T.C.

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INSTITUTE OF FINE ARTS

DEPARTMENT OF ART AND DESIGN

EMOTIONAL INFLUENCES OF COLOR IN THE DESIGN OF INTERIOR SPACES

Mohanad Mohammed Ali AL-QAYSI

MASTER'S THESIS

Supervisor

Asst. Prof. Dr. Tuğba ÇAĞLAK EKER

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SCIENTIFIC ETHICS STATEMENT

I have carefully adhered to scientific ethics and academic rules in the process from the stage of the proposal to the end of the study entitled, *Emotional Influences of Color in the Design of Interior Space*, which I have prepared as Master thesis. I certify that I have obtained within the framework of ethics and tradition, and that I have directly or indirectly cited every quote I have provided in this study, which I have prepared according to the rules of writing the thesis, I have fully cited and referenced all material and results that are not original to this work and that the works I have benefited from are those shown in the list of references.

04 /01/2023

Mohanad Mohammed Ali AL-QAYSI

TEZ KABUL VE ONAY

ÇANKIRI KARATEKİN ÜNİVERSİTESİ

GÜZEL SANATLAR ENSTİTÜSÜ

Mohanad Mohammed Ali AL-QAYSI tarafından hazırlanan *Emotional Influences of Color in the Design of Interior Spaces* başlıklı bu çalışma, 04/01/2023 tarihinde yapılan Tez Savunma Sınavı sonucunda oybirliğiyle başarılı bulunarak jürimiz tarafından Sanat ve Tasarım Anabilim Dalı, Sanat ve Tasarım-İngilizce Programında Yüksek Lisans Tezi olarak kabul edilmiştir.

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04/01/2023
Mohanad Mohammed Ali AL-QAYSI

ABSTRACT

Thesis Title: Emotional Influences of Color in the Design of Interior Spaces

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Supervisor: Asst. Prof. Dr. Tuğba ÇAĞLAK EKER

Thesis Type: Master's

Design researches and its association with emotions are new research in the world. There is an apparent lack in Iraq of research dealing with the emotional aspect of design. Selections of colors for interior spaces were usually accomplished either by the designer or by the investor based on imported formulas, especially in fast food restaurants. This was the main problem addressed in this research. One of the most important objectives of the research was to determine the emotional values of the primary and secondary colors based on the choices of samples from Iraqi society. The researcher examined color and its relationship with emotions in a theoretical framework. In addition, previous studies are reviewed and discussed. A survey study was conducted to reach the research data. The most important of these is the design of two questionnaires to determine the emotional vocabulary for each color based on the culture of Iraqi society. One of the questionnaires was created for abstract colors and the other for the interiors of fast-food restaurants. Participants in the questionnaire were students of the Department of Design, University of Baghdad. The research reached a number of results, the most important results were: a) each color has an emotional value that varies based on time, place, and society's culture. b) It is preferable to use yellow, separately or as a dominant color, in fast food interiors in Iraq, as it has achieved the highest emotional vocabulary, Acceptable and Attractive, followed by violet color.

Keywords: Interior design, color, emotions, restaurant, psychology, lighting.

ÖZET

Tezin Başlığı: İç Mekan Tasarımda Rengin Duygusal Etkileri

Tezin Yazarı: Mohanad Mohammed Ali AL-QAYSI

Danışman: Dr. Öğr. Üyesi Tuğba ÇAĞLAK EKER

Tezin Türü: Yüksek Lisans

Tasarım araştırmaları ve duygularla ilişkisi dünyada yeni araştırmalardır. Irak'ta tasarımın duygusal yönünü ele alan araştırmalarda açık bir eksiklik olduğu söylenebilir. Özellikle fast food restoranlarında iç mekanlar için renk seçimleri genellikle ya tasarımcı ya da yatırımcı tarafından ithal formüllere göre yapılmıştır. Araştırmanın problem durumu temel olarak bu durumu yansıtmaktadır. Araştırmanın en önemli amaçlarından biri, Irak toplumundan örneklemlerin seçimlerine dayalı olarak birincil ve ikincil renklerin duygusal değerlerini belirlemektir. Araştırmacı, rengi ve duygularla ilişkisini teorik bir çerçevede ayrıntılı olarak incelemiştir. Ayrıca önceki araştırmalar gözden geçirilerek tartışılmıştır. Bunlardan en önemlisi, Irak toplumunun kültürüne dayalı olarak her bir renk için duygusal kelime dağarcığını belirlemek amacıyla iki anketin tasarlanmasıdır. Anketlerden biri soyut renkler, diğeri ise fast food restoranlarının iç mekanları için oluşturulmuştur. Ankete Bağdat Üniversitesi Tasarım Bölümü öğrencileri katılmıştır. Araştırma kapsamında ulaşılan en önemli sonuçlar şunlardır: a) her rengin zamana, mekana ve toplumun kültürüne göre değişen duygusal bir değeri vardır. b) Irak'ta fast food iç mekanlarında sarının ayrı ayrı veya Baskin bir renk olarak kullanılması ve bunu menekşe renginin takip etmesi, ankette Kabul Edilebilir ve Çekici olarak en yüksek duygusal kelime dağarcığına ulaştığı için tercih edilebilir.

Anahtar Kelimeler: İç mimari, renk, duygular, restoran, psikoloji, aydınlatma.

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CHAPTER ONE

1. INTRODUCTION

1.1. RESEARCH TOPIC AND CONTEXT

When choosing any color or color scheme for the interior space, a form of emotion will be generated. These emotions can be positive or negative. Therefore, studying the effect of color in producing positive emotions for the recipient is considered one of the important priorities in improving the performance of the interior space. The interior space that does not provide a positive foundation is considered a poor and unsuccessful space.

The human relationship with color is a relationship of reception and affection, or a person's relationship with his environment, or with his beliefs etc. The depth of that relationship is determined through the process of sensory perception and analysis of that process, especially with regard to the design of restaurant spaces. Color contrast is one of the important aesthetic concept methods in designing the spaces of fast-food restaurants. Contrast that occurs as a result of the different tones affects the same recipient due to the change in visual perception, achieving aesthetic and emotional dimensions. So, the greater the contrast in intensity or saturation will have achieved the greater the sensory values. In general, the design without difference becomes rigid and lacks vitality, as well as the use of contrast in equal degrees between the elements, leads to a feeling of boredom.

1.2. FOCUS AND SCOPE OF THE THESIS

The research will be an important addition in the field of studying the emotional values of color and its relationship in the design of interior spaces for fast food restaurants. The search will reach to the local emotional translation of the primary and secondary colors. The user's favorite color schemes will be measured in the design of interior spaces, which will provide local professional designers and students with new mechanisms in the design of interior spaces.

