such as blacks).

In other words, for having the successful range of color, exact tones must be getting otherwise it's just going to be visual noise. The first step to doing this is to remove color from the equation, to create a range of tone using only black.

For example: one way for achieving the light color is to add white. But this is not the only way to reduce the intensity of the color, by adding another color of a lighter value a lightened color will be perceived. For example, to lighten a dark red a little yellow must be added.

2.2.5 Saturation (chroma, intensity)

There are various ways to express the saturation of color. The easiest and most limited way, is to use such words like; weak and strong or pale and deep color which are linked to the name of the hue. (for example: deep blue, pale green) Saturation is described as the percentage of hue in a color. Color saturation is the level of maximum chroma or purity, the degree of freedom from admixture of white. It can be also considered the degree of difference between the pure hue and its tint or shade. Also it is referred to as intensity or chroma; it is assigned the purity of a given color, the quality that distinguishes it from a grayed color. Two colors may be the same in the hue (for

example, two green), and one no lighter or darker than the other, yet still appear different in color strength (Mahnke,F, 1993, p. 27).

2.3 The concept of contrast in color configuration of interior spaces

Contrast express differences between colors. The principle of contrast determines how color is perceived, how a color is developed. Contrast is the concept that enables perception; therefore it is thought to emphasize it in this study with various characteristics.

Since the three characteristic of color are hue, saturation, and lightness, it is easy to identify the contrast. There are many types of contrasts, including light and dark, black and white, and warm and cool. It is possible to explore contrast in terms of saturation, or how much of each color a hue might contain. Two colors that make a whole, for example, a color composed of 80 percent red and 20 percent green, would contrast with a color of opposite proportions (Mahnke,F, 1993).

2.3.1 Contrast of hue

The contrast is formed by the juxtaposition of different hues. In the other word, there is great distance between the hues in the color wheel when the intensity of the contrast is weak (Ladu, R, 1989).

2.3.2 Light and dark contrast

Light and dark contrast can refer to either the amount of light hitting a surface or the actual value of a color. In this types of contrast there is a great gradation between light and dark contrast, (high- light, and low- dark).The best evocative of the light and dark contrast, is the combination of black and white and the shade of gray (Ladu, R, 1989).

2.3.3 Warm and cool contrast

Warm and cool colors can provide a sense of temperature contrast. They will clash when they are alongside. A cool color placed next to a warm color. (For example: blue-red next to orange-red), will not be harmonious (Ladu, R, 1989).

2.3.4 Complementary contrast

Contrast is using, to describe color opposites, or complementary colors. When pure light hits a surface, is absorbed or reflected, and is translated into color, only a specific portion of the spectrum is revealed in that color. The remaining colors in the spectrum are left over. For example, when light hits a red surface, blue and yellow are absorbed and red is reflected. Blue and yellow combine to make green, which is the complementary contrast of red and directly opposite on the color wheel.

Mixed together, complementary colors form a neutral gray-black. Beside, complementary colors arrange the maximum amount of contrast between two colors and will give a visual vibration (Pile,J, 1997, p. 14).

2.3.5 Simultaneous contrast

In the visual field, different colors usually are seen at the same time. This creates an optical effect which is related to the afterimages. The effect of the simultaneous contrast can be demonstrated by a simple experiment. While two colors placed side by side provide contrast and will affect one another. For example: when gray placed next to blue will make the blue appear yellowish. Complementary colors have maximum contrast, and when they are placed next to each other the sense of contrast between them will be improved. The same colors, when viewed against different background, will appear quite different to the eye. (Ladu, R, 1989, p. 54).

Simultaneous contrast occurs not only between gray and a strong colored background, but also between any two hues (as long as they are not complementary).

Each of the two hues tends to shift the other toward its own complement. Achromatic simultaneous contrast will make a gray appear dark against a light background, or light against a dark background.

The effect of simultaneous contrast is more obvious when the background color is saturated, and when it completely surrounds the surface being contrasted. Other observations show that closely related hues will lose some of their brightness, while complementary colors adjoining each other become stronger (Mahnke,F, 1993, p. 30).

2.3.6 Contrast of saturation

The contrast is formed by the juxtaposition of light and dark values and their relative saturation. In the other word, if the color placed next to more saturated color, hues with low saturation will appear monotonous, and if the color replaced next to the high saturation, will appear more vivid.

Contrast of extensional so known as the Contrast of Proportion. The contrast is referred to the relationship between sizes of the color area to reach a balance (Macevoy,B, 2009).

2.3.7 Achromatic simultaneous contrast

Achromatic simultaneous contrast concern with black, white, and gray. Light value, as well as hue, will appear lighter on a dark background. For example: when grays are placed on black or white background, their value will be change. (The gray is darker in light background and is lighter in dark background). For instance: white on a black background appear larger then a black area on a white background, because white spread and black by contrast, contract. Red is quite dark on white but warm and luminous on black. Blue appear darker in white and white become brighter, while blue on black is more brilliant (Freinser,A, 2006, p. 96).

2.3.8 Chromatic simultaneous contrast

In Chromatic simultaneous contrast, it is possible to make colors behave in predictable ways. For example: for appearing two colors, it should present against two different backgrounds and make it a middle mixture of two backgrounds. The separate areas of the comparative color should not be placed close to each other, otherwise they could be more easily compared and seen to be same.

This interaction is based on the fact that a surrounding color will subtract itself from any hue that appears on it. By putting orange on a yellow background and a red, it will appear to be redder on the yellow ground and yellower on the red ground. This is because, in the first example, the yellow is subtracting the yellow from the orange, so the result is reddish orange. And in the second, the red is subtracting the red from the orange, so the result is yellowish orange.

It is also possible to make two different colors appear, to be same color by placing them on two different colors. For example: yellow- orange on the yellow background and red-orange on the red background, they appear the same color when they are mixing, but the mixture depends not only on the hue mixtures but the values as well (Freinser,A, 2006, p. 96)

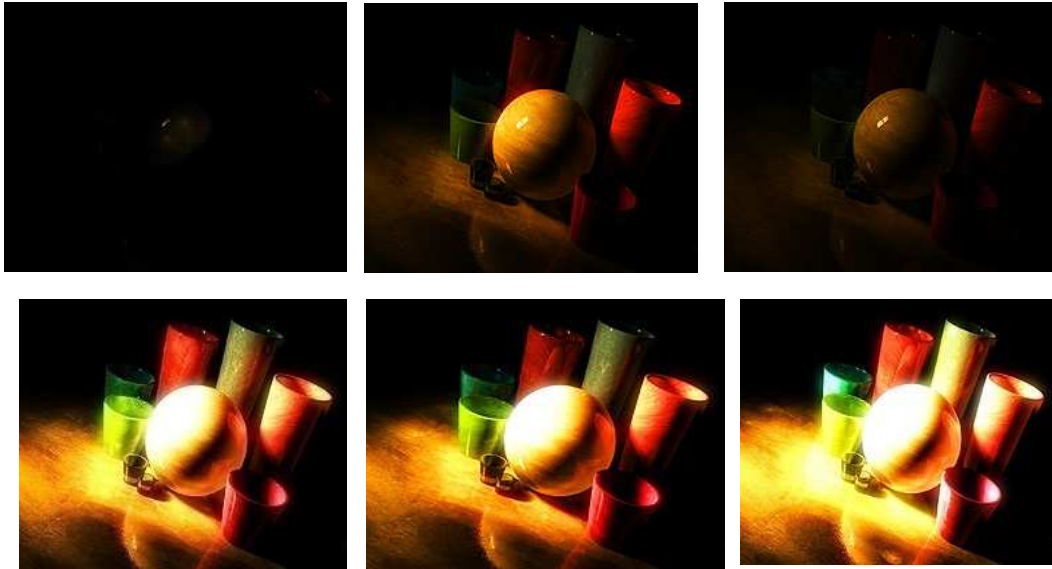


Figure 14. Brightness contrast
 (URL 3: Strømberg, 2009)
[.http://www.adobe.com](http://www.adobe.com)

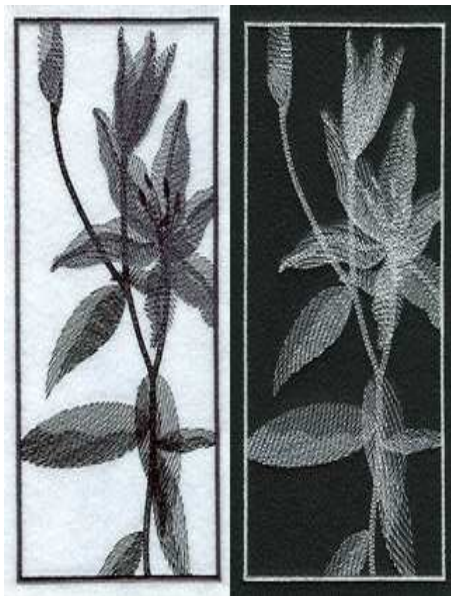


Figure 15. Simultaneous contrast
 (URL 4: Ludvigsen, 2009)
<http://siritsentient.com>

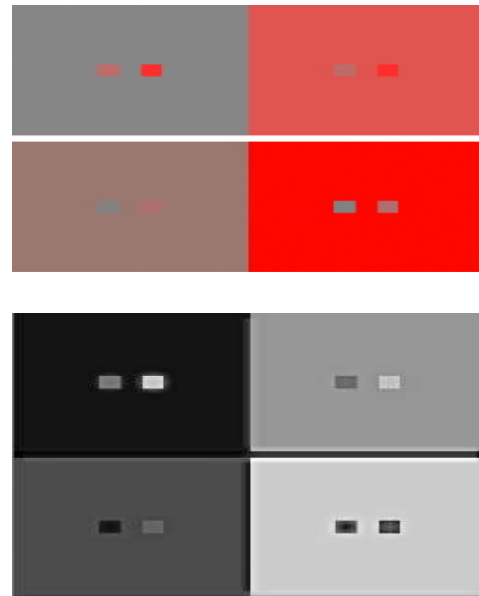


Figure 16. Complementary contrast
 (URL 5: Deza, 2009)
<http://patrickdeza.blogspot.com>

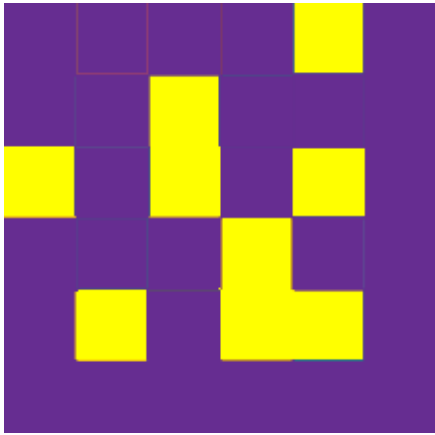


Figure 17. Contrast of extension

(URL 7: Keaton, 2009)
www.faculty.weber.edu

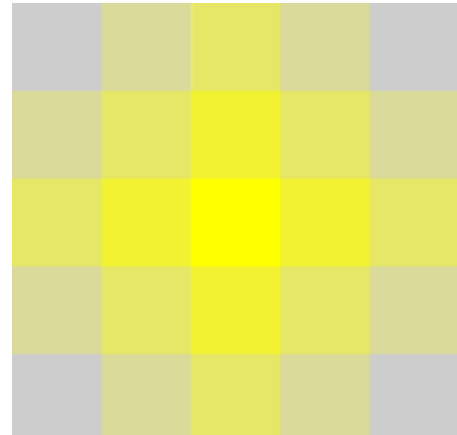


Figure 18. Contrast of saturation

(URL 6: Keaton, 2009)
www.key10reeder.blogspot.com



Figure 19. Achromatic simultaneous contrast

(URL 8: Struycken, 2009)
www.studiolab.io.tudelft.nl

TU Delft



Figure 20. Chromatic simultaneous contrast
(URL 9: Pelay, 2009)

<http://knol.google.com/k/maryvonne->

2.4 Color Mixture

In the color mixture the geometrical mixing method, visualize the color mixtures within a traditional color wheel. This method uses the midpoint between any two paints on the color wheel to estimate the saturation and hue of their mixture. The geometrical method explains saturation costs when any two or more colored lights or paints are mixed regardless of their hue. The unavoidable dulling of color are created. Saturation costs are encountered in the demonstration of mixing step scales for primary triad mixtures.

The geometrical method works very well for mixtures of light in additive color mixing. Because of the many differences between the two color mixing processes, it is much less defined for subtractive color mixing. A color wheel can be used equally well in both cases. Instead of removing the color wheel, it has to be used effectively as a color invention. This is the basic mixing method which explained (Evoy, Bruce, 2009). In addition the mixture of color can be explained in different aspects.

2.4.1 Additive color mixture

Colors are perceived in our eyes and brains by a three color code in the retina which is sensitive to red, blue, and green. Just as any color of the spectrum can be made by mixing the three primary colors, so the eyes distinguish the various colors by sensing different wavelengths with these three receptors.

Additive mixture is used in theatrical lighting, and in computer monitors and TV screens (Macevoy,B, 2009).

In additive color mixture (RGB), when light emitted to the surface to create color is often referred to as additive. Red, green and blue are typically used as the additive primary colors. In both, they combine to create (cyan, magenta and yellow) which are also called complementary color because each of them complements one of the primary color in additive mixture. When all three of the additive primary colors are added together, in approximately equal intensities, they produce white light. For example: cyan as a combination of green and blue light is the complement of red, so the result of the intermixture is spectrum. Correspondingly, yellow as a mixture of red and green lights, complement blue. And magenta, as a mixture of blue and red it provides green.

$$\text{White} = R + C = R + (B + G)$$

$$\text{White} = B + Y (R + G)$$

$$\text{White} = G + M (B + R)$$

As a consequence, it can be notice that additive color is a result of the way the eye identify color, and is not a property of light. There is a vast difference between

yellow light, and a mixture of red and green light. However, both stimulate the eyes in a same way, so it doesn't notice the difference (Macevoy, B, 2009).

2.4.2 Subtractive color mixture

The subtractive color mixtures are based on pigment. Primary colors of subtractive systems are Cyan, Yellow, and Magenta and formed by subtraction of one of the primary color from additive mixture. In contrary to additive mixtures, no combination of primary subtractive colors can produce white. Moreover, each subtractive primary absorb from white light, the wavelengths representing a additive primary. This principle as four formulas, define as follow:

$$C = W - R$$

$$Y = W - B$$

$$M = W - G$$

$$K = W - (R + G + B)$$

This way of definition of subtractive colors show that, for example: Cyan pain (C), subtract red light (R) from the white (W) light. Magenta (M) subtract green (G) light from the white light. Yellow (Y) subtract blue (blue); and Black (K) subtract all light from the white (Macevoy,B, 2009).

Now suppose that the red, green and blue light is shining on the surface ,only red and green light will reflect from it, so yellow will appear in the surface.

$$W-B = (R+G+B) - B = R + G = Y$$

Like in additive mixture, subtractive system involves complementary colors which neutralize one another. Thus, basic complementary pairs in subtractive mixtures are defining as: (orange complementary of Cyan, Violet complementary of Yellow and green complementary of Magenta).

As a result, Subtractive color starts by white light. Colored ink, paint, or filter between viewer and also light source (reflective surface subtract wavelengths) from the light, giving color to it. If the incident light is other instead of white, visual mechanisms are able to respond well, but it is not perfect, often giving a flawed impression of the "true" color of the surface (Macevoy, B, 2009).

In the summary of the chapter, it is worth emphasizing that color in built environment is quite apparent and should be applied accordingly concerning whether it meant to be energetic or rest and calm. In addition it was accentuated that value and saturation are as important as its hue. And the relationship between object and surrounded field will evidence a level of contrast; the more an object contrasts with its surrounds, the more visible it becomes.

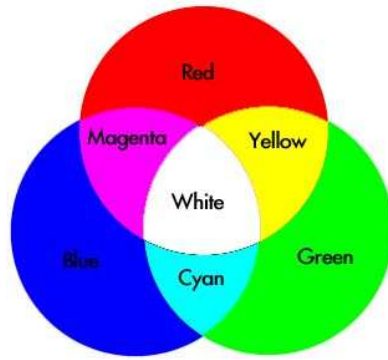


Figure 21. Additive color
Source: (Adelson,Ewald, 2009, p. 27)

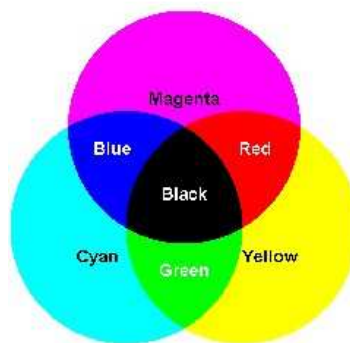


Figure 22. Subtractive color
Source: (Adelson,Ewald, 2009, p. 27)

Chapter 3

PSYCHOLOGICAL IMPACT OF COLOR

It is recognized that color has strong psychological influence on human reactions. There has been some research in this field to reduce various beliefs to some reliable finding that can be put to practical use (Pile,J, 1997, p. 136). Color and light are major factors in man-made environments; and there is no doubt that they have a strong influence on psychological and physiological well being. It is no longer valid to assume that the only role of light and color is to provide tolerable illumination and a pleasant environment. Although color vision does not appear in the forms of animal life, radiant energy and its spectral component still provide various psychological processes in all kind of living organism. For example: radiant energy is apparently vital for the growth of plants (Mahnke,F, 1993, p. 1).