1.3. THE RELEVANCE AND IMPORTANCE OF THE RESEARCH

Research in the field of coloristically evaluating interior spaces from a sensory and emotional point of view is recent in the world and does not exist in Arabic-speaking countries, so this research is considered the pioneering research in this field. The results of this research will help designers design fast food restaurant spaces and more to create a thoughtful emotional impact that contributes to the commercial success of the restaurant. The results of this research will contribute to creating a database of professional interior designers and interior design students

The tools that will be used by the research and the results that will achieve can be used in evaluating of the already completed interior spaces.

1.4. LITERANTURE REVIEW

The researcher will review nine researches that he believes are closest to the topic of the current research he will discuss the extent of disagreement and agreement with those researches regarding the scope of the research, defining the problem, objectives and types of mythologies that had been used.

Regarding the scope of the search, the scope of Marco was the interior color and psychological performance in the university residence hall (Marco et al, 2018). Brengman's research was the effect of color in the store environment (Brengman, 2002). However, Jawad's scope was the effect of color in the store environment (Jawad, 2013). Nima made choose of the effect of color for interior spaces on the shopping activity of commercial buildings, a specialized study of living room furniture (Nima, 2007). Al-Naimi research scope was the effect of color properties on stimulating positive feelings towards the urban landscape of the commercial street (Al-Naimi, 2005) while Al-Khalid scope was research visual perception of interior space in children's hospitals (Al-Khalidi, 2008). According to Al-Dabbagh's scope was unanalytical study of the remaining memory space in closed marketing centers (Al-Dabbagh, 2010). Zhang's scope was the application of colors in interior design, advances in the Social Sciences (Zhang & Kuang, 2017, p. 635) and Yassin choose for his scope the color systems and their role in achieving color diversity in commercial

advertisements (Yassin, 2007). The scope of the current research was the emotional influences of color in the design of interior spaces of fast food restaurant.

As for the research problem, Marco identified his problem with the following: The external color of the architecture affects the general urban design in determining the foundations of general aesthetic values. The color in the interior space can affect the feelings of love and attachment to the interior space (Marco et al, 2018). Brengman identified the problem of his research as no study on the effect of color in retail stores (Brengman, 2002). Jawad viewed his problem as lack of clarity in the impact of the diversity of finishing materials on the reception of the commercial urban landscape (Jawad, 2013). Nima defined his problem, the apparent lack of interior architecture in the use of colour, especially in commercial spaces (Nima, 2007). Al-Naimi adopted the lack of sufficient scientific knowledge about the effect of color characteristics in stimulating positive feelings towards the urban landscape of the commercial street (Al-Naimi, 2005). Al-Khalidi saw that the visual perception of interior space in children's hospitals is his problem (Al-Khalidi, 2008). Al-Dabbagh saw that designing interior spaces while keeping multiple sensory cues in memory (Al-Dabbagh, 2010). Zhang believed color had a specific function and it is possible for the environment in the user's interior space to bring pleasure and relaxation (Zhang & Kuang, 2017, p. 630). Yassin supposed that color systems and their role in achieving color diversity in commercial advertisements (Yassin, 2007), as for the current research problems summarize as follows, incorrect selection of colors and their sensory impact on the interior spaces of fast food restaurants in Iraq.

As for the objectives of the research, all previous research focused on the importance of obtaining the results of allocating the importance of color in the success of the interior space from the emotional and functional side, which is what the current research aims for.

The current research benefited from the methods of each of Marcus, Brengman, Nima and Al-Naimi according to which the primary and secondary colors and their emotional effects were chosen for the purpose of obtaining the required results. In addition to designing a virtual space and designing two questionnaires.

1.5. RESEARCH OBJECTIVE AND QUESTIONS

The objectives of the research is to understand the color relations in general and in particular the color schemes and their uses in the design of interior spaces.

The research will also deal with understanding the emotional sensory effects of color schemes in the design of fast food restaurants in order to identify them and diagnose the appropriate color effects in showing the required sensory effects.

As for the research objectives, they can be summarized as follows:

- The research will investigate color relationships and measure their emotional effects in the design of interior spaces for fast food restaurants.

- Emotional to primary and secondary colors will be measured. First as an abstract colors then colors used in the interior space of fast food restaurants

-The interrelationship between chromatic projects and color schemes will be recognized.

- It will recognize the importance of emotional effects as outputs in the design of interior spaces.

- It will be achieving the desired emotional effects in fast food restaurant spaces.

1.6. LIMITATIONS AND STRENGTHS

The research will be an important addition in the field of studying the emotional values of color and its relationship to the design of the interior spaces of fast food restaurants. The search will measure the Iraqi emotional translation of the primary and secondary colors. Seven emotional effects for colors will be measured in a virtual interior spaces of a fast food restaurant.

The participants in the questionnaire will be identified students from the Design Department of the Faculty of Fine Arts at the University

1.7. STRUCTURAL OVERVIEW

Previous studies and research related to the subject of this study will be reviewed for the purpose of comparison and disclosure of literature and topics directly related to this study. In addition to references and sources on the topics covered by the theoretical framework. The descriptive analytical approach will be followed in this study to obtain the results.

The second chapter will include the theoretical framework through defining and discussing color measurement and color formation for the purpose of obtaining the basics in understanding color formation from the visual side. Understanding color systems and their formations with regard to contrast and harmony will include too. Presentation of the relationship between color and light will be present, due to its importance in understanding color from the visual side and perception. The third chapter will be dealing with the psychology of color in its environmental, physical and emotional aspects. It will present the types of emotions and the methods of measuring them in the interior spaces. It will also deal with the types of restaurants in general and fast food restaurants in particular.

The fourth chapter will contain with the structure of the research, the methods and tools that will be used for the purpose of obtaining the research results. The study will also include creating a virtual space for a fast food restaurant, designing a questionnaire, one of abstract colors, and another one for interior space for fast food restaurants.

CHAPTER II

2. THEORETICAL FRAMEWORK

2.1. COLOR MEASURMENT AND COLOR FORMATION

For many centuries people believed that, music could only be recorded in memory and could not be written down. by the year 1700 an integrated music notation system was developed, and it became possible for music to write scale, pitch, intensity, intervals, and continuity, which giving musicians a golden opportunity to codify and study their compositions and preserve their output, the finest international musical productions began with the integration of the musical notation system. As for color, the matter is not different in terms of the importance of chromatic accentuation. The color vocabulary in the language is poor and barren, and all languages seem to be the same. Some languages of primitive people do not contain the names of all colors, and there are languages that do not contain names that differentiate between green and blue, such as the primary language of India (Graves, 1951, p. 324).

Colors are like music and their letters have very multiple meanings, and the more experience that has in applying them, the more our color tastes musical to match the human taste. This matter is not an easy job; it needs a delicate and subjective sense of music at the same time. It must also express a clear and objective vision (Abbou, 1982, p. 137). Leonardo da Vinci is an Italian artist and scientist who was one of the first theorists in the science of color. He knew several centuries before psychologists the primary character of green, yellow, red and blue. Knowing these colors leads us to know other colors. De Vinci mentioned in his book *Treatise on Paintings*, about the harmony between opposing colors, and how to put blue next to yellow, or red next to green to highlight both colors. These colors evoke a more aesthetic state than putting similar colors together. The book Treatise on Paintings remained the theoretical source adopted for several centuries. After him, Isaac Newton explained a color circle in the late seventeenth century, where he drew two fields of the solar spectrum to form together a complete circle composed of red, orange, yellow, green, blue, and violet. This is the first attempt to create or organize an image of the world of color, in the year

1866, the scientist Helmholtz reached the three basic dimensions of color (Birren, 1963, pp. 141-142).

2.1.1. Color Concept

Colors are one of the most beautiful and fertile things in the life of human beings, from which man enriched his life and added to it a wonderful beauty and splendor. The design element addresses us psychologically and emotionally, is considered the most powerful executive tool, and was developed to help the designer in producing works of high artistic value.

Recent research has led to the exploration of the components of light and chemical colors and their physiological, visual and psychological effects on humans.

The research began with building a knowledge base based on scientific foundations and previous literature, and in the manner of intervening between a group of sciences to extract a definition of the concept of color science and the process of its perception by individuals and the impact of their social and natural environments in that.

2.1.1.1. The Concept of Color in the Language

The phenomenon of light such as red, brown, pink or gray or visual perception that enables one to distinguish between identical objects.

The appearance of objects and light sources that can be described in terms of hue, luminosity, saturation of objects and hue, brightness and saturation of the light source (Hussein, 1978, p. 37).

2.1.1.2. The Concept of Color in Art

Color represents the vital aspect of the artist's culture since ancient times until today. Plastic artists consider color to be one of the plastic arts' means of self-expression. Color is a manifestation of the artist in his methods and his aesthetic and experimental sensitivity in creativity and application, and they consider colors as the stabilizer that maintains the dynamism of human feeling, Color is the extra dimension that gives the artist infinite meanings to express everything beautiful.

Colors represent the vital aspect of the artist's culture since ancient times until today, where the plastic artists and impressionists consider color as one of the means of plastic arts for self-expression according to the artist's experience and an aspect of his methods and his aesthetic and experimental sensitivity in creativity and application (Kubba, 1992, p. 36). They also consider the colors to be the stabilizer that maintains the dynamism of the sublime human feeling, which is full of poetic and emotional intimate. Color is the additional dimension that gives the artist infinite meanings to express everything beautiful. If art is thought to be a beautiful thing, it must be seen, felt, understood, and practiced.

2.1.1.3. The Concept of Color in Nature

Color has several concepts in every science of nature, and the sciences overlap in its definition, as follows:

A. Physicist has defined color as a mental phenomenon by means of light shining on the background of the eye, the retina after it passes through optical means,.

B. As for chemists, they consider color as a group of complex reactions resulting from the processes of pigmentation.

C. In natural science, color means those colored rays resulting from the analysis of light (the solar spectrum, for example, or other spectrum of different electric lamps (Kubba, 1992, p. 14).

2.1.1.4. The Concept of Color from a Psychological Point of View

Color is defined psychologically as that appearance of a body or light that is described as arising entirely from a person's perception of value, intensity, and hue (Nima, 2007, p. 92).

2.1.1.5. The Concept of Color from the Point of View of the Interior Designer

The designer defines color as an element of design that helps in giving the interior space its privacy and distinctive function, taking into account its cultural, aesthetic, psychological and physical effects (Holtzschue, 2002, p. 1).

2.1.2. The Importance of Color

Color occupies an important place in all aspects of activity in public and private life. Artists, psychologists, natural archaeologists, and interior designers called for that. Therefore, it is necessary to pay attention to the different aspects of color, including:

1. Plants grow depending on light and color, as they form a binary with each other in every form of life, where color performs an important function in the development of hormones and the internal system of nutrition.

2. Large and small animals have a reaction to the direction of color, as well as the migration of birds and the mating of mammals experiments have shown that when the red color was shed on the types of mice when mating, the result was the largest number of them males, and when the blue color was shed, the most females were (Holtzschue, 2002, pp. 67-65).

3. The importance of color to human: the study of the effect of color on the psychological and organic aspect of the human being, and it was found that the red and yellow color cause the intensity and speed of the heartbeat because of its long waves, activating the psychological state. Traits of comfort and reassurance, while others carry the characteristics of fatigue and turmoil, and laboratory tests and scientific experiments have proven that colors have a strong effect on the human psyche, as cheerful colors are a kind of psychological treatment for those who suffer from depression. In addition, the presence of radiant energy in colors, its strength can affect human health and happiness, and can create a feeling of well-being and depression, and indicate active activity or inactivity and latent passivity (Youssef, 2000, p. 99).

4. The importance of color in religions: Color has been closely associated with religions in general, there are special colors worn by clergymen in the spaces of different worship, each according to his beliefs, in addition to special colors that distinguish the interior spaces of the place of worship one from the other and according to religious belief.

In the Islamic religion, the connotations of color came expressive or symbolic, sensual or aesthetic. The color was associated with two sources: the first of which is the light

coming from the sky associated with the Creator. The light of God. In addition, the second source is the eye as a sensory tool for light and color. The eye is mentioned by God Almighty in the totality of his blessings on humans, just as the colors in the law of nature and creation in itself are a divine miracle that calls for attention and that their dedication was never in vain. The word color appears many times in the Holy Qur'an, where white, black, red, blue, yellow and green are mentioned (Ayyad, 2002, pp. 309-311).

As for the Christian religion, it opened new meanings to the old beliefs, and therefore the Christian color symbolism added new meanings to the old colors. The blue color was associated with the Virgin Mary, peace be upon her, as the Queen of Heaven, and the white color became the color of holy and purification virgins (Kubba, 1992).

2.1.3. Basic Color Dimensions

Different terms are used in slang to describe color, but in a more technical language, these terms have different meanings.

In 1905, artist and educator Albert found this confusion caused by the use of common color names to describe color. Dark blue may be one of the group of dark blue colors and therefore it does not describe all dark blue colors. Albert has dedicated his life to developing a color notation system to make the communication of color easier to describe. It is possible to determine the color in mathematical detail by some properties. These properties explain exactly the intended color.