Color is kind of energy which is effect to the mind and emotional feeling. As John Ott writes, “Behind the psychological response to color are more fundamental responses to specific radiant energy wavelength”(Birren,F, 1988).A person is likely to feel cheerful on a sunny day and glum on a rainy one. Conversely, psychological attitudes trough the color will affect bodily responses, and also it effect to the nervous system and hormonal activity. The kind and amount of energy that color effect to the space, evoke some of feeling response, it can calm or stimulate, cheer or depress.

In the design of modern environments color is very important. In fact, it is ahead of form in mans feelings. To talk about people, and their feeling about color,

many psychologists have noted that response to form is a kind of logical processes, while reactions to color are more impulsive and emotional. (Birren,F, 1988, pp. 27-29)

There are indeed a great range of psychological aspects of color uncovered through the years of comprehensive researchers. For example: numerous experimental studies suggest that color can be identified in conjunction with color, flavor and sound, weight and distance (Vodvarka,F, 2008).

Additionally, psychological and physiological aspects of color will become prominent in design decisions. According to the observations of theorists, the warm and cool color effect to the human personality and sense reaction. Warm color goes to the excitation, the extroverted human being, but the cool color goes to the tranquilization, the introverted human being. For example: red indicate extroversion. Such persons may not be too reflective and may be more ruled impulse than by reflection. They are thought to speed up heart and respiration rates and to raise blood pressure (Vodvarka,F, 2008).

Yellow, this is the warm color which has less aggressive in impact than red and it consider as sunny, cheerful and the happiest of all colors (Pile,J, 1997, p. 144). In Vincent Van Gogh, we can see the attraction of the hue in many of his painting. According to one of the theorist: “yellow is the typically earthly color”(Pile,J, 1997, p. 144). It seems to illuminate the space. At maximum saturation is the most aggressive of the hues.

Green, it is often the choice of persons who are intelligent, social, who are given to voluble habits of speech, and who often have an intense appetite for food. According to the psychologist, contains the calming, relaxing, refreshing, and quiet. It is associate with the power of nature and of life.

Blue, is the color to be associated with schizophrenia. Blue is a color of suspicion. Under stress persons who like blue may tend to flight from environment. Blue it considered calming, restful, and comfortable. They suggest that blue reduce blood pressure, pulse, and respiration rate. Perhaps this is because blue occurs so frequently at low saturation. Like: denim blue.

Orange: this color is a mixture of red and yellow. The intensity of excitement which is come from red is reduced but somehow is present. The sense of cheer is related with yellow so that orange become a color with happy implication (Pile,J, 1997, p. 144). This color increases the oxygen through the brain. It is very hot color that gives the sensation of heat. This may explain why many small children use the color orange when coloring a picture of a campfire. This mixture of red and yellow has been used to present the sun, happiness, attraction and encouragement (Seybert,J, 2007).

Violet: violet is combination of red and blue in the color circle. Is incorporates the conflicting values of warmth and coolness. In the spectrum it does not stand between two neighbors (green and orange). Usually violet is viewed as the color of sensitivity and artistic expression. Pale tint of violet are define as playful, magical. Deeper violet is dignified and mysterical (Pile,J, 1997).

Brown: brown are all warm colors. They tend appear to their as warm and comforting but have an unfortunate relationship to the dirt and soil. The more positive implication relate to the comfort of the house, the textile and the material such as wood, brick and stone. This color lack the energetic color such as orange, red and yellow but it retain some of the qualities and warm. When brown combine with other warm tones, they express the comfort, otherwise it will be very depressive if it doesn't combine with lively tones (Pile,J, 1997).

Black, Black absorb the most light of any color, and is thought of as opaque rather than transparent. A true black is an absence of any color or light, but most blacks must be defined in contrast to their surroundings. Black is strong color with powerful implication of seriousness, dignity. It can also project a sense of emptiness or blackness. Black can be warm or cool in component of chromatic color, and making them pure black. Dark gray and very dark blue can be close to the black, therefore such tones can express the qualities of black (Ladu, R, 1989).

White, like black, is only found in nature, in varying degrees of off white and gray. It is perceived as an appropriate color, although in the orient it is a funeral color. White reflects the most light of any color. It's lacks of chromaticism and is a symbol of the blankness, simplicity, cleanliness and purity. Although the color white it has only one tone, but in fact, warm and cool white have more chromatic color and are favorite background tones (Ladu, R, 1989).

Gray: this color is a result of the black and white or is a range from light to dark or from the mixture of chromatic tone with white and black. Usually, dark gray can be depressive and light gray in warm tone versions are useful as background.

The quality of color has been referred to by numerous investigators. To quote Maria Rickers (in Birren, 1988):

Color experience, when it occurs, is thus a much immediate and direct sense datum than the experience of form. Form perception is usually accompanied by a detached, objective attitude in the subject. Whereas the experience of color, being more immediate, is likely to contain personal, affectively toned notes (Birren,F, 1988).

To end up, color and light are as a form of energy. Color affects to the people feeling, and encourages them to provide satisfying human relationships and it make their life enjoyable. Beside, color is a response to physical phenomenon and cultural society. Both affect how people feel about color and how they use it.

3.1 Warm, Cool and Neutral Color

Warm colors: In the daily life, is usually talking about warm greeting, warm friendship, and a warm atmosphere. In color terms, the hues on the warm side of the color circle are generally understood as comfortable, cozy and pleasant. Experiment proved that warm color in space provides more comfortable area rather than cool color (Pile,J, 1997, p. 137).

Cool color: those are that give the feel of coolness or calmness. These color are green, blue, violet are on the cool side of the circle. These colors give sense of relaxing and calmness. Cool color may become depressive and negative in psychological impact.

Neutral color: white, black, gray are in this category. They are between cool and warm and they have less intense psychological effect. These color may seems very boring but in the positive perspective, they are using in practical area with a minimum of emotional content. Achromatic colors are also considered as a neutral color, like brown, beige and tans are also considered as neutral colors (Hummie,Ed, 2009).

3.2 Meaning from color

Color plays a vital role in the world of design, and since design can cover many different areas, it can be very powerful in human lives. Richard Gregory writes that "We attach such importance to our perception of color - it is central to visual aesthetics, and profoundly affect our emotional state - that it is difficult to imagine the gray world of other mammals, including pet cats and dogs" (QXS SoftwareGgroup, 2007).

Understanding the psychological impact of different colors, it is essential for designers for working in various sections such as logo; graphic design advertising; interior design for the home and interior design for industry and business.

In the world of marketing, color combinations are not only used to attract our attention but are also used to represent a company's culture. Lively colors bring excitement and energy, red is especially synonymous with speed, whether it is fast cars, fast food or fast phone and internet service. And also there are some brand which are always dominate like, McDonald's, Wendy's or KFC, who all make use of red as a dominant color. Coffee brands such as Green Mountain, Gevalia and Starbuck's draw upon earthy greens and browns to represent the nature. The purple packaging of Cadbury's, Milka and Lindt Dark Chocolate Truffles, and the gold packaging of Ferrero Rocher and Godiva represent luxury, wealth and royalty.

Color has the ability to affect a person's appetite, so a restaurant owner has to be aware about the hues that they pick. As already defined, red increases blood pressure so it will also increase a person's appetite, so red is very popular color for fast food restaurants. In a formal dining situation however, it may be more pleasing to encourage the customers to remain longer and therefore order more food or beverages, in which case the color blue may be used to calm and relax. Thinking about the definition of warm colors meaning happy and cool colors defining sad is not necessarily an incorrect line of reasoning. However, the meaning of color can be defined opposite to other persons. So these differences have been based on variable such as gender, culture, politics and experiences. Leonardo himself tried to make the definition of color simple by saying that:

“We shall set down for white the representative of light, without which no color can be seen; Yellow for earth; green for water; blue for air; red for fire; and black for total darkness” (Frank, P, 2006).

However, his definitions were not widely accepted. But before anyone can define the different colors, one must first know what color is.

The color red is an intense color which can remind feelings of war, danger (such as red lights on alarms), strength and power. In some countries most people think about the color red, as a popular holiday, Valentine's Day, with this thought, many think about red roses and hearts which can represent feelings of passion, desire, and love. On the other hand, physiologically, red has been found to increase metabolism, and increase blood pressure (Seybert, A, 2006).

Faber Birren writes that:

"In human beings red tends to raise blood pressure, pulse rate, respiration, and skin response (perspiration) and to excite brainwaves. There is noticeable muscular reaction (tension) and greater frequency of eye blinks. Blue tends to have reverse effects, to lower blood pressure and pulse rate, skin response is less, and brain waves tend to decline. The green region of the spectrum is more or less neutral. Reactions to orange and yellow are akin to reactions to red but less pronounced. Reaction to purple and violet is similar to reaction to blue" (Birren, F, 1974).

Orange is a color which is combination of exciting of red and joy of yellow. And it can increase the mental activity. It gives a sensation of heat. Orange color represents sun and happiness, creativity, attraction and success and encouragement this is why children use this color. However, when some people see the color orange, the sign of warning comes to mind (Seybert, A, 2006).

Yellow is the color of joy, happiness, and freshness. Exposure to the color yellow can activate mental activity. However, culturally it has been noticed that babies cry more in a yellow room. Although, most children around the world do not choose yellow as a favorite color, but often times men will relate the color yellow with children, In German, yellow actually describes a state of jealousy (Frank, P, 2006). The next color in the spectrum which is most natural and most restful is Green. Green is a

symbol for growth, freshness, harmony and fertility. On the contrary, the darker greens can express feelings of jealousy, because it makes people think about money (QXS SoftwareGgroup, 2007).

3.3 Use of Color Implications in Practice

Numerous researchers, conducted by various methods including the experimental studies, observation and investigation, have identified a range of universal psychological response to color, related to color associations with various objects, moods and emotions. Perhaps, the best example of the universal reactions to color is a hue with temperature. Thus, yellow-red region of the spectrum refers to warmth and heat. While blue and green hues refer to the cool region (Hallok,J, 2008). Notably, various colors which are associated with different temperature are supported by numerous studies and experimental investigations.

Additional colors should appear supportive of the main color. Colors invoke different emotions. Some are positive; some are negative depending on the viewer's perspective. Beside, people have been describing the feeling and emotions by using the various color names in daily speech. For example: “She is blue”, “Wow that’s a great red sunset”, “green with envy” (Tedric,A, 2007).

Moreover, color effect person moods from the moment they are born, therefore knowledge of what tone obtain certain reactions from babies is a very useful tool for interior design with client that are expecting a child. It is no accident that they put the babies blue or pink, because they are very calming to the baby. Bright red and yellow hues make a baby restless, and orange which is not a typical color can create a warm nurturing feeling (Birren,F, 1974).

Faber Birren writes that "In human beings red tends to raise blood pressure, pulse rate, respiration, and skin response (perspiration) and to excite brainwaves.

There is noticeable muscular reaction (tension) and greater frequency of eye blinks. Blue tends to have reverse effects, to lower blood pressure and pulse rate, skin response is less, and brain waves tend to decline. The green region of the spectrum is more or less neutral. Reactions to orange and yellow are similar with reactions to red but less pronounced. Reaction to purple and violet is similar to reaction to blue” (Birren,F, 1974).

Nevertheless, due to long term associations, most of the individuals still tend to associate red, orange and yellow with heat and blues and greens with coolness. Indeed, it is set on instinctive level and support by life-time experience that yellowish sun and orange red fire produce heat, and blues and greens with coolness.

In addition, there is a great experimental investigation between the color and emotion over the years. This study was from experiments may assist between color and human emotions and their effect on daily life. For example according to some theorist, it has been revealed that connection of some moods and emotions with some color are more obvious than other (Buckalew, I, 1985). In doing so, having an idea of what characteristics are appropriate to the space will lead to choices of color, material and color relationship will intended purposes. For example: the useful exercise might be to plan color and material for a number of spaces, such as a family living room, library, hospital, restaurant, shops and etc. any number of this place may developed in order to consider which colors and materials are appropriate for these space (Pile,J, 1997, p. 155).

3.4 Effect of Color in Form

It has been suggested by some of the theorist that color and form are related as expected. As a theory of Itten, there were connection between primary color and the simple geometric form of the square, triangle and circle (Pile,J, 1997, p. 156).

Therefore, in terms of form perception, color can be applied to stress, weaken, or convert perception of specific form into new sensation. Indeed beside its impact on the weight, size, and distance color has ability to shape the space, diminish the volume or it makes it more pronounced. Apparently, color form relationship is one of the aspects in a design.

According to the Bauhaus theory, the supporting theory argues that the square with its horizontal and vertical lines is related to the gravity and so to red. The triangle and its weights it goes to the yellow, “the symbol of thought”, the circle which is symbol of relaxation is then seen as relating to blue. To move this theory further, Itten proposed that the secondary color had relationship to geometrical form as well. For example: Trapezoid related to orange, spherical triangle relates to green and ellipse relate to violet (Pile,J, 1997, p. 156).

To start with, it is worth to review the example of color form synthesis which has proposed by Brochman on two dimensional planes. Firstly, Brochman draw a cube with red color, but he left the third plane white (Hesselgren, S, 1969, p. 114). He note that conspicuous perception of cube diminishes immediately, and appear as a part which is cut from another larger object. Consequently, Brochman (Hesselgren, 1969) writes, “uniformly color surface thus contribute to underline the form, multi-colored surfaces to dissolve it” (Hesselgren, S, 1969). In addition, he proposes to take another drawing of a cube and give to each of the surfaces its own color, for example red, blue, and yellow. As result, Brochman find out that, “now every impression that the cube is made throughout of a homogeneous mass has been conjured away and we are left, it seems, with several almost separate surfaces” (Hesselgren, S, 1969). As a result Brochman notes that the color can transform or destroy perception of form, by creating the new object, or splitting it.

Along these lines, another experimental study was conducted by Swirnoff. Among numerous researchers on characteristic of color, Swirnoff, note that color is one of the “constituents of form”, conducted a number of studies, and dedicated to effect of color on visual appearance of object.

One of the experiments according to this theory was that, two cubes of equal size were joined together at right angle by a square plane at their common base. It was supposed that the observer would be placed the frontally the object. Further, the face of the cube was divided by diagonal line into various patterns. As a result the division of each plane resulted in cluster of triangle which turns into impression of pyramids (Swirnoff,L, 2003, pp. 75-77)and it should be note that, value and saturation of color rather than hue effect to the shape.

Chapter 4

PERCEPTION

4.1 The Perception of Color

In general, preceding chapter has dealt with psychological impact of color. However all former data are given rather theoretical to explain how warm and cool color effect to human mind and emotion and how color became prominent in design decisions. Continuously, in this chapter the color perception and the way that people receive color are explaining.

Human perceive color principally in two different ways: as a characteristic of objects and as a phenomenon. The unexpected fact is that the first, regard as natural and normal, is based not upon the true appearance of the color but upon the experience and visual memory what human can actually see. It is obvious that the sky is blue, the grass is green and the earth is brown. The true view of color is generally regarded as the choice of painters and others who work with color. but regularly for other people, it is the object view that exist.

In order to find out way in the world to negotiate objects, identify things under a variety of different setting and different light conditions is important. In parallel with the size, shape, texture and brightness, color enable to recognize objects and situations that experience has taught person to identify ,thus freeing the perceptual sense for detection of the new and the less familiar (Lancaster,M, 1996, p. 31).

Additionally, color for Newton and the theorist was something absolute, given by the wavelength of light reflected from each point. Isaac Newton provide logic framework for understanding color. His early research into color resulted in his discovery that sunlight is collected of all the colors in the spectrum. He directed the sunlight through the prism. He observed that the ray of light was bent, and the result was an array of color with the different range of wavelengths, in the following order: red, orange, yellow, green, blue, blue-violet, and violet. This array is known as the visible spectrum.

When light hit a surface, some wavelengths are absorbed and other is reflected by its pigments. This process gives the surface its color. For example red is visible when only red wavelengths are reflected off the surface of an object, such as red apple, and the remaining wavelengths are absorbed. And when all the wavelengths are reflected off a surface are mixed, the result is white (Freinser,A, 2006, p. 4).

In this, there is a direct similarity between the brain and the information processing mechanism of a computer, although is much more complicated. The visual system is made to obtain a maximum of information with a minimum of attempt: that which is not immediately required, or can be taken for granted, can be considered unneeded; the eye has evolved to see the world in unchanging color, in spite of changeable, variable illumination (Lancaster,M, 1996, p. 33).

Additionally, perception is a very selective activity which examines how the concept of the visual world is formed. While it is clear that the person can only live in a functional environment, there is much disagreement on how these functions are expressed to be much more than forms following function. They are symbol, comforting or otherwise, of the places people live in.

Furthermore, it must be emphasized that perception can build up the images of the visual world. The visual process is one of the scanning. For example: the eye move, the head, neck and body, gathering images like the frame of a moving film. From these images the scene concentrated the information and stores them in visual memory (Lancaster,M, 1996, p. 22).

In general, most of the conceptions and judgments of the environment are based on human perceptions. The belief and thoughts about physical world depend on the perceptual abilities, about what human can see, hear, feel and understand.