2.1.3.1. Hue

The light emitted by a color source has a clear characteristic; it may be yellow, green or otherwise. The origin of the color is the characteristic by which one color is distinguished from another; it means that the color pigment has the correct significance that is agreed upon by more than one person. The primary colors that were distinguish are based on spectral colors, red, orange, yellow, green, blue, and violet (see Figure 2.1). All colors are similar to one or two colors of the solar spectrum, thus pink and crimson are close together In Hue even though they are two different colors. Hue is determined physically by wavelength (Al-Jubouri, 1997, p. 25).The scientist Mansell classified colors physically into:

1. Chromatic colors: they are classified into two main categories: -

a) Primary colors: stemming from the spectrum: yellow, red, and blue from which the rest of the colors are derived.

b) Binary colors: They are the compound colors of any two primary colors such as orange, green, and violet (see Figure 2.1).

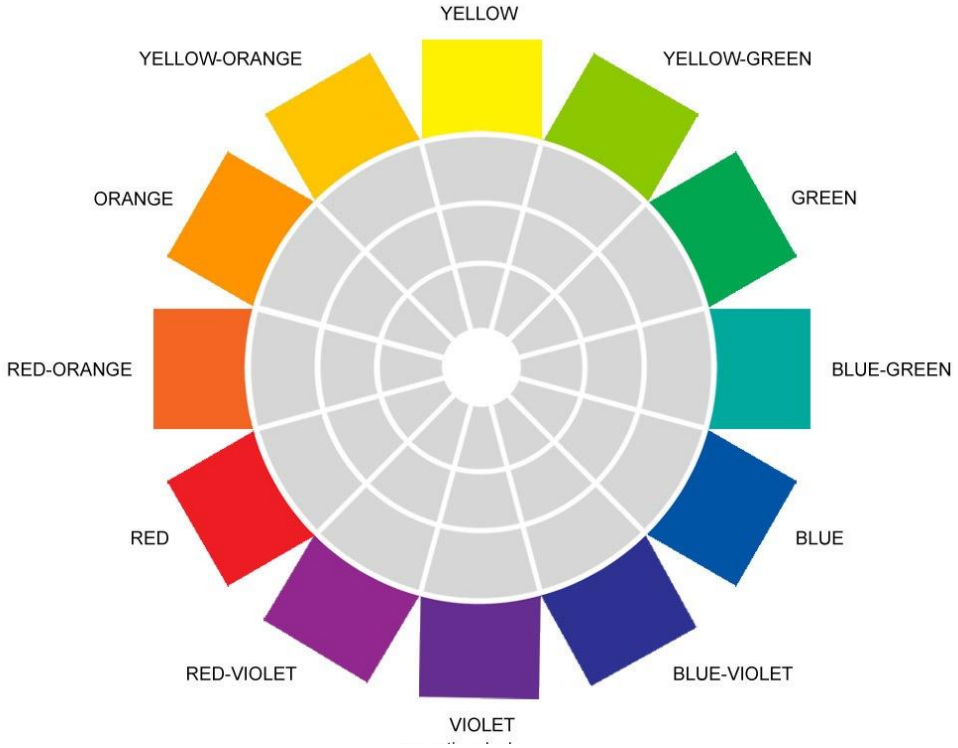


Figure 2. 1. Shows the primary and secondary colors (Abbou, 1982, p. 34).

2. Achromatic colors: They are composed of white and black, , or a combination of three basic colors in different proportions, or two complementary colors, opposite in the same color circle (Jawad, 2013, p. 67). Neutral colors are in two cases: either white light colors, their composition is in certain proportions or dark colors close to black, and they are termed black colors. Between the white and black color in the color gamut there are varying degrees (see Figure 2-2), representing the shadows falling on the bodies of their surfaces. White or shades if mixed with artificial colors, they represent light or dark colors and in this case, they are called monochromatic colors (Marco et al, 2018, p. 2). The method of organizing gray colors differs according to different scientists in terms of arrangement. The optical results obtained from them are one and close, and the most famous of these organizational circles are Oswald's organization, and the Mansell organization.

Which will be discussed in detail later, Figure 2.3 shows the use of Achromatic colors in interior space.

Figure 2. 2. Achromatic colors (Kauldhar, n.d.)

Figure 2. 3. The use of achromatic colors in interior design (Kauldhar, n.d.).

2.1.3.2. Chroma Intensity

It describes the degree of purity and strength of the color, where it is possible to distinguish between two colors that have the same color origin Hue. For example, a color that is darker or lighter than the second is, but they differ in the intensity or strength of the color, which represents Saturation degree of the color. That saturation comes from the strength of the color. Color or its lightness. In other words, seeing two adjacent colors from one family. But they are mixed with a neutral color such as white or black (Abbou, 1982, p. 54). Usually, it can be said that a certain color that it is light or dark from the intensity of the color, and its quantity placed on the background, whether it is white or black. The highest intensity of the color is when the color comes

out in a large amount from the color box, Figure 2.4 shows that the closer to pure red, the higher the Chroma, so to get the required intensity; the wall usually paint with a number of Layers of a single color

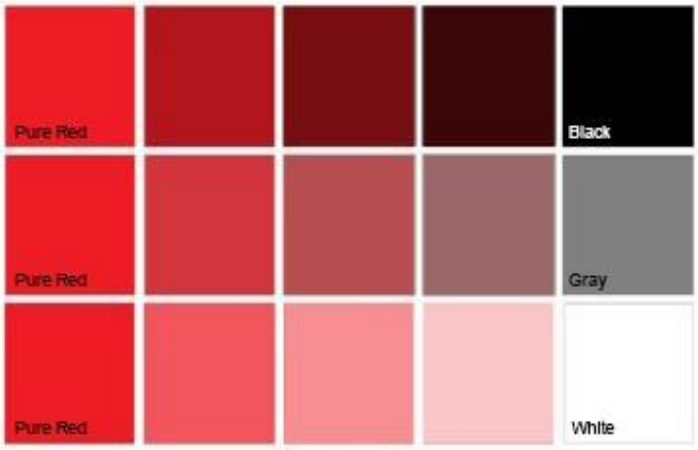


Figure 2. 4. The closer to pure red, the higher the Chroma: the closer to black, white or gray, the lower the Chroma (Smith, n.d.).

2.1.3.3. Luminous Value

It is the third dimension of color. The quality by which is distinguish dark color from light color, and the optical value of the dye is a measure of the light reflected from its surface. This differs from the term “brightness” which expresses the intensity of the light source or the luminous sensation when describing light (Al-Jubouri, 1997, p. 27). In other words, the color value is the value of the color saturation with light or bright light and shadow and bright shade or value, between a pure color and another pure color adjacent to it in the Oswald circle of colors. The color value is classified according to its association with black and white (see Figure 2.5).