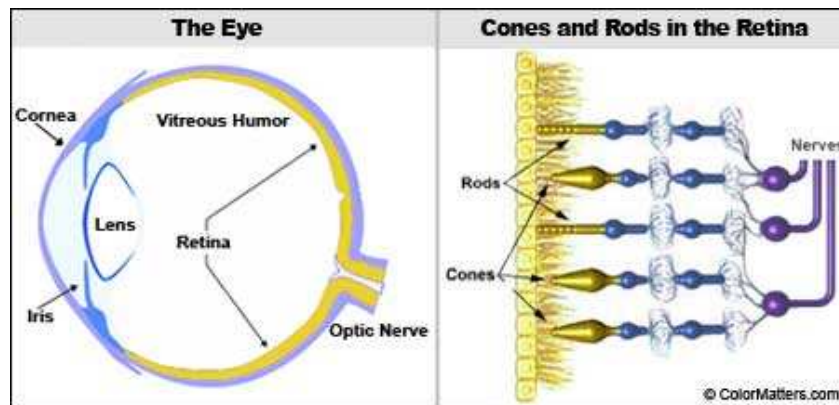


Figure 23. An Eye for Color
(URL 10: Manteghian, 2010)
www.ultimateavmag.com

4.1.1 The human eye and color sensation

Basically, the human eye consists of cornea, the iris, the lens, and the retina. The cornea, which serves as a preliminary lens helping to focus light, is the transparent covering in front of the eye. Light enters the cornea and passes through the pupil, the opening in the center of the eye. When the amount of light pass through the pupil is

controlled by a ring of muscles called iris. The path continues through the lens, which modifies its curvature to focus the light so that it produces a clear image on the retina.

Retina the inner surface of the eye is the part of the eye that receives image. It is located on the back of the eye and is regarded as a part of the surface of the brain that is sensitive to light. The retina contains two types of cells; rods and cones (Mahnke,F, 1993, p. 38). The function of the rods is to allow the brain to see weakly light. They do not distinguish hue, only black and white. While, the cones help to perceive hue. The cones in the eye only recognize red (long wavelengths), blue-violet (short wavelengths), and green (middle wavelength), and send these color messages to the cones of the fovea, an area at the center of the retina, whose cones transmit to the brain. The brain then absorbs the red, blue-violet, and green impulse and mixes them into a single message that informs that, the color being viewed. For instance: the reason of seeing red is because the red sensitive cones are activated while the green and blue-violet ones are relatively inactive. It should be known that objects emit many colored wavelengths (red, orange, yellow,green,blue, violet) but the eyes cone break these colored wavelengths into red,blue-violet,and green which the human brain processes into the colors that can be seen. Yellow is the result of the green-sensitive and red sensitive cones being activated and mixed while the blue-violet cones remain comparatively inactive (Freinser,A, 2006, p. 3).

4.1.2 Color vision

The human eye contains about 120 million rod-shaped cells that are sensitive only to light, and about 6 million cones shaped cells that are responsive to color; these are connected by series of nerves which are associated to the brain. Accordingly, in the central fovea and in the region next to it, most of the action of seeing takes place; for

example: the eye perceives fine detail and color; fovea sight is essentially cone vision and day vision; minor sight is rod vision, especially useful at night (Feisner, 2006).

In man vision, the fovea area of the retina will focus on form, brightness, color, and detail, shape and distance. At the same time, the retina will respond to brightness change or motion on the outer boundaries of the field of vision.

When two lights are flashed at the same time, one striking the fovea and the other the border of the retina, the light seen foveally will appear to flash ahead of the other. Similarly, blue lights require a slower blinking rate than red lights, if such blinking is to be seen (Feisner, 2006).

In seeing any color the eye has a tendency to produce a strong response to its opposite. So prominent is this reaction that it brings afterimages to view. By staring fixedly at a color image, the ganglions become saturated and the image becomes temporarily impressed on the retina. For example: when staring at a red area and then at a neutral surface, the after image of red will be green and the afterimage of yellow will be blue. The phenomenon has great influence on color effects and gives intensity to strong contrasts and to merge color arrangement.

Recent scientific experiment point out that afterimage effects take place in the brain rather than in the eye. This also seems true of illusions linked with brightness contrast (the fact that colors look relatively light on dark background and relatively dark on light background) (Birren,F, 1988, p. 22). A positive after image occurs on instant observation and is the result of different colored lights. When the afterimage is seen as the complementary hue of the observed color area it is expressed as negative afterimage. Negative afterimage occurs after a color is observed and required more than an instant glance (Freinser,A, 2006, p. 94).

The after images provide a way of determining the exact complement of a hue. It was supposed that red and green were complementary hues, but red or orange-red bring a cyan afterimage and green bring magenta. Blue and yellow intermixes were once thought to produce green, but a vivid green was not forthcoming. Violet-blue evokes a yellow afterimage and vice versa, with green nowhere in the formula. If we stare at a black and white image on the television screen, the afterimage will be white and black.

If the glance is diverted to a colored background, the afterimage is seen as a mixture of its complement and the background hue. For example: if the retina is saturated with an orange red image and the glance falls on a yellow background, making the yellow background appear even yellower. And if the glance is diverted to the same color as the afterimage, the eye is deprived of its proper afterimage and the result is visual instability (Miller, M, 1997, pp. 68-69).

The physiological phenomenon of afterimage is used as proof that complementary colors are the basis of harmonious design. Also, when complementary colors are placed next to each other, the effect is both pleasing because the afterimages of one improve the other (Mahnke, F, 1993, p. 29).

Consequently, the concept of complementary hues is based on the color wheel, on which those colors that are opposite are considered complementary.

4.1.3 Color Rendering

Color is one of the most challenging aspects in the environment. To deal with any color related problem, it is essential to realize that combination of pigment colors and mixture of spectral hues will produce a very different result. Red, blue, and green, are the primary colors of light, and the secondary are yellow, cyan, and magenta. It must know that mixing pigment and mixing light are very different. For example by

mixing, brown paint occurs, but red and green light make yellow light. When beams of light are mixed without any absorption, an additive process occurs and we get white light. However, when light lit through a color filter, a subtractive process occurs. To think about color relative to light and its effect we should consider about additive and subtractive color mixture (Erdman,D, 2007).

A common concept of color temperature and color rendering is that both describe the same properties of the lamp. Color temperature describes the color appearance of the light source and the light which is emitted from it and the color rendering describes how well the light renders colors in objects.

The color rendering index is a single number on a scale from 0 to 100 that rates a light source according to the illuminates a full range of color. A perfect light source would have a value of 100 CRI. Standard incandescent light has a CRI of 95 or better, fluorescent light falls in a range from 48 to 90 according to the types of tube (Pile,J, 1997, p. 24).

As an example: the image of the left is an example of a full spectrum of the source of Kelvin temperature similar to the natural daylight and CIR of 93. The image of the right side is from the halogen bulb which has a CRI of 98 and the reason that the image appears yellow is because the several shades more than the actual sunlight striking the earth surface (Hewson,B, 2009).



Figure 24. The illumination of same object with light with different CRI
 (URL 11: Luca, 2009)
www.lightcalc.com



Figure 25. An object illuminated with light sources of different CRI values
 (URL 12: Goldberg, 2010)
www.techbites.com

The result of this observation show that the scene lighted with in photo with the CRI of 90 is vivid than when lighted with the light CRI of 50. However a light bulb with light with CRI is not equal to light from another light bulb with certain CRI.

Photo: Javier Ten

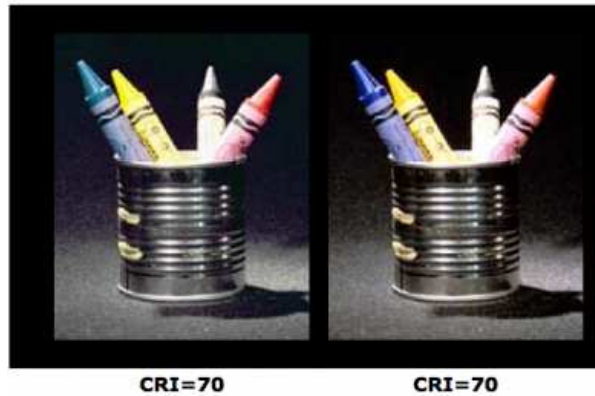


Figure 26. The color blue is different when illuminated with light of the same CRI value.
(URL 13: Rusell, 2009)
www.eye.co

In this example the two light sources illuminating the object have a CRI of 70, but the light source on the right renders blue more naturally than the one on the left.

4.1.4 Color Temperature

The term color temperature is describing the color of light emitted by natural sources. Initially, the concept of physical color temperature is based on the association between the temperature of black body radiator that is a theoretically perfect radiator (Davidson, M.W, 2004). According to Dill “A measure of the distribution of power in the spectrum of white, or colorless, light, stated in terms of the Kelvin temperature scale. The human visual system is incredibly adept at quickly correcting for changes in the color temperature of light; many different kinds of light all seem “white” to us. Photographic film is not so forgiving; daylight film is made to be exposed by 5500 K light, while “indoor” film requires light with a color temperature of 3400 K (or 3200 K, for professional film)”. The human visual system is adapted for changing the color temperature of light. Usually many lights seem as white. Usually daylight film is made to be exposed by 5500 K light, while indoor film require light with color temperature of 3400 K. on the other hand, photographs on indoor film which is taken in sunlight

becomes blue as the photograph taken outdoors in shade illuminated by blue sky(Dill,Ch, 2007).

According to Kelvin “study by heating the carbon the different range of color with different temperature will be produced. The black cube first produced a dim red light, increasing to a brighter yellow as the temperature went up and it produce a bright blue- white glow at the highest temperatures. In doing so, the color temperatures attributed to different types of lights which are connected based on visible color matching a standard black body, and are not the actual temperature at which a filament burns” (Birn,J, 2001).

In addition, color temperature applies only to natural source (sun, sky) and when it refers to the light sources such as fluorescent, and other arcs, the proper term is correlated color temperature. To demonstrate the range of colors which are generate by different light source. Usually warmer colors are represented by lower temperature, while the high temperature implies cooler hues (Birn,J, 2001).

4.2 Interaction of light and color

Color studies begin with the interaction of light and color, for without light human wouldn't observe any color, shape, or space. The understanding of light and color was assisted by Sir Isaac Newton's discovery that white light contains all visible color.

All light is seen as white except when standing in a space lit with colored light, either through colored glass windows or by virtue of particular lighting elements (Vodvarka,F, 2009).

Cool colored lights make the object appear cooler and vice versa. For example, furniture in a home that are reds and oranges can be more appear under warm colored light, and a space with blue and green decoration appear better under cool colored lights. If warm light colored are lit over cool colored objects and vice versa, the objects will appear darker than their natural color.

Seeing the same object under different colored lights will result different to the human reaction. For example: in the restaurant typically use warm bulbs such as red, to enhance the atmosphere and to make their food seem more appetizing (Karlen,Mark, 2004).

As discovered by researcher, blue light are used to decrease appetite. For this reason blue and cool colored bulbs are not typically used in restaurant. Blue and cool colors are using in hospitals and medical facilities due to their calming effects (Karlen,Mark, 2004).

How light gives an objects color

In order to use color it is important to know how light become color. Color is light and light is one of the known forms of radiant. Light is traveling in the wavelengths. The wavelengths have different frequency and the number of frequencies concludes the individual colors. For example Red has the lowest vibrations (430,000 times), Violet the highest (732,000 times).

Color is appearing by the light. In the absence of light all objects are colorless and they exist as a shade. A full range of the white light contains each color of spectrum, like: red, orange, yellow, green, blue, indigo and violet. None of these color exist, until the wave light reflect and enabling our eyes to perceive and transmit them to the brain.

As it was mentioned in the previous chapters, Sir Isaac Newton discovered that when sunlight is passed through the prism, the light bent, and the result is the colors which are display in an order. And the arrangement of the color is from the longest wavelength (red) to the shortest, (violet) with orange, yellow, green, blue, and indigo.

Of the method for producing different color is absorption and reflection. Usually the world is colored by absorption and reflection. When light hit the surface, some waves are absorbed and some of them reflected off the surface. These reflected light waves are picked by eyes and they then transmitted to the brain as color. For example: to appear red, an object will absorb almost all of the spectral wavelengths except the red, which will reflect. Or an orange is not orange, a grape is not green, they are colored by their molecular structure, which allows the wavelengths of light absorbed into the object to be reflected in order to be perceived by eyes (Ladu, R, 1989, p. 45).

As a result, according to a physical characteristics and chemical component of a material, specific wavelengths are absorbed and others are either transmitted or reflected, thus, contributing to the color appearance of an object.

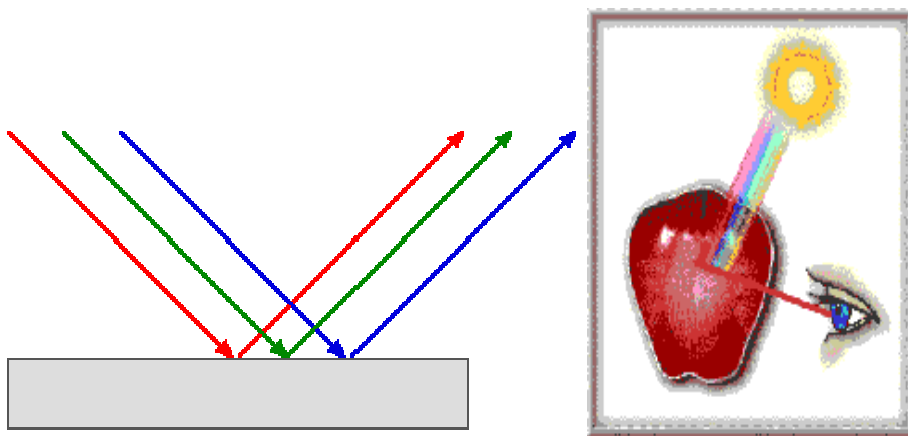


Figure 27. The picture is of white light going through a prism and showing color
(URL 14: Blanc, 2010)
<https://moodymiddle.wikispaces.com>

Chapter 5

COLOR AND INTERIOR SPACE

5.1 Variety of Functions of Interior Spaces

As it was exposed in previous chapter, the human belief and thoughts about physical world depend on the perceptual abilities that what a human can see, hear, feel and understand through the literature surveys' that without light no color, shape and space would be observed. Accordingly, certain colors were found to effect to human life and the sense of vision, can be considerably altered by color.

Every people have experience of space. Color can be seen; space can be described in terms of forms, objects and containment. Whereas, space represent the elements that they organize the place, and they give character to space. In the dairy life, people learn to negotiate objects and people, developing particular skills in sports, dancing and acting, which are process of understanding space.

According to the Greek philosopher; space would not be exist, because it could not be seen. At the same time, Plato, introduced the idea of geometry. According to him; "space was seen as the sum of all places, a dynamic field with directions and qualitative properties, which can be interpreted as space and character in the landscape." (Lancaster,M, 1996).

In the Renaissance, the Italian attempt to understand the space by analysis, and designing and the architects tried to impose a rational order on the patterns of the

cities, without considering the color. Afterward, in the twentieth century they succeeded to the vernacular architecture and discovery of color. The principle of the new renaissance was embodied in the new renaissance cities with the straight streets, unbroken roof line round arches, repetition element as a cornices, windows and columns of the façades (Lancaster,M, 1996).

Additionally, the most villages and old town are described as colorful place, such as; Italy, Austria, Mexico. To these must be add also, the traditional places distinguished by the natural color. Additionally, although color was implied as an aspect of material, but it was not major element in seventies, perhaps because of the architectural inhibition of that time. In addition, there has been exploration of color everywhere, but with lack of meaning and harmonization. But currently, color is easily available, mixable and limitless. Color can modify the proportion of the house, and it can create calm and exciting room. In addition, there is number of aspect that colors affect to the functions. A decision to work toward a scheme dominated by warm, cool, or neutral tones can be influenced by several factors. Like; climate, orientation (Pile,J, 1997, p. 158) for example warm color is more acceptable in cold climate, and cool color is suitable in summer and according to the orientation of the building; where window admit daylight, for southern orientation of the house is suggested cool or neutral colors and in northern orientation, warmer colors are suggested. Thus, this is a best way to arrange color selections within the space. In doing so, the process by which color is choosing in a design has effect to the interior design of the house (Pile,J, 1997, p. 159).

To quote Patrick Heron: “for the human eye there is no space without its color; and no color that does not create its own space. When you open your eyes the textures

of the entire visual field consist of one thing: and that is color” Laurence King Publishing (Lancaster, M, 1996).

5.1.1 Residential

Bedroom

The color scheme of bedroom interior design among the people is different. And it would be durable or soothing. There is no hard and fast rule for decoration of the bedroom. Planning the layout for the bedroom is an important part of the design. For instance by choosing the best position of the bed, table, partition, creating a walk in dressing room or even a suite bathroom the room will appear different (Taylor, L, 1998, p. 6).

By using bright color and avoiding the busy pattern, pleasing and tranquil environments are created. Shades of beige and cream accompanied with textured cotton are very comfortable together.

“The hues, especially shades of medium to dark browns, are perfect for the bedroom because they are nurturing and satisfying our souls” (Haupt, J, 2009). Explains CMG's Bredenfoerder:
"Greens and browns are a classic combo that's very popular right now," says Seattle-based designer Nancy Satterberg. "It's a great combo for the bedroom because of the feeling of warmth. You want to feel cozy in your bedroom." (Haupt, J, 2009).

Usually men have durable and bold color as selection for their room. As opposed to the bold black or any other strong color, natural grainy wood is often attractive to the room. In addition, bedroom interior design ideas for women according to the color scheme are softer. Some women might like the natural wood but others could also like the attractiveness of metal or wrought iron or floral styles (Hallett, I, 2010).

Generally there is one main difference between a child bedroom and older people in the house. The children's room should grow with the child. It is possible to

provide the child with the facilities style, comfort and safety. So before designing the children room it's important to know what effect to the children is. There are some cases which are effects to the children psychology such as: a dash of color, light, covers of the floor, piece of furniture, window to the child room and so on.

As it suggested for the color of children room, it is better to use bright color such as yellow, blue, pink for the children to make their room alive. Lighting also is another important element in children room. For example floor lamps are very useful and it can be placed near the play area. By using light with dimmers it provide this possibility to dim the light while reading the book for children. Another aspect that should be considers to the children rooms is floor covering. Safety should be the first thing to consider when selecting the flooring for the child's bedroom. So the friction and the fine material that are allergy proof should be devoid in the room. The essential pieces of furniture in a kid's bedroom are a bed, cupboard, bookshelf and study table. While selecting the furniture, it should be consider to the color and the quality of the material. The other important aspect in the child's room is window, so by using the shading, the direct sun can be controlled through the inside (Gupta,R, 2009).

Bathroom

The bathroom is one of the most intimate rooms in the house. A bathroom can use as cleansing the body and as a sanctuary in which to relax at the end of long day. The bathroom can divide in some categories such as modern and ultra modern. Modern bathroom have the new shape of bath, shower cabinet and it decorate with uncluttered style. Both the modern and ultra modern may change the mood. This mood change can be created in a number of ways. For example: well placed light fitting can affect the bathroom area and color of the wall (Lee,V, 1996, p. 10).

It is quite obvious that wall and floor need careful consideration in a bathroom. Paint are a good option, and now a days there are some products especially for kitchen and bathrooms. A plain painted wall in vivid color is a suitable contemporary style. However ceramic, marble are very practical in bathroom and suitable for the wall and floor (Taylor,L, 1997, p. 62).

Despite of the wide range color of bathroom, white color is more popular. The white bathroom depends on the surrounding, so it needs not to be limited to white alone. In some scheme other color are successful also. For instance: many people think that white tile bathroom is very suitable for the bathroom, but combination of white tile with the other element and texture and also colorful accessories like blue tieback to the room can make pleasure environment (Taylor,L, 1997, p. 38).

Living Room

There are some varieties of room types in environment that each of them needs to specific design. The interior designers should be familiar with the design issues. And the best arrangement of the room it depends on the circulation, balance, texture, harmony and comfort (Miller, M, 1997, p. 92).

In addition, there are a variety of factors which is related to the function. In a house or apartment with a several room, it is often possible to choose a space for color treatment. Alongside new ideas in architecture, the modern house has been shaped with the social and economical patterns. In the last two decades experience showed that the new changes affect to the house pattern. As town and cities grew in size in twenties century, the urban land price increased also. The house has now become the most valuable asset (Sweet,F, 1999, p. 14).

Most houses have range of functions. They allow people to live together or separately and they have different activity places which can make up people lives.

Over the century the house was divided in separate room, and each had separate function. For example: they provide open space, private and social space. Some areas will be full of activity and some area was made as quite place for reading and thinking (Sweet,F, 1999, p. 18).

A number of overview applies to color selection for different functional situation. The color scheme can influence to the several factor. For example: the color scheme which is dominated by warm, cool or neutral tones can be influenced on climate, orientation, activity. According to the climate: warm colors generally are more acceptable in cold climate and cool color is better to use in warm region. For getting the better result of the color, the orientation of the building should notice. For instance: in the southern orientation of the house, it's suggested to use a cool color while in northern orientation use of warmer color is suggested. As it was mentioned color can effect to people moods and activities, warmer color tends for excitement and activity and cooler color favor calm and consideration (Pile,J, 1997, p. 158).

Designing and decorating the living room is one of the most important aspects in interior design, because people are spending most of the time for sitting and relaxing in this area. So by taking a close look at the basic element of the walls, floor, lighting, soft furnishing, mixing style, texture and form, the designer can create the pleasure of designing and decorating of the living room (Taylor,L, 1998, p. 10).

As it was mentioned previously, the idea of using color might be very useful and successful in the living room. The process by which color is chosen in design it effect to the interior design. Painting all aspect of the room with the same color can effect to the volume of the space. This method can appear the room smaller or bigger. The idea of red room or green room may seem very attractive but it depends on the numbers of living space which are available in a house. So occupied can choose

among alternative strong color environment. For example when woodwork is using in the frame window or door, white or more chromatic color can be use to contrast with them. This strong chromatic can be used in furniture or accessories such as cushion. Floor is usually best to use in warm color. For example: natural wood flooring such as carpet makes the room warmer and more inviting (Pile,J, 1997, p. 160).

Kitchen

The kitchen is a heart of the house, is a friendly center of the house, a place where a family and friend gather and the food is prepare and eaten. With increasing the important role that the kitchen plays in modern homes, the designers can consider to the interior design of the kitchen (Lee,V, 1997, p. 60).

As this place is using for limited period of time, kitchens can make use of strong color for walls, cabinets and floors (Pile,J, 1997, p. 162). By creating color in kitchen it can stimulate the hunger. The material such as: granite, laminate, steel are another way to spice up the kitchen. One of the efficient ways to add color in kitchen is painting the cabinet. Since cabinets usually occupy the great part of the kitchen, adding color it can spice up the kitchen décor. For the kitchen wall the best way is to install the colorful tile, because it looks beautiful and clean.

Since lighting effect to the color, the best way is to use light to make the kitchen look brighter and appealing. So by using the spot light in the kitchen, it makes the kitchen more dramatic. Using color in accessories, flowers jar, bar stool, and pictures it makes focal point of color (Leo,D, 2008).

5.1.2 Non residential

Although the focus of the interest of interior design is often personal, it certainly needs not to be limited to the personal home environment. Life style today

dictated that people spend many of hours in working situations, shopping and they also spend time eating out, traveling and staying in hotels. The nonresidential environment should be as well planned as the home environment.

Color in public and work area is different with residential complex. For example, color in medical facilities is different with office interior or gallery interior. The difference is according to the people needs. Designer must be responsible about people needs, since it can effect to the behavior and attitude. In fact, Philosophy of color has changed in few years. For instance, medical facilities used to be white and cool looking. Today it has found that, the soft and neutral color in a variety of value, from dark to light are relaxing. The interior design of hotel, restaurant, and motel are dedicated to the culture and climate. In doing so, more lavish and pattern are using in reception area. In restaurant, red and orange are most stimulating to the appetite (Nielson,K, 1990, p. 74).

Office interior depends on the nature of the business. For example the perfect interior design for an interior designer office will be totally different from a high-tech computer company. One of the main objectives in the office design is to create an efficient working environment, which can support productivity and provide comfort for the users (Dianne,R, 2009). It's important to know how color affects the health and well being of people in the work place and their productivity. And it has proven that the office environment can effect to the job performance and communication. For example studies show that red, which is a warmer color, causes the heart rate to increase; and blue, which is a cool color, causes it to decrease (Marberry,S, 1994, p. 113).

In school and collage which is including the different functions such as office, cafeterias, dormitories; the classroom and lecture room should design in a way that

move the student attention to the board. In general warm and cool as climate and even orientation of the building should be concerned. Stronger color may be used for the front of the wall with color related to or contrasting with the green or blue of the chalkboard (Pile,J, 1997, p. 174).

As for the color of walls and fixtures, there are some reasons that why certain colors are better than others. To begin with, the most valued colors in the psychological sense are blue, red, and green. These primary hues are suitable for signs, end walls, and displays. They appeal on sight, because they are enjoyed by all ages' level and people with all cultural backgrounds. Because of the needs of attraction, wall colors in stores and shops can be on the clean, clear side. For example oyster white could be used as a general sequence color. End walls, walls around elevators, and freestanding columns could then be used in bright colors perhaps flamingo for women's department, sapphire blue for men, pumpkin or bright yellow for house wears (Birren,F, 1988, p. 88).

5.2 Various Effects of Color on Interior Space

5.2.1 Volumetric approach to color

Color may be used to modify and improve aspects of the size and shape of the space. Color may be used for example to draw attention on some element. For example: trim might be painted in a color with strong contrast with its surroundings to give emphasis to the elements it accents or it may be painted to match the surroundings to make it modest. Or a doorway can be given importance or noticeability. The general purpose of a space can be made by functional color choice to show calm or relaxing, excitement or activity (Pile,J, 1997, p. 99).

In general terms color can serve in four main functions: 1.it can catch attention, 2. it can hold attention, 3.it can convey information, and 4.it can make information

memorable. Usually, color is the most eyes catching. As a rule color can be identified from a distance more easily than a word or formal symbol. As an example: when looking for an item on a supermarket shelf, color is useful for helping to identify to products. In doing so, when the aim is to attract viewer attention, the combinations of color are not suitable for catching the eyes (Osborn, R, 2004, p. 60).

Colors are playing the role of combining shape, form with depth perception. This means that, the focus will be the brightness view of the room. This means that the area of focus mostly will be the brightness view in the room, and allowing the eye through the central field of lightness, darkness, or equal value at the perimeter. Along these lines, when color surrounds the viewer, dark color tends to enlarge or close the space. Usually, in the comparative color, the color of room behaves more like an object color.

Sometimes, the condition of value influence on depth which is related to the people view point. For designers who work within the space, the comparative color will advance and when used as a major room seems smaller: darker value, greater saturation and warmer hue. As surrounding color in interior space, the variation will make the room appear larger.

As a matter of fact, the theorists suggest that color for small room is better to be light to appear larger. In other condition, if the room is much larger and darker in value, a white room can appear small by contrast. A small room that is light in color can appear very clutter, if the objects in the room are darker than the room (Kopacz, J, 2003, p. 137). In doing so, to represent the spatial effect of color in terms of distance and depth perception it is worth to reviewing some of the suggestion of theorist:

1. Avoiding height saturated color for larger area. In this case it makes the surface or object seem larger.

2. By limiting of using the contrast, because contrast break the space. In doing so, by control the contrast and using the texture without reducing the scale, the space will be more attractive.

3. Avoiding the dark value, warm hue or height saturation on a ceiling, for increasing the height. By using the darker value, the height of the ceiling will reduce. In this case the color on the floor and the ceiling that are similar in value and different from the wall should be avoided. The eye will connect these planes effectively reducing the distance between them (Kopacz, J, 2003, p. 133).

To sum up, it is important to know the role of color in interior environment and how it reacts to the space. In this case, if the color advanced in relationship to it surrounding, it seems closer to the observer and it will appear the object and surface closer than they are. As an example of the corridor in the house in terms of the distance. The experiment shows that if the end wall is define by the color which is lower than the rest of the surface in value, the distance would be shorter. Therefore, the surface of the end wall will advance to the observer and it reduces perceiving distance.

5.2.2 Planner approach to color

Interior space, is define by parallel and perpendicular planes joined at right angles, wall, ceiling and floors although diagonal or curved wall, ramp vaulted ceiling can be found. The process by which color is choosing in a design has effect to the interior design of the house. Color can add perceiving weight to surface, modify the proportion of the house, and it can create calm and exciting room.

The vertical plane color can lead the eye though the space and emphasize the space elements at the end of the wall. Another way for emphasizing and make the attention to the viewer is using the single color to the small objects or the door and

window frame to appear more present in the room (Grimley,CH, 2007, p. 152). A change with color in plane can be separate adjacent wall surface of a room by detaching them at the corner, thereby, “If a dark or boldly patterned wall stands between two light ones, it will seem quite free in space, but if all four walls are dark, or if all are patterned, the room will seem small.” (Mock,E, 1946).

Monica Billger, in her doctoral dissertation, stated that the “feasibility of working consciously with colors is limited by our knowledge about how the appearance of colored materials varies with context, that is, how a colored surface is affected by its spatial situation” (Billger,M, 1999, p. 5).

For designer who work as an architect through the space, some comparative colors will advance, and when used as a major room color, these changes will make the room seem smaller: darker value, greater saturation, and warmer hue. As surrounding color in interior space, some changes will cause to make the room appear larger with lighter value, lesser saturation and cooler hue. In addition, a color scales effect to the background which has contrast with object. In some cases the high saturated object looks larger on low saturation than in same object in low saturation on background of similar saturation. (Kopacz, J, 2003, p. 133).

Consequently, the designer must have knowledge of these properties and their relationship to the functional, spatial, and lighting aspect throughout the space. The designer and the user must separate personal taste from professional design (Kopacz, J, 2003, p. 134). Thus, in this case, for providing the proper interior the following notes will be suggested:

- Providing timeless color harmony to attract the people.
- Use accent colors for finishes that are subject to periodic change (carpets, wall coverings, upholstery, etc.)

- Provide small amounts of intense colors in borders, accessories, and artwork for visual stimulation.
- Use warm colors to make a room seem smaller, more “human” in scale; warm colors appear to advance toward the viewer.
- Use cool colors to make a room seem larger, and more open; cool colors appear to recede from the viewer (AMC, 1999).

In addition, floors are the supporting base for everything, the structure, furniture and people. Usually dark colors identify the floor. White floor can make the furniture seem “float”. Mahnke and Mahnke warn that white floors may be “touch inhibiting”_ not to be walked on (Kopacz, Jean, 2003).

Along these line, in responses to the force of gravity, color and pattern on ceiling and floor is experienced largely in terms of visual weight One wall of advancing color which is surrounded by receding color can be dominant by itself. Also advancing color can effect on wall that stop the movement, such as where a passage way ends a corner. It can give attention to selected areas, such as reception areas, elevators, or entrance; it can also divert attention away from other areas that should be deemphasized (Kopacz, Jean, 2003).

In association, what people perceive is affected by the color of the material or the color which applied to the surface. According to the Freisner (2000), the contrast affects to the perception of architecture. For instance, the light and dark contrast can create three dimensional effects on flat planes, with broken surface appearing smaller, and the smoother, flat surface appear larger. For example, “a building containing many (dark) windows embedded in white grid or surface will appear smaller than the same sized building with blue tinted window set in a steel wall” (Feisner, 2006, p. 143).

Emphasize design element

Color plays an important role in attracting attention, for it is seen before form. The artist should set the focal point of the work in order to express the message intended (Freinser,A, 2006, p. 72). Some people are blessed with a natural feeling for color. They usually know which colors will go together, how to balance tones and when to use an accent shade (Hunter,T, 1998, p. 11).

Emphasis is the creation of a focal point of an area which is important to draw attention. As an example of focal point it can be mentioned to the beautiful fire place, a view from a window or art glass window (Pile,J, 1997, p. 99).

Without color, the element would be emphasize by making it larger, or isolating them from the rest of the composition. With color however the tiniest spot of red or orange amount green or neutrals will shine out to make attention (Pipes,A, 2003, p. 167).

Objects may be important because of meaning attributed to them. Sometimes just being huge or tiny or complicated can make the objects important. In doing so, since the color has contrast with the background the more visible it becomes; and since the object blend with the color background, the less visible it happens (Miller, M, 1997, p. 21).

When there are functional concerns to be addressed, color can be used to articulate these in a positive way. One of the most common detail elements of color is that of attention getting. In fashion the most important details are given prominence through selective use of contrast. The same is true in several forms of architecture. Contrasts are used to draw attention to some elements of spatial form over others. As an example: red is a strong predominating color over large areas, it is often used as an accent color to liven up quite, cool understand color schemes.

Lots of things in a room can be good for color, table runner; window coverings and art work are all good to have nice look. Sometimes the main surfaces like walls and floors need light or bright tones, window and door frames a little darker .in doing so, by painting the trim wood darker than the wall the attention will be more. (Tuberman,L, 2010).

Emphasizing the small element of a design door and window trim reveals of the ceiling or the connection of materials can draw the viewer's attention to subtle aspects of the design that might be missed on initial inspection. Painting elements such as reveals in the ceiling a darker color than adjacent objects can make the objects appears to float. Emphasizing the color of a door in a wall can cue the viewer to its importance. A red door in a white wall will seem more present in the room than a door within a wall of the same color (Grimley,CH, 2007, p. 152).

5.2.3Accenting effect of Color

An accent color is element that is small in size but they are powerful in color to draw attention. It is also most easily changed so that it can move the totality of a color scheme with minimal difficulty. Usually accent color is chosen to contrast with the dominant colors of a scheme in one way or another. Where the basic scheme is close to neutral, any strongly chromatic color can become appropriate as accent. For example in a scheme that emphasizes creams, white and beige an accent could be a red, a green or a blue or other chromatic tone. In the same way, in a scheme that uses white and grays as a basic color, the chromatic tone will act as an accent .The contrast in each of these cases is according to the color saturation. With the basic color de saturated, any saturated tone is suitable as accent (Pile,J, 1997, p. 102).

The suitable accent color is depends on the background of the colors which is combined with. For example to make lively contrast if the warm sandy yellow is

chosen, the accent color could come from the cool side of the color wheel same as blue or green, or the choice of red or pink accents which are almost the opposite of yellow on the color scheme are also prominent.

Accent color to be successful doesn't need to be strong contrast. Adding accents that are closely related to the basic color scheme has a harmonious and restful effect, and can be used to emphasize individual tones (Kimberly,K, 1992, p. 37).

Primary colors on a white wall can make a room look juvenile; subdued colors always end up looking more sophisticated and calm" (Schmidt,B, 2007).And also she says. "When having a piece professionally custom framed, remember that less contrast between the art and wall provides a more classic look (Schmidt,B, 2007).