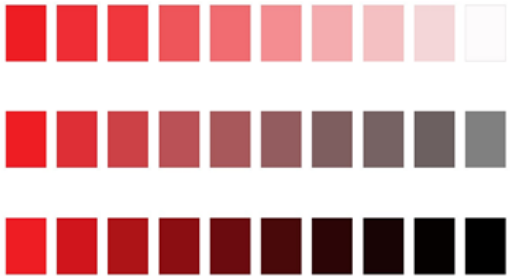


Figure 2. 5. Value changes of the primary colors (Smith, n.d.)

- **Tint**

Tint is adding white to the value of the color hue. It can mix the dye with a very small amount of white to get a little tone or add a lot of white so that the color is very light. All these tones are tints of one color; one color formula is displayed for each gradation in the color circle. It is next to the color gradation. Its location is in the middle of the distance between the white gradations (see Figure 2.6) (Youssef, 2000, p. 80).

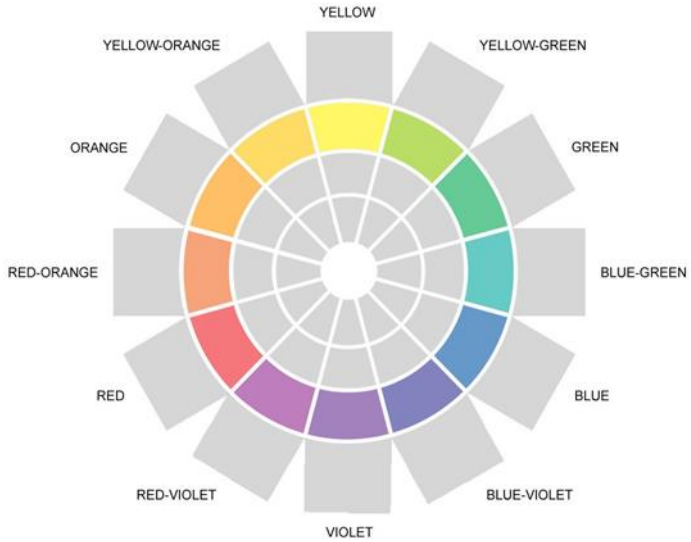


Figure 2. 6. Tint on the color wheel (Smith, n.d.).

- **Shade**

Shade is the dark value of the color obtained by adding black color. It is possible to add a very small amount of black or add a large amount of them. These are all considered shadows in the color gamut on the color wheel (Holtzschue, 2002, p. 69). One shadow appears in the middle of the distance between the value and the black color (see Figure 2.7).

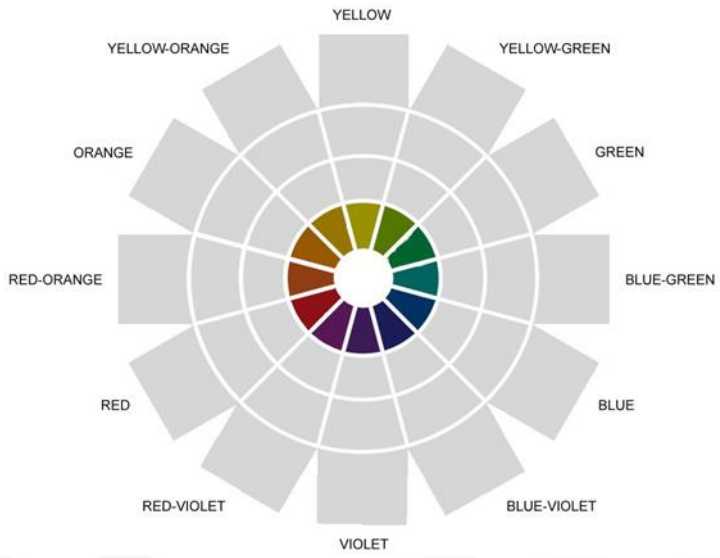


Figure 2. 7. Shade on the color wheel colors (Smith, n.d.).

- **Tone**

A color tone is formed when color is mixed with gray, a color mixed with any amount of gray is considered a tone, and there is one tone on the color wheel located in the middle of the space between the gray scales (see Figure 2.8).

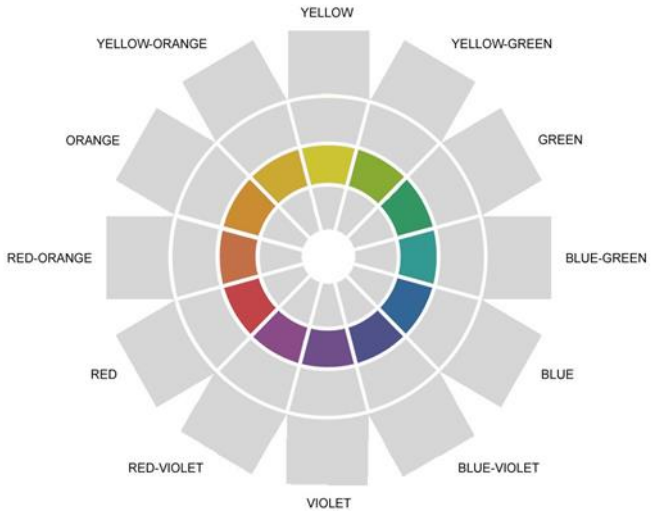


Figure 2. 8. Tone on the color wheel, (Smith, n.d.).

2.1.4.4. Color Temperature

The concept of the term warm and cold for color in design does not refer to the physical temperature, but rather to the feelings and moods that the color produces. For example,

our experience with the color blue refers to the association with water, the orange color is associated with the warmth of the sun and fire, therefore, and the terms warm and cold refer to the accumulated life experience of the people (Marco et al, 2018, p. 10).

- **Warm Colors**

Colors are classified as cold and warm. Warm colors are known to be bold and lively and have the ability to convey a feeling of closeness to the interior of the space at the same time. These effects can constitute a significant change in the product's appearance and can dominate other colors when used extensively, (Labrecque, 2022, p. 56).

- **Cold Colors**

Cold colors are Blue, green, bluish green, red, violet, violet, and bluish violet are cold colors. These colors have an opposite effect on a person compared to warm colors, as they reduce heartbeat, breathing and blood pressure, as they do not have any effect on the nervous system (see Figure 2.9) (Al-Qadi, 1975, p. 78).

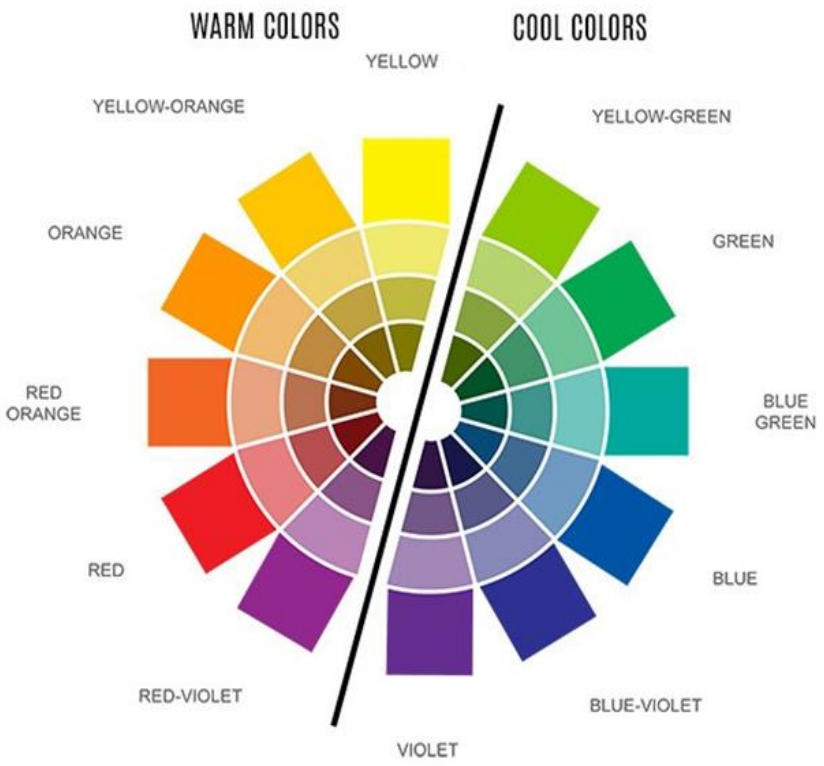


Figure 2. 9. Shows the warm and cold colors and the gradation of the luminous value and intensity (Smith, n.d.).

2.1.3.5. Color Family

Figure 2.10 shows that each part of the color wheel represents a color family, there are twelve color families on the color wheel, one for each color on the wheel.

It is possible for the interior designer to benefit from these color families in choosing colors for interior designs, design relationships in interior spaces such as contrast and consistency.

Figure 2. 10. Color family (Smith, n.d., p. 26)

2.1.4. Color Organization and its Systems

Reaching the system for color notation was not the result of easy individual efforts, but rather it was continuous efforts of a number of scientists in various specializations. Perhaps the research of the two scientists, Albert Mansell and William Oswald, were the best evidence of that effort.

2.1.4.1. The Color Solid

It is a less regular stereotype than the regular spherical shape of the color ball of the different color systems. Which helps us visualize the comprehensive system of all colors for any color system. It expresses the properties of each color of hue, value and intensity of it, because the color sphere of any system does not contain all the colors

compressed into a regular spherical shape, but rather it is just a symbol of the three-dimensional basic idea of colors and the relationship between colors. As shown in Figure 2.11 the color solid consists of a central axis representing Value scale containing two points of equal distance from the center. one representing the typical black color at the bottom and bearing the number zero, and the other representing the typical white color at the top and carrying the number 9, and the divisions represent The average on this axis is the gray scale values of equal areas connecting black and white, this axis is called the gray scale. The horizontal lines running from the central axis towards the periphery, similar to the branches of a tree representing the colors. In each branch, there is a color chain that has the same hue and luminous value. However, they differ in terms of intensity (Tahafi, 1993, pp. 324-332). As it increases as moves away from the chain from the middle axis of the lead neutral and any two branches of the branches' Colors are of the same degree within the median axis. They have the same luminous value. But they differ in the origin of hue and intensity. In addition that each sector of the color sphere for any color system its colors share the origin of the color Hue and differ in light value.

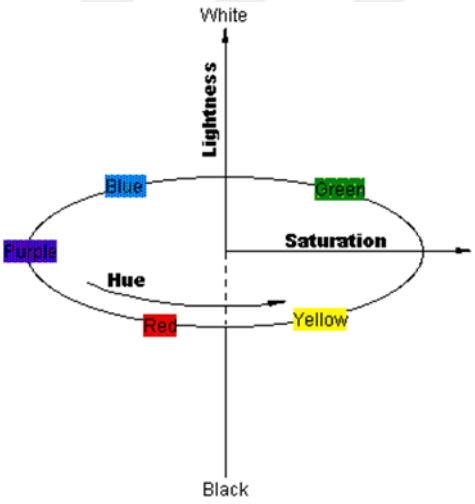


Figure 2. 11. The color solid (*Color systems*, n.d.).

2.1.4.2. Mansell Color System

A basic and practical system acts as a scale that determines the characteristics and properties of colors and measured intervals. Scientist Mansell confirms that just as the box has three dimensions to describe it, color has three dimensions to describe its properties. These dimensions are represented Chroma, value and hue (see Figure 2.12).

These dimensions must be clearly aware of their connotations and the way they describe the color. The system consists of a color circle placed in a horizontal plane on which the colors and their divisions are distributed, perpendicular to a median axis, the gray or gray scale mentioned earlier. Figure 2.13 shows that the horizontal color circle shows us20 spaces equal to the colors read in a clockwise direction. These colors consist of five basic main colors, principle hue: red, yellow, green, blue, and violet. Halfway between these colors are the secondary colors: reddish yellow, greenish yellow, bluish green, violet blue and reddish violet 2-3 (Kruschwitz, 2018). The color is divided and classified by ten Triple divisions mediate between the primary divisions and secondary divisions, which are 80 divisions. The first letter of its name in the English language symbolizes the color in this system. For example, the red color is symbolized by the symbol R, the yellow color by the symbol Y, and the orange color R45Y as it symbolizes the colors that fall within the ten triple divisions by numbers. It is symbolized by many symbols from 1 to 9, for example R2, R45Y3....and thus, in this way the first dimensions of the color are indicated, which is the pigment origin of the color. The need for tripartite divisions appears in harmony between adjacent hues and opposing colors, so the colors close to each other in the color circle are more harmonious than the divergent colors. the farther the colors are, the greater the difference and contrast until they reach their peak in the opposite colors on both sides of the circle Color, the complementary colors such as: red and bluish green, which are located on both sides of the color circle and represent the maximum color separation or color contrast (Graves, 1951, pp. 324-325).

The optical value of a color, which represents the degree of its luminosity and brightness, is graphed from the central axis, the lead or gray scale, which is known as a numerical scale that includes the presence of equal optical distances on it. With a number of 10 values or Neutrals from black to white symbolize by numbers 0-9. Each comma can be divided into ten sections and denoted as follows 1.1, 1.2, 1.3, etc. Each pure color is symbolized by the symbol N. The degree of its brightness is determined from its location on this lead scale gray, symbolized by a number above a line such as N2/, N3/, N0/ and either the symbol N0 represents the absolute black color . It is a default color because there is no color that does not reflect any amount of light. As for N10 symbolizes the white color and it is also a default color because there is no color

that reflects all the radiation falling on it. The normal white color has its luminous value 9 (Konrad, 1961, p. 334). In this way, the luminosity of the color is determined by the gray color in the light value scale. Where the optical value of the color is determined by writing the origin of the dye or its symbol, followed by a number that determines its location according to the light value scale. The researcher finds that colors appear more homogeneous when their luminous value is similar or contiguous, while colors appear more antagonistic when their luminous value is far apart such as value 3 and value 8.