"If you are dealing with a plain white or beige wall, consider matting all artwork using the same accent color. Even if the art isn't related, a gallery is created through the mat board." (Schmidt,B, 2007).

"Hang art in white lacquered frames with white mat board against a brightly colored wall. There will be a nice contrast while creating a cohesive focal point. For a bright color, Kelly green is very trendy right now," says Schmidt (Schmidt,B, 2007).

According to the Mc Murray, "cool colors like green and blue are good for places where you want to relax. Warm colors like red and yellow are better for areas where lively activities take place. When selecting a color, it helps to look at what you already have in the room. A color that exists in artwork or upholstery fabric can make a great choice for an accent wall," she says. "But don't pick the dominant color. If you choose red and you have a red sofa and a red rug, you aren't accenting a wall; you are carrying on the same color scheme. It's better to choose another color that complements your surroundings" (Bowling,Mary Jo, 2002).

In addition there is some principle to creating the accent wall: by accentuating the best features. It means that by taking the wall as a focal point. Such as: a fireplace wall, an unusually shaped wall, walls holding dramatic artwork, or the wall behind a bed's headboard. These are where the eyes go first. An accent color only makes a focal point

more dramatic but more than one color on such a wall can create an unsettling effect (Bowling, Mary Jo, 2002).



Figure 28. Accent color
(URL 15: Stanely, 2010)
www.homedesignsphoto.com

5.2.3.1 On proportion of a room

In general meaning, proportion” is a relationship between the size, degree and shape between the element of the object and the way it relates to the total physical form. Usually, there are three types of proportion which are consist of “geometric”, “harmonic” and “ arithmetic” (Wallschlaeger,C, 1992, p. 196).

In the interior design, the proportion is characteristic of a shape. Notably, the meaning of proportion of a shape does not only concentrate to the dimensions. Several issues effect to the proportion of room and the location in plan, for instance the position of function of the room and the way of furnishing of the room and choosing the accessories will shape the space (Grimley,CH, 2007, p. 77).

According to the Ching (1979), the concept of the proportion is to create a sense of order in element. Generally, the observers would not perceive the proportion relationship between object relatives to each other and the whole. However the order can be recognized through the experience (Ching,F, 1979).

Although proportion, relate to the experience, but there are still number of proportion systems and rules that created for the practice in architecture and interior design field. Hence, the best known theories of proportions which were used through the century were “Golden Section” (Ching,F, 1979). Nevertheless, as some principle of proportion is important in the design, the basic value should be known for successful application in practice.

In general terms, the proportion of a space, it can be related to the width and length, complex and irregular form of the shape. In general, proportion is considered to the series of related element. For example, the designer should consider to the proportion of the wall and window and the space between them. The character of a room influence by the proportion of the space. For example: the room which is long and narrow is totally different with the room which has square plan with the long ceiling, because square is a geometrically stable but it's very difficult to furnish it but rectangular spaces are the most common shape of the room, so the arrangement of the furniture and the circulation is more easier (Grimley,CH, 2007, p. 78).

Room can be arranging in a proportional sequences of spaces. When a designer uses a rule of proportional system they consider to the items such as weight, balance designing the space in between to the design. Beautiful proportioned façade also is another aspect that designer consider about it. For example: the proportion of window and the spaces between the window, the proportion of the wall, column, are the aspect that the interior designer should consider during the design (Grimley,CH, 2007, p. 80).

Color also can change the proportions of a room. In high ceiling room, corridors or narrow rooms, by contrasting the dark floor and ceiling colors with light wall the proportion of the space can change. This has the effect of appearing to lower

the ceiling and increase to the width of the room. In this way, a long room appears shorter if the end wall used as warm color (Kerrigone,K, 1992, p. 56).

5.2.3.2 On material

Every interior space has some unique qualities attached to it. If it was visited a natural outdoor space like a forest, it will be noticed thousands of varieties of “textures” such as wooden barks, leaves, stones, water etc... All these natural elements create a unique visual effect which effect on human mind. In doing so by using carefully textures and materials wonders in interior design can created (Vaidya,Sh, 2007).

Materials are core of the interior designer’s works. Materials have a direct manner of color, light, texture, and pattern that the designers will need to deal with every project. So in this way, designers must learn the numerous materials, from the purely functional to the aesthetic (Grimley,CH, 2007, p. 154). In the architectural environment which is a kind of physical environment because of the elements such as warmth of fabric and curtain, floor covering, and wood furniture that they are recognized as primary transition elements, they relate people to building and make architecture livable (Miller, M, 1997, p. 129).

The most commonly used materials in interior design and decoration are cloth for linen, wood for furniture, rubber/leather for flooring, paper as wallpapers, plastic for accessories like lampshades and other decorative items, steel for furniture (Vaidya,Sh, 2007).

One of the most commonly used for furniture, door frames shutters is wood. The main reason behind this is because is very easy to work with wood. Its very popular choice between furniture designers. They are very soft; at the same time very endure. Also wood offer a rich variety of textures, colors and appearances and they

have so many possibilities of shapes. Its abilities, is to work in many ways. It gives a rich flexibility in building everything from very small pieces of furniture to wall, stairs, ceiling and huge auditoriums (Soucek King,C, 1995, p. 10).

There are some other items which are using in interior design, such as Cloth, Rubber, plastic, Steel and etc.

Wood: wood material mostly used for furniture, door frames shutters. The main reason of using wood is that, it is easy to work with it. For example; the art of carpentry is very old profession. It is very popular choice among the furniture designer, because of the nature of wood like softness and the same time the amount of strength it can withstand. A polished wood is more luminous than an unpolished wood. An unpolished wood reflects light directly off from the surface, while the deeper color of wood is the result of multiple reflections (Miller, M, 1997, p. 133).

Cloth: this material is very smooth which is suitable for bedroom where comfort is a very important factor. The biggest advantage of this material is that they are washable so maintenance of them is so easy. This material can be painted so it can be add to the beauty of the space (Vaidya,Sh, 2007).

Rubber: is used as PVC flooring, they very durable and they are using at the floor. It can be using in any style, and any colors. The PVC flooring affect less than tiled flooring in atmospheric changes. Other types of tiled floorings or even wood in flooring because of the expansion can have a direct effect on them.

Plastic: There are infinite uses of this great material, because of its artificial nature; they are manufactured in different color, shape, size, strength. The biggest advantage of this material is, they are waterproof and electrical shockproof. They are very light to compare with the other material. Entire furniture pieces such as chairs, table, can be easily shaped as a model in plastic.

Steel: this material is mostly used in interior design and the main purpose is to give support and weight to the floor. That's why they use steel as structural frame that carries the weight of the people who are going to use the furniture piece. Furniture objects that have been designed with a combination of wood and steel look much balanced from aesthetic point of view (Vaidya,Sh, 2007).

5.2.3.3 On pattern and texture

Texture is a surface characteristic which is appearance in every element of interior design. Texture is appearing smoothness or roughness on the surface which is appearing different to the eye than it actually is to the touch. Smooth textures usually are associate more in high style interior while rough textures are more casual. A balance or a variety of texture is necessary within this ambience to create proper order. For instance: if every texture reads as smooth, the interior would seem cold and unwelcoming. And differently, if the texture is rough, the interior may become harsh. Thus, texture can be used by different surface to experience different preference (Nielson,K, 1990, p. 42).

The word texture has two meaning in the interior design. On the one hand is describing the differences between the smooth surface and rough surface. On the other hand is describing the quality between plain surface and wall paper in or painted in the surfaces. For example wood is texture which gives the sense of rough and also it gives the sense of grain which the eye can see (Garrett, M, 1998, p. 52).

Remarkably, the perception of color it may occur in local color of surface, gradating in hue, value and saturation. As a result the texture may appear to have some depth and thus perceive as grain, or can merely remain as plane (Hesselgren, S, 1969, p. 112).

Pattern is essential in any room. They can be fine or coarse grained or very rough and large in scale such as field stone, or in small scale. And it can create the

style and make the ornamental the color scheme, whether it is used in small areas such as cushion, decorative artwork and tile, or in much larger area such as wall covering, ceiling and floor. The pattern design shouldn't be undervalue. For example design in the bold color shows better than plain color in color surface. Scale is another aspect which is important to be consider in design. Large scale wall paper design in a small room, it appears the room smaller and busy. But mixing all sort of pattern can be show the room looks busy. But by relating them in correct way, it can be successful (Kerrigone,K, 1992, p. 67).

Decorating with texture is the life of the rooms. Texture in interior design is a technique which gives a sense of depth and interest to the house rather it is wall or brick, ceiling texture, stone, wood, or texture of decorator fabrics. One of the decorating layers is the texture of walls and flooring. The wall can be painted as a background. For texture on an accent wall usually faux painting are suggested in interior design technique. Another way of using the texture is using the wall paper or wall coverings. Using the stone, brick, marble or tile as textures to the fireplace or other part of the house to make the house alive.

Wall to wall carpet, pavestone, tile, wood, area rugs. All of these materials give the wonderful interior decorating options in texture (Freeman,T, 2001).

Texture and pattern gradient on a receding plane can be influence to exaggerate or minimize the effects of its convergence. For instance: The apparent depth of a receding plane can be exaggerated by using a coarser texture or a larger scaled pattern nearer the viewer and a smaller texture or a smaller scaled pattern farther away or in the other way, the apparent depth of a receding plane can be minimized by using a finer grained texture or a smaller scaled pattern nearer the viewer and a coarser grained texture or a larger scaled pattern farther away (Miller, M, 1997, p. 38).

5.2.3.4 On elements and display

Accessories are items smaller than furniture that makes up the visual field of an interior. Types of accessories are including wall clocks, umbrella stand, and magazine racks; items that have personal sentimental value, such as souvenirs and magazines and family racks; and objects with specific aesthetic value, such as collections and artwork. Fundamental to the idea of accessories in an interior is that they are worthy to display rather than store them (Grimley,CH, 2007, p. 258).

Accessories play two important roles in interior design: first, they introduce a smaller scale of elements within a comprehensive design strategy. Second, they personalize a space, since accessories can convey individual interests, sentimental attachments, or a specific aesthetic taste.

5.2.3.5 On accessories

Functional accessories include the items that need to be on the space, such as bathroom towels to wastepaper baskets to television sets. They can have aesthetic value, which a good designer can add into the design of an interior. For example: Kitchen pots and pans can be transformed into accessories if the designers display them in good way to the shelves. It means that they should give worth the objects. This choice could be inspired by the clients' desire to communicate their love of cooking as much as the wish to add character to the kitchen through small scale objects. Books are another example of an everyday object that can be elevated to the role of an accessory, either collected on open shelves lining a library or as a single volume displayed among objects on a coffee table.

There are the other types of accessories that play an aesthetic role in interior design. Such as flowers, plants and family photographs. This group of accessories is best to composed as large compositional numbers of scale and balance. Additionally,

large works of art display as focal point in a room and lesser artwork are display in composition whether they arrange in table or hang in the wall. In this case, the artful composition can make their own aesthetic (Grimley,CH, 2007, p. 258).

5.3 Color scheming

In art as well as music, harmony comes from a pleasing arrangement of the parts. There are many tried and true way to use color in correct way, which is based on how colors contrast with or enhance one another, how color temperatures are juxtaposed and how well our eyes are willing to accept optical tricks.

Color schemes are using to create style and appeal, when they use together they create an aesthetic feeling to complete each other in color schemes. A basic color scheme will use two colors that look appealing together. More advanced color schemes involve several colors in combination, usually are based around a single color.

Additionally, Color schemes also include different shades of a single color; for example, a color scheme that mixes different shades of green, ranging from very light (almost white) to very dark (Pile,J, 1997).

As a matter of fact, the modern color theory comprised a set of basic color combinations which considered as harmonious and widely used as a base in various color applications ranging from architectural to a digital medium. The basic color schemes can be described as follow:

Achromatic color combination:

Generally, achromatic colors are the group of color that has no hue or saturation but brightness, such as neutral color like white, black, and various shades of gray. Neutral colors are useful in modifying the values and intensities of all hues (Miller, M, 1997).

Monochromatic color combination:

The monochromatic are create by shade, tints, and tones of one hue or a neutral, but with varying saturation or lightness for example: different shades or tint of red (Miller, M, 1997, p. 72). Such color combinations show the feelings of unity, harmony, peace and continuity. For a successful result, it must be careful to use color proportionately. Single hue is used with a single consistent intensity is sometimes designated as a monotone scheme. An all white scheme, or an all pale blue, will be a monotone vision of monochromatic (Pile,J, 1997, p. 53). A monochromatic harmony that is based on value, a ranging of 10 on white and 1 on black will allow imposing a proportion on each of the values to be used (Freinser,A, 2006, p. 75).

Analogue color combination:

The analogue color or related harmonies combine usually more than three color next to each other on the color wheel, and they produced by the hue. This three hue are unified because of a shared color. Analogue schemes become most definite when the common hue is the primary hue. They offer the unity and the sense of calm, and they are most harmonious when the middle hue is the primary. For instance an analogue scheme consisting of red, red-orange, and orange would not be as harmonious as one of red-orange, red, and red-violet (Freinser,A, 2006, p. 75). Although analogue color scheme is similar to monochromatic color combination but there is more variety on the analogue system. The colors that form an analogous relationship will usually fall within one fourth of the full color circle, that is, within three or four segments of a 12 hue circle or six or seven segments of a 24 hue circle. Typically analogous color schemes might use blue-green as a key color together with blue and green (the hues on either side of the blue-green) or the blue green key color could be used with green

alone or with green and yellow –green adjacent colors on one side of the blue-green (Pile,J, 1997, p. 54).

Complementary color combination:

The complementary color is built on hues directly opposite each other on the color wheel. For example: red and blue-green; yellow-red and blue; purple-blue and yellow. These harmonies offer more contrast and introduce both warm and cool colors into the environment (Mahnke,F, 1993, p. 31). Using color in the correct proportions is important when utilizing any of the complementary color schemes. The general group of complementary schemes can be divided into sub-groups which are defined as follow:

Double complementary:

The double complementary color usually is further more than complementary color, because they are using in two pairs of complementary. In this case the two hues on each side of the wheel must be placed much closed. This combination is based on two sets of complementary hues and has less contrast than complementary. As an example with blue and green on one side and orange and red on the other, this is the total of four hues. in doing so, two primary and two secondary are in use with only one primary and one secondary omitted.

Usually double complementary schemes are most workable when two or three hues have low intensity, shades or tints rather than strong and bright tones (Pile,J, 1997).

Split complementary:

The split complementary it consists of one color and the two colors adjoining its complementary color. For instance, the complementary of red is blue-green, which is bordered by blue and green. The arrangement therefore includes red, blue, and

green. Hence the contrast is less intense than in the complementary schemes but it's more intense in the double complementary. Such schemes provide interest and variety. In general, split complementary schemes tend to be more muted than complementary schemes (Pile,J, 1997).

Triad color combination:

If the three hues are selected from the color circle so that their positions form an equilateral triangle, those hues form a harmonious triad. In the triad color scheme, the hues for each triad scheme are central from each other on the color wheel. Triad color schemes result in a dominance of warm or cool. The combination is as follows: pigment; yellow, blue, red (yellow-green, blue-violet, and red-orange) (Freinser,A, 2006, p. 76). if one color in a complementary dyad yellow / violet is replaced by its two neighbor, thus associating yellow with blue-violet and red-violet or violet with yellow green and yellow orange, the resulting triads are likewise harmonious in character (Itten,J, 2003).

Tetrad color combination:

Such combination, four color in either a rectangle or a square across from each other on the color wheel. There are two tetrad graphs on the wheel, one that is the square and the other one is that is rectangle. As with the triad, these create less contrast, but more balance (Itten,J, 2003).

In addition there are also other color scheme classifications which are not referring just the color wheel. Such as:

Neutral color scheme: A color scheme that includes only colors are not belongs to the color wheel; they are called neutrals, such as beige, brown, and gray.

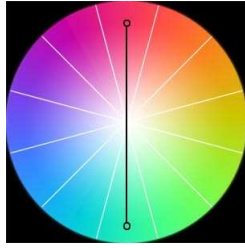
Accented neutral color scheme: Neutral colors of color scheme, are white, beige, brown, grey, or black, and one or more small doses of other colors. For example: brown and beige with blue, gray and black with red.

Warm and Cool Color Schemes: Warm color scheme does not include blue in the color scheme, and also cool color scheme does not include red. For example, a color scheme that includes "warmer" colors, have orange, yellow, and red-orange in it. "Cooler" colors are green, violet, light blue, etc (Gordon V. Smith, 2010).

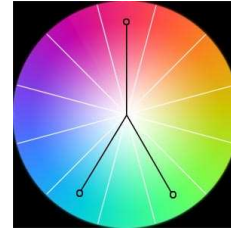
Light-on-dark color scheme: is a color scheme that uses light-colored text on a dark background. Color scheme with light text on a dark background is easier to read on the screen because the lower brightness causes less eyestrain.

Dark-on-light color scheme: is a color scheme that uses dark-colored text on a light background. For example: red appears more brilliant against a black background and somewhat duller against the white background. (Quiller, Stephen, 2010).