As for the third dimension of color, the intensity and intensity of the color, it is determined from the scale of the color change between Neutral-gray and the maximum intensity of the color. It is an axis perpendicular to the gray axis and parallel to the color circle. It branches from the center of the circle for each pigment and is numbered outwards from the lead axis to the intensity of the color difference for each color pigment in the different levels of the luminous value. It contains a certain number of divisions that differ according to the pigment, because the colors, due to their nature, extend more than others towards outside. The red color at its maximum intensity is stronger than the intensity of green, symbolizing this particular number of divisions of numbers 1, 2, 3, and symbolizing the intensity of the color with a specific symbol placed under the luminous value of that color. For example, if it a green was dyed with luminous value 5 and intensity 1, it would be written as G5/1 (Tahafi, 1993, p. 339). It is worth noting that the dye with a low optical value can have a higher intensity, as in the purest dye bluish violet, as it has a low optical value. In addition, it has been found the highest intensity Chroma in value 3 and its value is stronger than value8 (Graves, 1951, p. 257).

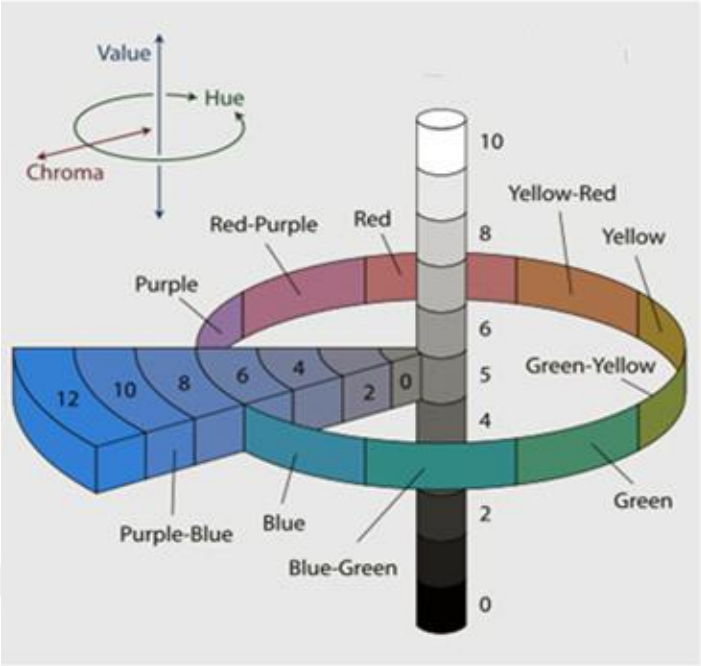


Figure 2. 12. Mansell Color System, (Kruschwitz, 2018, p. 56).

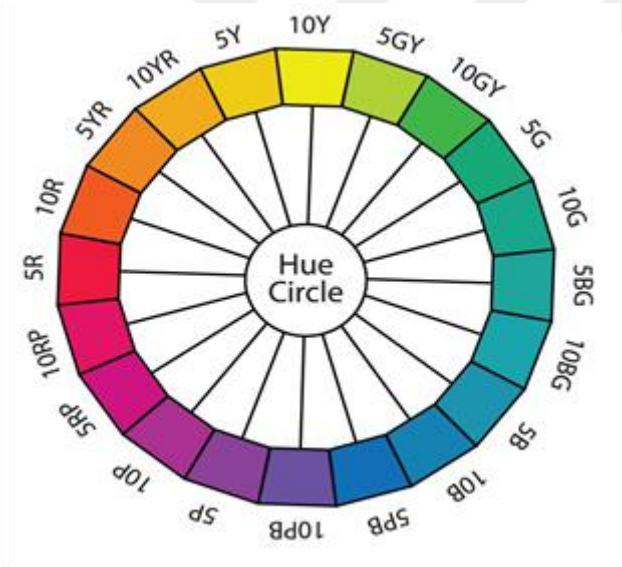


Figure 2. 13. Mansell color notation system, (Kruschwitz, 2018, p. 57).

2.1.4.3. Oswald Color System

The color organization in Oswald’s system is an anthropomorphic, with white at its upper pole and black at its lower pole. Arranged according to Oswald's color wheel. Its arrangement is based on placing the four main colors consisting of: red, yellow, green, and blue, integrated oppositely in the color circle. Then the rest of the colors

are graded among themselves in the form of five colors within equal intervals between each two main colors to be in total 24 pure colors (see Figure 2.14) (Shikisoukan, n.d.).

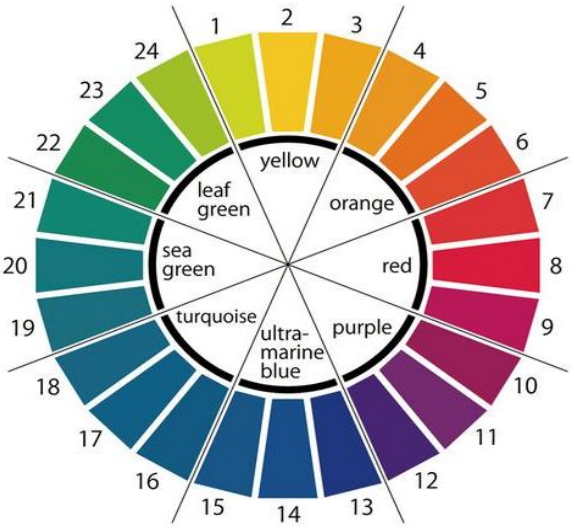
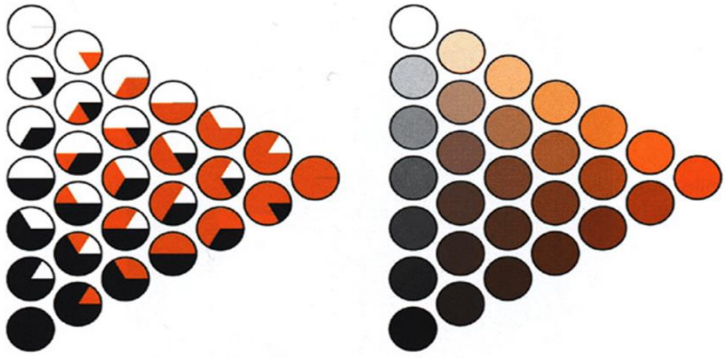


Figure 2. 14. Color organization in the Oswald system (Shikisoukan, n.d.).