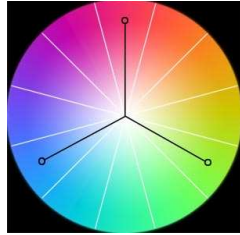
To summarize, every basic visual element can be involved for the variety of purposes, for example it can affect to proportion of a room, also to human simulation of size, length, and depth and also to direct attention, emphasizing function for specific meaning. The color scheme effect to residence or non residence spaces and may incline either towards positive or negative direction.



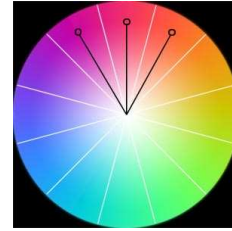
Complementary



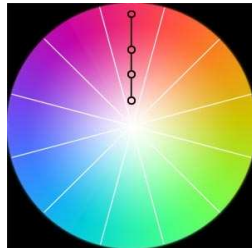
Split complementary



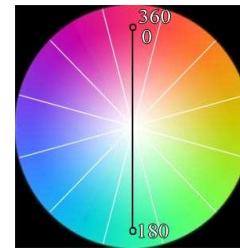
Triad color combination



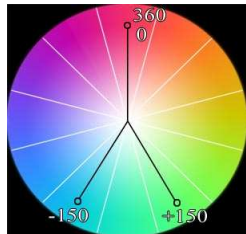
Analogue color combination



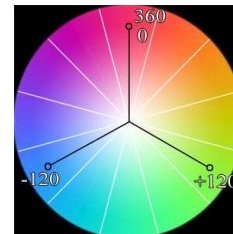
Monochromatic



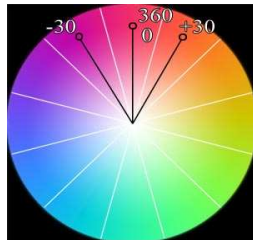
Complementary color scheme



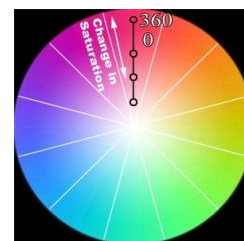
Split complementary scheme



Triad color scheme



Analogue color scheme



Monochromatic color scheme

Figure 29. Color scheme

(URL 16: Smith, 2010)
www.chainstyle.com

Chapter 6

HOUSE AS A SUBJECT OF INTERIOR

ARCHITECTURE

6.1 House and its Meaning in Human being Life

The meaning of house is very often connected with comfort, relationship, family, friends and tradition to the life. A permanent basic or foundation setting for the lives of the inhabitants of a house, and one in which they can create, alter or modify as they wish (Goldman, K, 2008).

House is one of the major issues in a country. Therefore, is affected by the country economic characteristics. "House environments take up the majority of developed land and we spend long periods of our life within them" (Biddulph, M, 2007).

Each generation, each occupants, changed what he found. That is why in restorations more than one ceiling is found, or why panelling hides earlier, often more beautiful, wall decoration, why conservatories are added, doors blocked up and others formed, balconies removed or added. These alternations were not always done for functional purposes. They were done to keep up with the times or because notions about living changed (Kawano, N, 2007).

The inside of each home or apartment of interior space regardless of social and cultural, ties to the ruling family's living space, so it won't be useful without desires, needs, attitudes and their habits. And the relation and the shape of the space are very important (Blookshian, A, 2010).

According to Davidoff “People define places, places define people. This generalization is crystallized in the relationship between woman and dwelling” (Cook , J, 1972).

6.2 The case of Iran

Iran is home to one of the world's oldest continuous major civilizations, until recently Iran was a rural culture. Even today Iranians spend most of the time in the open air. At the same time Iranians will try to bring the outdoors inside whenever possible. The wonderful carpets that every family strives to own are with flower and animal design. Fresh fruit, flowers nature, garden, poetry are a part of every entertainment (Beeman, W, 2007).

The most notable art work is seen in the masterful woven carpets. The cities of Ardabil, Tabriz, Kashan and Isfahan are the best producers of Persian carpets. For example in Tabriz many of the rugs are made for prayer and contain a centralized medallion of sorts.

By considering deeply to Iranian life style, houses in residential neighborhoods were built with abutting walls, each home having its bit of the outside in the form of open courtyard with a pool, and a tree and a few flowers or a kitchen garden. The concepts of “inside” and “outside” are using in architectural themes. The inside, or “andaruni”, is the most private in architectural space. It is the place where family members are more relaxed. But the outside, or “biruni” is by a contrast a public space where social niceties must be observed. So every family creates both kinds of spaces. Even if they live in a single room (Hillman, M, 2007). Seven thousand years of Persian culture today can be likened to an old ark which is in corner of Iran that this generation does not benefit from it.

6.2.1 The way of living in Iranian culture

Iran officially the Islamic Republic of Iran is a country in western Asia. The 18th largest country in the world and has population over 60 million. This country neighboring the Gulf of Oman and Persian Gulf in the south and the Caspian Sea in the north, and it edges between Iraq, Pakistan, Afghanistan and also it shares of borderline with Turkey, Turkmenistan, Azerbaijan and some kilometers with Armenia (Wales, J, 2010).

In Iran, the family is the basis of the social structure. The concept of family is more private than in many other cultures.

The life style is depending on the person. A Persian can be poor, depends on the person. A Persian can be poor, wealthy or of the middle class. But in any region they keep their culture.

Until the 19 century, people did not use the chair. They were sitting cross-legged on the floor preferably on a carpet with cushion. Most of the Iranian houses were one where any room, with the exception of those used for cooking, was used for any social purpose, like eating, sleeping, entertainment, business or whatever else one can conceive. One spread a dinner cloth, and it was a dining room. After dinner, the cloth was removed, cotton mattresses were spread and the room became a bedchamber. So in this case, Iranian families could live and entertain many guests in much less space. But in the 20 century every family had a room which stuffed with uncomfortable furniture for important visitors and guest. And when the guests leave, family member go inside and they relax on the carpet (Beeman, W, 2007).

But furthermore, the tradition life replaced to the modernity and tradition became ordinary in people life, the new generation and wealthy family get exhausted of basic belief so they tried to improve their life style by following the foreign culture.

So the interior designers, architects and artists start to prove themselves by creating new idea of design and bringing the new material and changing the environment of the city, step by step the tradition replaced to the modernity. The design of the house, the minimalist form, the geometrical building shape, the interior design and decoration was dominate in human life.

6.2.2 After image of revolution

Furthermore, house became an important role in society, step by step the construction at once raised in Iran. Villagers rush to the cities, built new factories, settlements and establishing new standards was formed in areas. Clearly, the old and traditional construction replace to the modern architecture, although they still keep their culture. This diversity has emerged from the special needs of people in different times. The interior space has been considered more by architects and interior designer. The artists and architects in the world proved that they have high ability because of the unique historical effects that they left. The decoration industry grew. Walls were removed and discarded the traditional fireplace. People celebrated their home ownership, and all were looking for modern architectural styles. In doing so, most people spend their earnings to their home. The age of the traditional house was finished. The modern house changed people's life style. The houses come out with new view. The bright color and geometrical shapes used in construction to change people mood from war. They Poured down the walls and make the room's open along with lights than were the traditional style. The color was essential in houses and wall paper with light color was used in the houses. The angles and shape was used a lot in the house and it was interesting and fashionable for people. The living room which was used only for wedding and ceremony, it changed to permanent space. So the family spends more time in the house. The living room and kitchen were merged to each

other, and the kitchen was not in the corner or in the backyard. The central heating systems were used in all houses (Ahari, A, 2006).

consequently the industrial and mechanical life dominate the society, for escaping from the cultural duality that willingly or was created in society People need a cultural policy which are positive and constructive, so this is happen by blending the rich Iranian culture with the tradition and civilization.

6.3 Analyzing the color usage in the Iranian house

Theory about color is very important in terms of interior architect. However, it is furthermore important to bring this theory to a testing state with such an aim, use the theoretical aspects about color has been addressed. In trying to do so, some examples have been chosen in terms of this analytical observation.

The research and experimental investigations are analyzed regarding to the major effect of color in human life. Furthermore, psychological influence of color is analyzed in terms of color suggestion through interior spaces according to the people needs.

The analysis of the research was done: 1. According to the different region of the houses in Tehran, (as it was mentioned in previous chapters, Tehran is a big city with different types of the house, such as villa or apartment).

2. According to the user groups: wealthy or middle class. So every people according to their social and economical situation designed their house, by interior designer or by their own experiences.

3. by considering of using all three dimensions of color are used in the space and the way that effect to the size, length, depth, weight, position of an objects within space, temperature . As a matter of fact, depending on the way in which specific color are utilized, may dispose toward positive or negative direction.

Ultimately, this analysis of the color usage of the Iranian houses has been done according to the theoretical information included in the chapter such as: a representative visual from the space: in this part the different point of view of the living room are photographed. Schematic plan of the dining room: the plan of the specific space which supposes to analyze about it is drawing. Assignment of the specific colors to the main elements in the composition of the living room: in this section, the basic element of architecture like wall, ceiling, floor and the accessories are defined with their existing color. Color scheme of the chosen living room: in this segment the categories of color scheme are explained such as monochromatic color combination, achromatic color combination, warm, cool, neutral color and so on, are explained. physical explanation: The physical explanation explain about types of dwelling, size of the house, size of the living room, number of inhabitation, occupation of the inhabitation and the function of the house. Psychological sides of the color scheme used in space: in this part the color scheme with the psychological aspect of the color are explained in the space. Definition of color which is used for specific elements of the space: This part, the spots of color which are used in the element of the space are mentioned. Analysis of the color usage in the chosen living room: the various effects of colors in interior design are explained. The percentages of the color used: in this segment, the percentages of color used in the element of the space are illustrated.

6.4 Synthesis of the Research

Psychological reactions to color may differ among individuals of different gender, various age group and diverse personality types. These facts might be of basic importance if color scheme is designed specifically for residential spaces. Indeed color

selection for the personal living units must follow primarily individual taste and preferences of space inhabitant

In Iran color effect so much to interior design of houses and it can change the people mood and mind. So people by choosing the specific hues of color combination they can change their house environment and eliminate harms which are face in the city and society.

This research is written for all those who work on interior design of the house, so in this field of study according to the objective and description of the study some information are given for users.

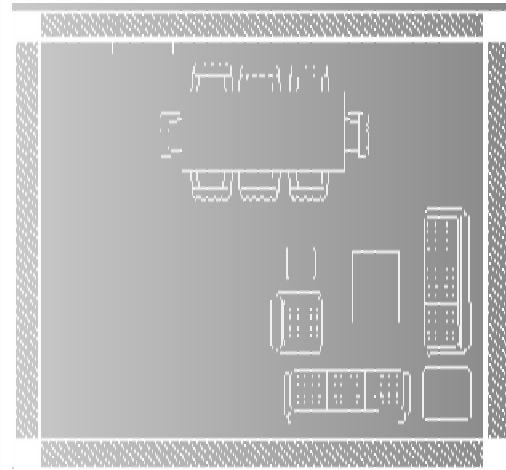
1. The technique of the synthesis is by analyzing the human space in case studies which enable us to understand the color usage in the space.
2. The method of the thesis was by choosing the random sampling of houses which based on experimental studies and observation.
3. In general the research process involves by data collection, analysis and synthesis and various document and experimental investigation and the like.

In this context, it must be emphasize that in different societies certain color might have symbolic meaning which reflect to the cultural values, for instance as it was mentioned in previous chapters every color give the different sense to the users, this can be according to the culture or according to the modernity and so on. So the colors which were used in the case studies in some part, goes back to the Iranian culture, tradition and region, and some other goes to the modernity. Although people went in to developed world, but they still retain their culture and they integrate the modernity with the tradition.

Picture from the space:



Schematic plan of the dining room:



Assignment of the specific colors to the main elements in the composition of the living room:

Wall surfaces: white
Ceiling: ocher
Floor: ocher
Furniture: brown
Table: brown
Dining table: dark brown
Accessories:
Carpet: brown
Cushion: khaki

Curtain: White

Wall decoration: Brown

Color scheme of the chosen living space:

Neutral colors with the shade of the brown color on the furniture make the space comfortable.


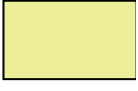






Physical explanation:

Types of the house: apartment flat
 Size of the House: 120 sq/m
 Size of the Living room; 90 sq/m
 Number of Inhabitation: 1
 Occupation of the inhabitation: lawyer man , no wife, no children
 Functional area of the house: Living room, Kitchen, Dining room, 2 bedrooms and 2 bathrooms.

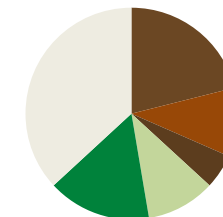
Psychological sides of the color scheme used in space:

The colors which are used in color scheme are in warm side of the color scheme. Brown, dark brown, beige and green. The brown colors of the furniture appear more in the white wall. According to the color psychology The brown color which is used in the living room make the space warm and comfortable. And make the harmony in the area. According to the color contrast: green color which is used in the carpet makes contrast in the space and makes the space more alive.

Definition of colors which are used for specific elements of the space:

-  Carpet
-  Wall
-  Floor
-  Cushion
-  Furniture
-  Ceiling
-  Table
-  Dining table

The percentages of the color used:



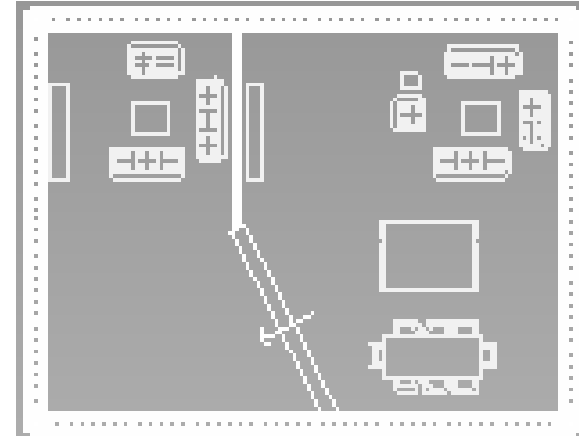
Analysis of the Color Usage in the Chosen Living Space:

The color which is used in the living room is monochromatic color scheme which has harmony between the shades of the brownish color and makes the place warm and comfortable. The white color of the wall make the furniture more visible and the green carpet make the contrast with the furniture. In the couch there are balances of warm khaki with touch of dark brown. According to the proportion approach: there is harmony between the brownish color of furniture and the green carpet. According to the volumetric approach the color of furniture blend with the ocher wall, so there is harmony in the space. According to the planner approach: the accent green color of carpet is nature color and make the space tranquil and has contrast with brownish color of furniture.

Pictures from the space:



Schematic plan of the dining room:



Assignment of the specific colors to the main elements in the composition of the living room:

- Wall surfaces: white**
- Ceiling: white**
- Floor: brown**
- Furniture: brown and white**
- Shelves: dark brown and brown orange**
- Table: light brown**
- Side table: beige**
- Console: dark brown**
- Accessories:**
- Curtain: brown +orange**
- Carpet: beige**
- Vases: crème**

Color scheme of the chosen living space:

Neutral color scheme which is composed of shade of brown color scheme for the furniture, it creates sense of unity on the space which bring whole together.


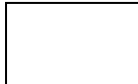








Physical explanation:

Types of Dwelling: Villa
 Size of the House: 160 sq/m
 Size of the Living room; 90sq/m
 Number of Inhabitants: 5
 Occupation of the inhabitants: Civil Engineer father, housewife mother, 3 school children.
 The function of the house includes: 1 Living room, Dining room is divided with a partition TV room, 4 bedrooms and 3 bathrooms.

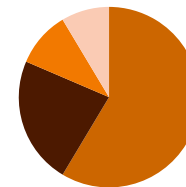
Psychological sides of the color scheme used in space:

The color schemes which are used in the space are the shade of the brownish color. The neutral color of dark brown, brown orange, beige and crème are using on the elements of the space, such as furniture, shelves and floor. According to the color psychology, these colors that they have harmony in space, they provide tranquil atmosphere because usually brown color express the comfort. The successful contrast of the space lead the eye move rapidly The contrast between dark and light brown furniture harmonies the space. According to the Achromatic simultaneous contrast, the white furniture on brown surface appears more and also the black accessories on white wall appear more.

Definition of colors which are used for specific elements of the space:

-  Sofa
-  Wall
-  Floor
-  Library
-  Table
-  Shelves
-  Console
-  Curtain
-  Carpet
-  Vases

The percentages of the color used:



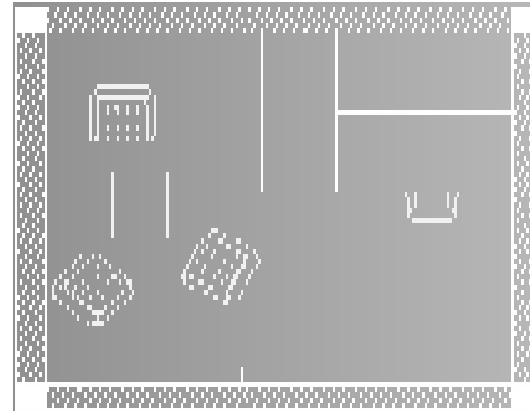
Analysis of the color usage in the chosen living space:

According to the planner approach the white color of the wall makes the space lighter and larger and it emphasize the furniture. The color which are used in the space are shade of brown. These colors such as brown- dark brown, brown orange and beige create sense of unity to the living room. The dark brown of the furniture are the accent color in the area which is emphasize the element. And the black shelves in the wall are the accent color and they can lead the eye through the space and bring the contrast between the white walls. According to the proportion approach, there is a sense of order to the space. These orders are used by organizing linear order in the space and also the order can be recognized from the tone of brown. According to the volumetric approach: by using height saturation on the wall and ceiling and darker value in furniture, there will be contrast on the space and the space appears larger.

Pictures from the space:



Schematic plan of the dining room:



Assignment of the specific colors to the main elements in the composition of the living room:

- Wall surfaces: white**
- Ceiling: white**
- Floor: white**
- sofa: reddish brown + orange**
- Table: light brown**
- Accessories:**
- pictures: brown orange**
- Carpet: pink**

Color scheme of the chosen living space:

The warm color schemes are used in the space. The orange, yellow, red, these colors dominate to the space and make the space more alive and positive.

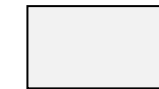





Physical explanation:

Type of Dwelling: apartment
 Size of the House: 200 sq/m
 Size of the Living room; 90 sq/m
 Number of Inhabitation: 4
 Occupation of the inhabitation: lawyer man, house, teacher woman with 2 children
 The function of the house includes: Living room, Kitchen, Dining room, 3 bedrooms and 2 bathrooms.

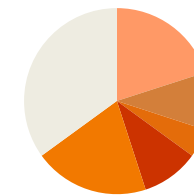
Psychological sides of the color scheme used in space:

The color scheme of this living room's furniture are orange, dark orange, yellow and beige and the color of the wall surface are white, so for prevent the room from appearing too cold, the designer create different color harmony between the reddish colors of color schemes. According to the color psychology these colors bring excitement and stimulate. The cool and fresh color of the furniture and the wall pictures give the sense of freedom and life to compare with the colors and ordered of the city. According to the Emphasizing design element: by having contrast between furniture and background, the more visible it becomes. So by emphasizing the color of furniture such as dark orange the designer tried to draw attention of the viewers and make the space excitement. According to the planner approach: by using the light color on floor and wall the space appears larger and color furniture appears more.

Definition of colors which are used for specific elements of the space:


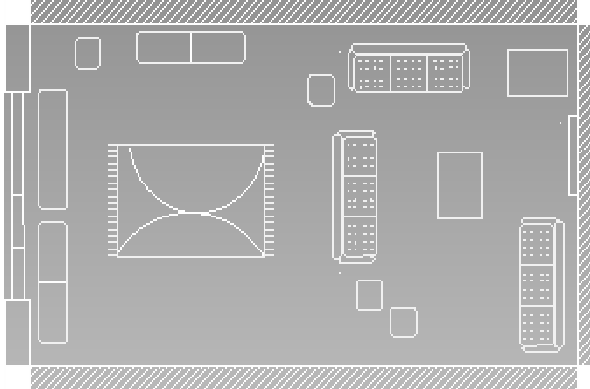








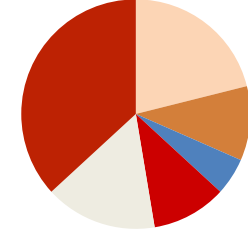

-  Floor
-  Wall
-  Carpet
-  Sofa
-  Table
-  Picture


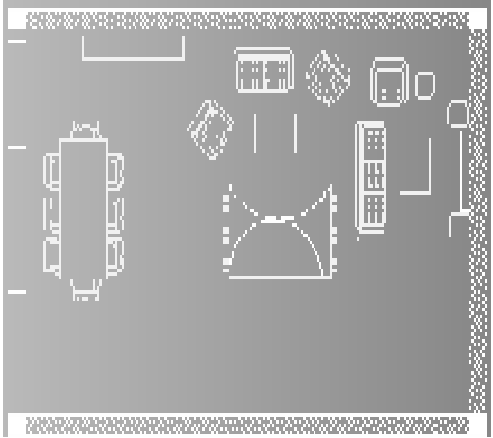








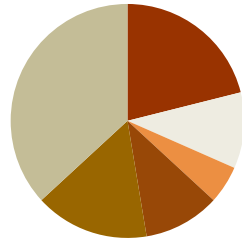

The percentages of the color used:


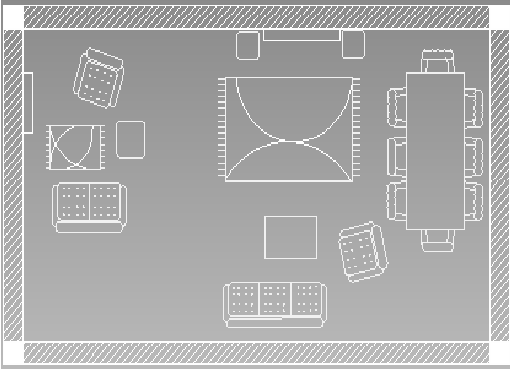













Analysis of the Color Usage in the Chosen Living Space:


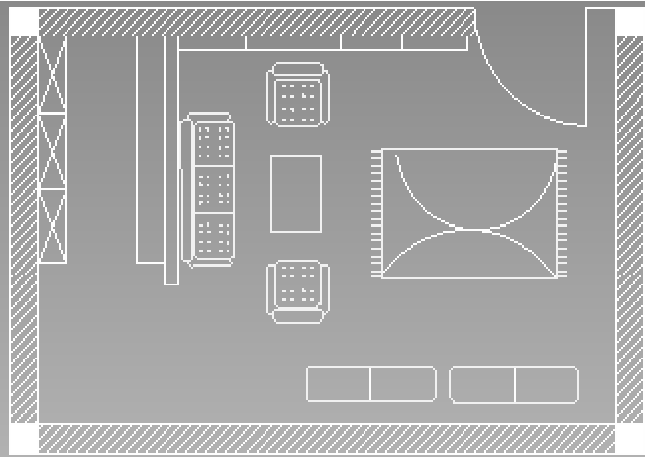





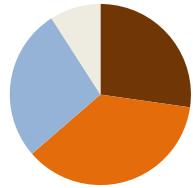
The color scheme of this living room's furniture are orange, dark orange, yellow and beige and the color of the wall surface are white, so for prevent the room from appearing too cold, the designer create different color harmony between the reddish colors of color schemes. the color psychology these color bring excitement and stimulate. According to the Emphasizing design element: by having contrast between furniture and background, the more visible it becomes. So by emphasizing the color of furniture such as dark orange the designer tried to draw attention of the viewers and make the space excitement. According to the planner approach: by using the light color on floor and wall the space appears larger and color furniture appears more.


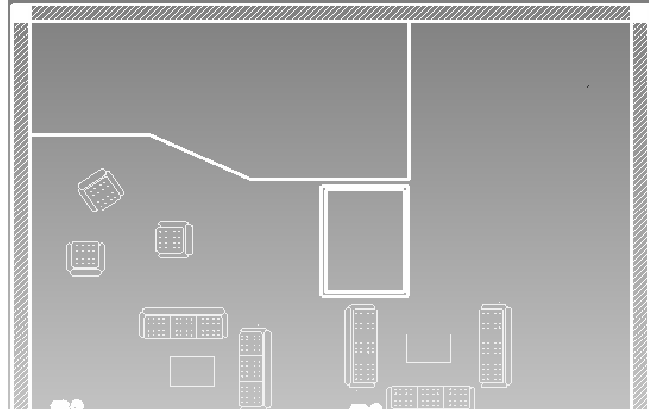
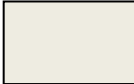





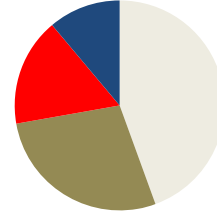

<p>Picture from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: House Size of the House: 120 sq/m Size of the Living room; 40 sq/m Number of Inhabitation: 4 Occupation of the inhabitation: architect Functional area of the house: Living room, Kitchen, Dining room, 3 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Brick  Sofa and cushion  Wall  Floor  Furniture  Accessories  Carpet 	<p>Analysis of the color usage in the chosen living space:</p> <p>The color of the living room is in warm side of the color scheme. According to the planner approach the white color of the wall makes the furniture more appear. The wooden floor makes the space cozier. The dark red and the brown furniture make the space more intimate. According to the emphasizing design element: the trim texture on the wall makes the space tradition. Generally, the concept of the design of the living room is kind of Iranian tradition. These colors make the space more inviting and comfortable. According to proportion approach: there is harmony between the shades of the red color, and also there is proportion in lighting.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white Wall texture: brick Ceiling texture: wooden beam Floor: brown Furniture: beige Table: brown Accessories: Carpet: red, blue Cushion: dark red</p>	<p>Psychological sides of the color scheme used in space:</p> <p>White color of the wall with the trim texture on the wall. The warm color of the furniture, the wooden table and beam. Here the strongly colored couch and carpet make the balance with the wooden table and floor. According to the color psychology, the red color can create the feeling of warmth and intimacy. And the dark reddish dark which is used to the space is symbol of the tradition which is integrates with modernity. In first picture dark color carpet with darker hues make a room appear more intimate. According to the warm and cool contrast cool color placed next to a warm color. And they provide a sense of temperature contrast.</p>	<p>Percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>By using Complementary color, the contrast of warm color of reddish side of color scheme appears in the space.</p>			

<p>Picture from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Type of Dwelling: apartment flat</p> <p>Size of the House: 120 sq/m</p> <p>Size of the Living room; 90 sq/m</p> <p>Number of Inhabitation: 4</p> <p>Occupation of the inhabitation: Business man, 2 small children</p> <p>Functional area of the house: Living room, Kitchen, Dining room, 3 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Wall  Carpet  Wall texture  Furniture  Floor  Dining table  Curtain 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The color scheme of this living room is combination of cool and warm color with texture. By using monochromatic and plain color scheme with simple furnishing the modern look was created. According to the planner approach the wonderful texture of the wall creates a living room place of variety and interest and it emphasize the space. According to the proportion approach: The warm tones of floor texture are in complete harmony with the soften texture of the wall, curtain and dining room. According to the color psychology the shade of the brown color make the space welcoming and cozy and there is harmony between the brick texture of the wall and the brown color of the floor.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white</p> <p>Wall texture: stone</p> <p>Ceiling: white</p> <p>Floor: brown</p> <p>Furniture: beige</p> <p>Table: brown</p> <p>Dinning table: dark brown</p> <p>Accessories:</p> <p>Carpet: pin</p> <p>Curtain: brown</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Using plain color on the furniture and neutral color on the floor, dark brown color on curtain and dining room the shade of brown color make the space cozy and warm Using white color on the wall with the stone texture. The designer by using stone texture on the wall bring the nature to the space and tried to emphasize the space and makes variety on the space. The light and dark contrast appears in the area. In this contrast there is great gradation between light and dark brown.</p>	<p>The percentages of the color used</p> 	
	<p>Color scheme of the chosen living space:</p> <p>The neutral color schemes are used on the area. The shade of the brown, Create harmony on the space.</p>			

<p>Picture from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: apartment Size of the House: 90 sq/m Size of the Living room; 35 sq/m Number of Inhabitation: 4 Occupation of the inhabitation: Actor man, teacher woman, 2 children The function of the house includes: Living room, Kitchen, Dining room, 3 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Floor  Wall  Carpet  Furniture  Plantation  Dining table 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The combination of black and white creates the stunning and dramatic atmosphere and it provides fresh clean and elegant space. According to the planner approach The orange cushion as an accent color and the warm color of carpet bring excitement to the space and make the space more alive. In addition the neutral color of the floor, it brings smooth contrast between the floor and the furniture. According to the proportion approach: there is harmony and proportion in the space. The cool color of the carpet makes the contrast in the space and makes the space more alive.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white Ceiling: white Floor: brown Furniture: black Table: black Dinning table: dark brown Accessories: Carpet: cool colors Plantation: green</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Using dark brown, black furniture with the cool color of color scheme in carpet, orange cushion and using plantation to create contrast to the space and attract the eye through the element. The black and white color schemes which are used it combine with a accent color of orange and red which humanize the space. The combination of black and white creates the stunning and dramatic atmosphere and it provides fresh clean and elegant space.</p>	<p>The percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>The color scheme of this space is light on dark and dark on light. As it shows to the living room , the black furniture are on white wall, which appear more in white background, and the white cushion on sofa and orange cushion on white sofa are in other category of color scheme. In this case the dark colors on white are more brilliant.</p>			

<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: apartment flat Size of the House: 90 sq/m Size of the Living room; 35 sq/m Number of Inhabitation: 3 Occupation of the inhabitation: computer engineer man, housewife woman, 2 children</p> <p>The function of the house includes: Living room, Kitchen, Dining room, 3 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Floor  Wall  Carpet  Furniture  Sofa  Curtain 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The colors which are used in the space are cool and warm side of the color scheme. Green, Pink, beige, brown floor are used in the space. These colors have harmony with each other. According to the volumetric approach: The brownish color of the floor blends with the green sofa and makes it more visible. The pink color of the furniture has a harmony with the carpet. According to the planner approach: the trim color of curtain and sofa has harmony together and they are predominant in the space.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white</p> <p>Ceiling: white</p> <p>Floor: brown</p> <p>Furniture: pink</p> <p>Sofa: green</p> <p>Accessories:</p> <p>Carpet: pink</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Green, pink, beige are used in the space. The pale hue of pink has harmony with furniture and contrasted with green color of sofa..The light color of the space gives the sense of freshness and cleanness to the space and gives the sense of royalty to the owner.</p>	<p>The percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>The Monochromatic color are used in the space are shade of pink and green. Such color combination shows the feeling of unity and harmony in the space.</p>	<p>The green color of sofa makes the restful place. The colorful plantation makes the space alive and leads the eyes through it.</p>		

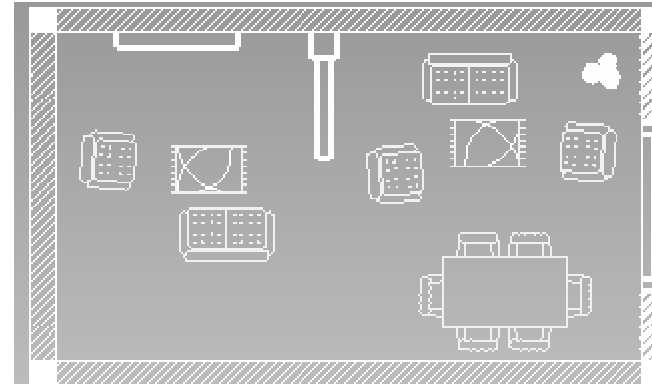
<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p>  <p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white Ceiling: white Beam: brown</p> <p>Door and frame: blue Floor: brown Ceramic Furniture: brown Accessories: blue Cushion: red</p> <p>Color scheme of the chosen living space:</p> <p>The neutral color with the shade of the brown color of the furniture and the floor make the harmony to the space. and the blue accent color make the contrast to the space and make the space more alive.</p>	<p>Physical explanation:</p> <p>Types of Dwelling: villa Size of the House: 60 sq/m Size of the Living room; 35 sq/m Number of Inhabitation: 3 Occupation of the inhabitation: university professor man, business woman, 3 children</p> <p>The function of the house includes: Living room, Kitchen, 2 bedrooms and 1 bathroom.</p> <p>Psychological sides of the color scheme used in space:</p> <p>Dark Brown, light brown, white, blue are used in the space. By using the neutral color the designer create warm space and they bring nature to the space. The blue color of door and frame make the contrast to the space. According to the color psychology: the reddish dark of the poshti, light blue of the accessories and door and window, the cement wall, the handcrafts all express the Iranian traditional style.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Frame  Door  Wall  Furniture  Floor <p>The percentages of the color used:</p> 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The colors which are used in the space are in warm and cool side of the color scheme. Here there is only one that predominates and that is wood. The designer of the house provides maximum effect through a minimal number of materials. by using wooden furniture and old accessories and brown ceramic they tried to bring the traditional style to the house. According to the volumetric approach: by using trim color which are surround the frames it emphasize the elements and make them noticeable. According to the emphasizing design element: the accent color of blue in the door and the frame of the window and accessories it lead the eye to the space and it bring the contrast between the cool and warm color.</p>
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<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: villa Size of the House: 400 sq/m Size of the Living room; 250 sq/m Number of Inhabitation: 3 Occupation of the inhabitation: French ambassador man, French tutor woman, 2 child The function of the house includes: Living room, dining room, Kitchen, swimming pool 3 bedrooms and 3 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Wall  Stone  Sofa  Sofa  Cushion 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The colors which are used in the space are in warm and cool side of the color scheme. The main color (blue, red) and secondary color (green, orange) are used in the space. according to the volumetric approach: the light color of the wall and floor make the space bigger , so the blue, red and green furniture are appear more in the space and make the space more alive. According to the planner approach: the trim texture of the wall makes the space separate from the other part. The hard texture of the wall has harmony with the water and it gives the sense of the nature. The colorful playground effect to the child psychology and it make cheerful place for the child.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white Wall texture: stone Ceiling: white Floor: ceramic Furniture: blue, red, yellow Table: brown Accessories: Cushion: orange Play ground: blue Swimming pool</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Blue, red, orange green are used in the space. the color which are used in the space make the space so alive. Red tends to generate the most anxiety in the space. The light green color is opposite color of red has a harmony with red and make the space tranquil. The blue color makes the place calm and restful. The orange cushion look brighter when is placed in light green. Generally by using the colorful space they tried to create fresh and lively atmosphere for themselves.</p>	<p>The percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>Using complementary color is used in the space make the space positive and energetic. Red and white is a seldom used color scheme because it is so harsh, and invariably looks both modern and happy regardless of the style of the patterns.</p>			

Pictures from the space:



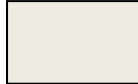






Schematic plan of the dining room:



Physical explanation:

Types of Dwelling: Villa
 Size of the House: 200
 Size of the Living room; 120sq/m
 Number of Inhabitation: 3
 Occupation of the inhabitation: Iron Factory
 The function of the house includes: Living room, dining room, Kitchen, 3 bedrooms and 2 bathrooms.

Definition of colors which are used for specific elements of the space:

-  Wall
-  Frame
-  Furniture
-  Curtain
-  Plantation
-  Carpet
-  Cushion

Analysis of the Color Usage in the Chosen Living Space:

The colors which are used in the living space are in cool side of the color scheme, the light green, pink yellow. According to the volumetric approach there is shade of green on the space which make harmony in the space. The light color of the wall and the carpet and the furniture make the space look larger. According to the planner approach the trim color of yellow make the space shiny and alive and the purple plantation has contrast to the space make the space luxury and elegant.

Assignment of the specific colors to the main elements in the composition of the living room:

Wall surfaces: white
Ceiling: white
Floor: ceramic
Furniture: Yellow, Green
Table: glass
Accessories:
Carpet: Pink
Curtain: Green
Plantation: purple
Lighting: Yellow

Color scheme of the chosen living space:

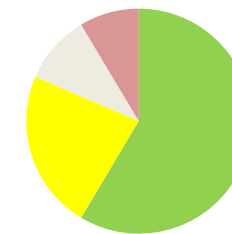
Cool color scheme: the cool color pink, light green, yellow are used in the space, The variety of cool color make the space simple but stunning..


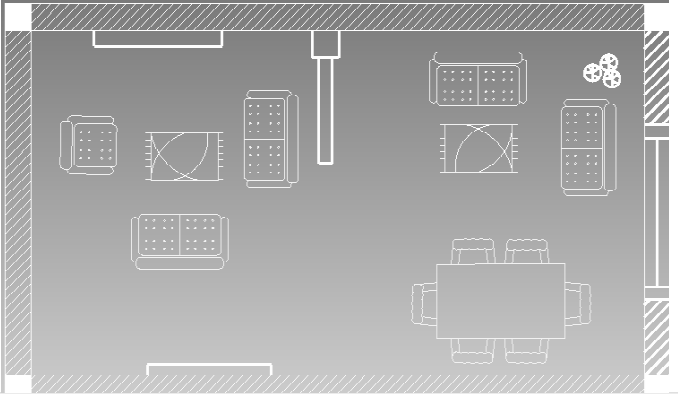

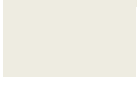




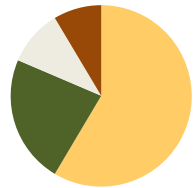

Psychological sides of the color scheme used in space:

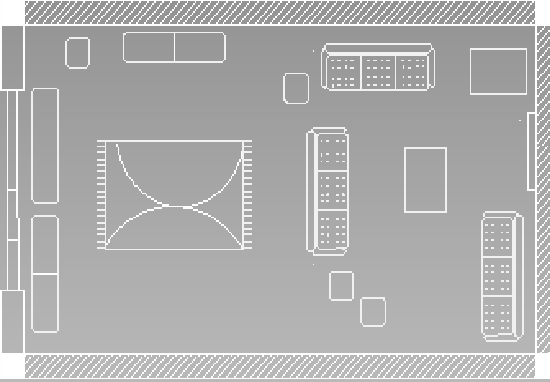




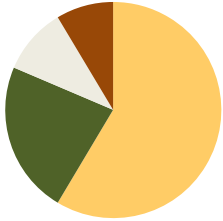
The yellow green, green, pink and violet are using in the living room. The light green color on furniture make the space tranquil and refreshing. And the yellow color of the frames which combine with the green, make the space shiny and stunning. Usually yellow furniture with the pink color of carpet express classical style and give the sense of royalty and wealthy to the family.


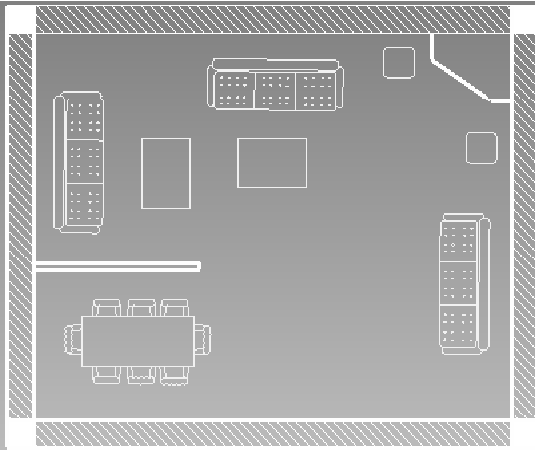







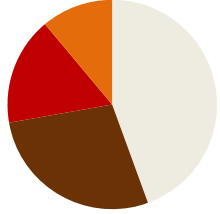

In the living room are like this there is no over-design because it's just that simple all of this space has a perfect blend of colors in every detail the goods that exist in this room. thus to complement the beautiful design in needing the use of a combination of colors in every design detail was seen only in the design of this room are all simple, but it all joy, fresh and lively impression.(Admin,M, 2010).


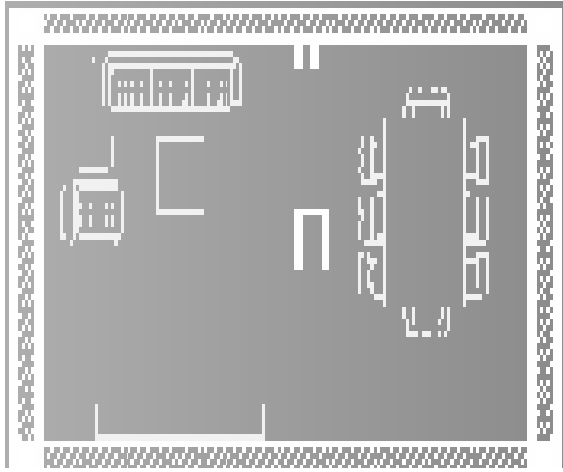









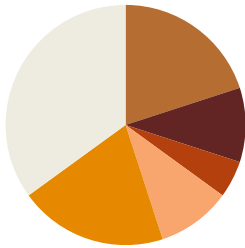

The percentages of the color used:



<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: Villa Size of the House: 200 Size of the Living room; 120sq/m Number of Inhabitation: 4 Occupation of the inhabitation: Textile factory The function of the house includes: Living room, dining room, Kitchen, 3 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Wall  Sofa  Table  Floor  Fire place 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The colors which are used in the living space are in cool and warm side of the color scheme, beige; green and brown are used in the living room. these color are the nature colors and have harmony together. According to the volumetric approach: the color of the wall make the space more warm and welcoming and make elegant space. According to the planner approach: the trim color of the fire place emphasizing the space and is very inviting and it separates the living room from dinning room. According to the proportion approach: the trim red on the ceramic, characterize and define the space. and the red color make the space more exciting and visible.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: beige Ceiling: white Floor: ceramic, Furniture: white Table: brown Accessories: Fire place: Green</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Beige, green, brown are used in the space. These colors come from the nature and have harmony together. The beige color of the wall surface makes the space warmer. The green color makes the space tranquil and comfortable The trim red color on ceramic separate the space and it define the space.</p>	<p>The percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>The neutral color schemes are used in the space. Beige wall, brown table make a good combination in the space and green accent color make a contrast to the space.</p>			

<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: king House Size of the House: 1000 sq/m Size of the Living room: 300 sq/m Number of Inhabitation: 5 Occupation of the inhabitation: king man, queen woman, 3 children The function of the house includes: Living room, Kitchen, Dining room, bedrooms and bathrooms, offices, meeting room</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Curtain  Wallpaper  Furniture  Carpet 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>A room scheme that combines too many colors can look busy and restless. Although of quite different color, the mainly red furniture and carpet have harmony with the green wallpaper. Although green is considered as a cold color in color scheme but the pale yellow beige is combined successfully with the green. In the living room different variations of yellow, orange are used for the curtain and furniture. The creamer yellow on the curtain will make the cold room look sunny and welcoming and it gives the balance with butter milk color and orange. According to the planner approach: the one green color of the wall can create an illusion of light without contrasting too sharply in the space. According to the volumetric approach: the light color of the ceiling appears the object more visible.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: Green Ceiling: butter milk Floor: Red carpet Furniture: Orange Table: White Accessories: Curtain: Creamer yellow</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Green, red, creamer yellow, Butter milk, Orange are used in the space. The green color makes the space tranquil. The beige color of the curtain and the butter milk color of the ceiling make the space bigger. The orange color of the furniture has harmony with curtain, wall and red carpet. And as it is shown in the picture colors are all from either the warm side or the cool side of the color wheel. The yellow color of the wall and ceiling and classical decoration give the sense of rich and wealthy to the user.</p>	<p>The percentages of the color used:</p> 	
<p>Color scheme of the chosen living space:</p> <p>Analogous color scheme. Are used in this space, the color scheme would be orange, yellow orange and orange yellow.</p>				

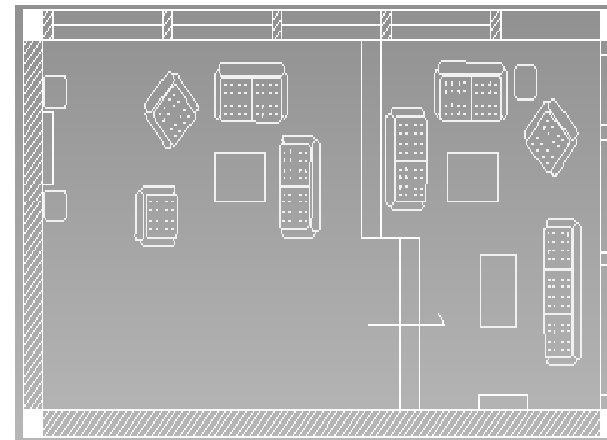
<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: Apartment flat Size of the House: 90 Size of the Living room: 60sq/m Number of Inhabitation: 3 Occupation of the inhabitation: interior designer</p> <p>The function of the house includes: Living room, dining room, Kitchen, 3 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Wall  Picture  Furniture  Cushion  Carpet  Cushion 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The comfortable feeling provided by wood. Wood makes the atmosphere both clean and warm. According to the planner approach there is harmony in shade of brownish color. The blue accent picture on the wall has contrast in the space and leads the eye through it.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white Ceiling: white Floor: ceramic Furniture: reddish brown Table: brown Accessories Cushion: orange Picture: blue Carpet: red</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Brown, orange brown, orange and red are used in the space. The colors which are used in the space make the space cozy and welcoming. The designers by using these types of furniture make the space modern. The brown color blends very well with orange color of cushion and red color of carpet. The interior designer by using the different style of the furniture, they make the space different from the other houses.</p>	<p>The percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>The monochromatic color in the space is the shade of the brownish color of brown which make harmony in the space.</p>			

<p>Pictures from the space:</p> 	<p>Schematic plan of the dining room:</p> 	<p>Physical explanation:</p> <p>Types of Dwelling: villa</p> <p>Size of the House: 120 sq/m</p> <p>Size of the Living room: 60 sq/m</p> <p>Number of Inhabitation: 3</p> <p>Occupation of the inhabitation: Landscape designer man, interior designer woman, 3 children</p> <p>The function of the house includes: 1 Living room, Dining room, 2 bedrooms and 2 bathrooms.</p>	<p>Definition of colors which are used for specific elements of the space:</p> <ul style="list-style-type: none">  Sofa  Brick wall  Cement wall  Floor  Table  Table  Dining table  Lighting 	<p>Analysis of the Color Usage in the Chosen Living Space:</p> <p>The color scheme which is used in the living room is cool color which appears the space larger. These color contain brown, dark brown and beige. To add more warmth to the space, the shade of the brown color (neutral color) has been incorporated. According to the color psychology the brown color are The neutral material of the space like wood and brick Texture is appearing smoothness on the surface which is appearing different to the eye, and make the space comfortable and cozy. Moreover, for emphasizing the element, the strong color of the furniture can be define as an accent color in the space. According to the proportion color scheme, there is unity and harmony in the color and material of the space.</p>
	<p>Assignment of the specific colors to the main elements in the composition of the living room:</p> <p>Wall surfaces: white Wall texture: brick Ceiling: white Ceiling texture: wooden beam Floor: brown Furniture: beige Table: brown Side table: brown orange Dinning table: dark brown Accessories: Carpet: dark beige Lighting: steel</p>	<p>Psychological sides of the color scheme used in space:</p> <p>Neutral color of brown, dark brown, light brown, beige, make the space warm and more inviting. The brick texture on the wall makes contrast to the space, and makes the space larger.</p> <p>The strongly colored of furniture, beam, floor make the balance to the space. As we see most of the wooden furniture in the living room is in this hue. Therefore adding brown as a shade for the living room not just gives a stylish look to the interiors however it brings comfort and warmth as well. Brown color comes in different shades and gives unique appeal. Dark chocolate brown of dining room be used where there's enough light in a room. The modern furniture and creative table design make the space very unique and exclusive rather than the classic style and it give the sense of simplicity and modernity to the viewer.</p>	<p>The percentages of the color used:</p> 	
	<p>Color scheme of the chosen living space:</p> <p>Neutral color scheme are used in the space the shade of the brown, beige make the space warm and cozy.</p>			

Pictures from the space:










Schematic plan of the dining room:



Physical explanation:

Types of dwelling: villa
 Size of the House: 200 sq/m
 Size of the Living room; 80 sq/m
 Number of Inhabitation: 5
 Occupation of the inhabitation: housewife woman, no husband, 1 children
 The functional area of the house: Living room, Dining room, 4 bedrooms and 3 bathroom, Kitchen

Definition of colors which are used for specific elements of the space:

-  Wall
-  Floor
-  Furniture
-  Sofa
-  Plantation
-  Curtain
-  Carpet

Analysis of the color usage in the chosen living room:

Most of the color which is used in the living room comes from the warm side of the color scheme. The different variation of brown, it brings the harmony in the space. The cold color of the carpet, make the space wider and alive. The rich deep brown in the curtain has a strong contrasting with the yellow furniture in the TV room and has harmony with the floor color. According to the volumetric approach the brown color of the floor make the white furniture more visible.

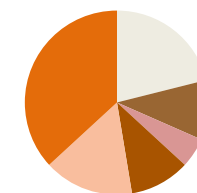
Assignment of the specific colors to the main elements in the composition of the living room:

- Wall surfaces: white**
- Ceiling: white**
- Floor: wood floor**
- Furniture: brown**
- Sofa: butter milk**
- Table: brown**
- Accessories**
- Carpet: pink**
- Curtain: khaki**
- Plantation: pink**

Psychological sides of the color scheme used in space:

Brown, beige, ocher, butter milk colors are used in the space. The pink colors of the carpet make the space bigger, the butter milk tone of the sofa are separate the space from the living room. The brownish color of the floor makes the sofa more visible. The khaki color of the curtain has harmony with the wood floor. According to the color contrast there is light contrast between the shades of the brown.

The percentages of the color used:



Color scheme of the chosen living space:

Using monochromatic on the space. The shades of brown color create harmony between the wood floor, furniture and curtain.

Chapter 7

CONCLUSION

During this study it was mentioned that color in environment serves a variety of purposes. Color can make the objects obvious. Many things are recognized by their color. Color affects mood, emotional response to events and the sense of physical environment. Furthermore, this thesis emphasized the effect of color on human surroundings, especially in living environment.

1. The thesis approach to the research subject by first taking a general view of color skill regarding to the theories, psychological, color structure and functioning of human's visual system. This research was done to obtain deeper understanding of color relationship in the space and direct relation to human psychology conditions. Thus, it was indicate that the color can effect on human psychology in its entire life.
2. In addition, in some color implications it is essential to emphasize that in different societies certain color might held symbolic meaning and reflect specific cultural values. Beside psychological reactions to color may differ among various group age and personality types, so this fact might be very important for residential space. Indeed, color selection for the personal living units must follow user preference in space.

- The color must be analyzed along with its all three dimensions (hue, value, saturation).
 - Space and its relationship to color must be considered.
 - Selected color should provide an appropriate emotional outlet with consideration of function activities and behaviors of the space user.
3. As a result of the case study warm and cool color effect to the people sense reaction. So the process by which color is chosen in design had effected to the people psychology. The cool color give the sense of live, fresh and tranquiller to the space and warm color give the sense of cozy and comfortable to the space.
 4. As a summary, the cases have shown that variety of color combination has been used in the living rooms. Although city may give a feeling of sense of color, ordered, depressed impression, the interior of the houses are very rich in terms of colors used. So people by using cool, warm, neutral and color combination they tried to express the culture and tradition which integrated with modernity and also they tried to change the atmosphere of the house for instance: by using cool color scheme, they create fresh and tranquillest atmosphere and by using warms color of the warm side of the color scheme they create cozy and comfortable space. So these modify, caused people to abolish the troubles and crisis that society provide for people.

As a result, it was ascertained and pointed out that it would be impossible to make a rule regarding color within interior environment but assigning varying color schemes in the living environments to increase the quality of design in space is important. In this respect, as a final part of the thesis, some theoretical

implications about the color in interior design of the houses have been assessed.

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