Each pure color in the color circle forms with the black and white colors an equilateral triangle that includes 28 chromatic colors in addition to 8 achromatic colors. That are represented the median axis common between the colors of the holographic, and symbolizes each of these eight colors previously mentioned by the following symbols: A, C, E, G, I, L, N and P according to the sequence from white to black (Pohlmann's, 2020, p. 78). As for the upper outer surface of the holographic, there is a series of light colors, which are graded from pure color to white, while on the lower outer surface of the isosceles triangles there is a series of dark colors. Which are graded from pure color to black. The gray scale plays an important role in determining color symbols in Oswald triangles. Each color in the triangle is denoted by a symbol consisting of two letters, (see Figure 2.15), for example PA. The symbol A indicates what the color contains of white, and P indicates what the color contains of black, this is according to the lead scale. Oswald’s system consists of 18 steps or symbols. As for the color number, it is placed to the right of the previous two symbols. For example, when the color symbol is 8en, then 8 means red, it contains a quantity of white for what is in stage e of lead scale. In addition, its black contents equal to what the phase or step n contains in the lead scale, this means that the black content 8pa is less than what it contains in 8pc and so on (Al-Jubouri, 1997, p. 45).



Figur 2. 15. Color notation in Oswald's triangles (Pohlmann's, 2020, p. 58)

There is a vertical series of equal purity colors. In each triangle, a group of equal colors lies on one vertical line. It has been termed that the pure achromatic colors in each triangle are given the symbol o. While the columns are numbered in Latin numbers XIV, XII, II, IV, VIII and X, the spaces in the colors are to give room for other gradations and columns (Al-Dabbagh, 2010, p. 78). In general, any color in the Oswald system must belong to one of the following color series (see Figure 2.16).

Figure 2. 16. Oswald color sold (Mulvenna, 2016).

- **Shadow Series**

It is a series that is vertical and parallel gray scale and starts from the top with a pure color mixed with the white color and gradually towards the bottom. The body of the

orange when illuminated from one side, a vertical series of colors are distributed over the body of the orange.

- **The Equal White Series**

In this series, the colors in each row parallel to the lower side of the triangle contain the same amount of white as in the lead scale at which this row ends.

- **The Equal Black Series**

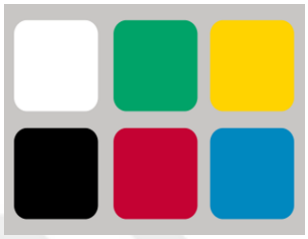
The group of colors is in the form of a row parallel to the upper side of the triangle, and contains the same amount of black as the lead color at the end of the series.

It can be said that the scientist Oswald adopted the physiological and psychological point of view through his system by accepting the idea of Heiring. He categorized red, yellow, blue and green as basic colors, although greenness obtains from mixing yellow with blue as pigments, the green color as a feeling is neither yellowish nor bluish, in contrast to the orange color. It gives a feeling that it contains yellow and red (Al-Jubouri, 1997, p. 98). Oswald also emphasized in his system that all colors could be derived from the four pure colors, white and black; therefore, it relied on the principle of isosceles triangles, which are primary bodies through which secondary bodies can be formed. The pure color is mixed with white to form Tint or Whitish colors. When the pure color is mixed with black, it becomes shades or Blackish color the pure color and the white and black color combine to form Tones, which is grayish color (Haddad, 1993, p. 76). The secondary form of colors refers to their primary components, for example, Tints have both the quality of pure color and the quality of white color, and that shades resemble pure color and black color. Tones give an impression of all three or primary forms pure color, white and black. Therefore, any color a person sees must be one of these seven forms.

2.1.4.4. Swedish Natural Color System

A color atlas stands for NCS. It is called Natural because it is based on the classification method established by, Oswald Herring based on the cyclo physiological basis of the colors and sensations generated by its six primary colors, which are red, yellow, bluish-green, and blue and white and black (see Figure 2.17). The color

classification depends on the following properties, pure color content, black color content, Hum. The color wheel is divided into four main sections: red, yellow, bluish-green, and blue form 9 Intermediate colors between each two main colors. The coding starts from the four main colors plus whiteness and blackness. The system consists of about 1300 colors of four colors and 5 degrees Achromatic scale and includes reddish gray, bluish lead, greenish lead, and yellowish lead, (Mahnke & Mahnke, 1987, p. 35).



Figur 2. 17. Swedish natural color system (*Opponent process*, n.d.).

2.1.4.5. DIN Color Chart

The colors in the Dutch institute for norming system called DIN are classified according to the following characteristics, relative lighting, saturation, hum and saturation hum. The color wheel is divided into 24 sections and four relative colors: red, yellow, green and blue. This system includes 600 or 900 colors derived from 24 achromatic colors and scales (see Figure 2.18) (Mahnke & Mahnke, 1987, p. 35).

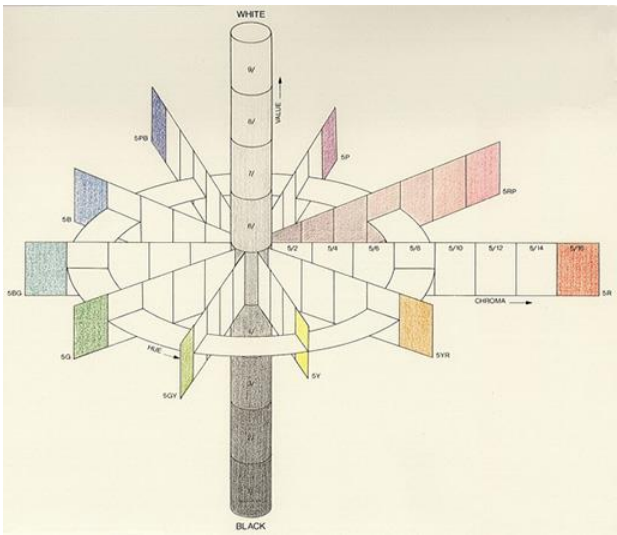


Figure 2. 18. DIN color chart (*DIN system*, n.d.)

2.1.4.6. Paint Color System

The interior designer deals with more than one system of dyes specialized in interior or exterior colors. All companies that produce dyes have their own systems that are linked to the common standards and mixtures of dyes. Each company puts what suits it in its work of coding. In many cases, color characteristics are written on the Hue standard. In other systems, the criterion is the saturation and the luminous value, but in the case of loss of coding, the reliance is on the visual calendar, (Mahnke & Mahnke, 1987, p. 35). The common pigments in decorating walls and interior designs are divided into oil and watercolors. All of these colors have light degrees. The colors are different and have a thermal connotation (Abbou, 1982, p. 134). Each color has a specific temperature. For example red is hotter than green. A special thermometer measures the color temperature, so it is necessary for the interior designer to choose the appropriate color in proportion to the environment.

2.1.5. Balance in Color

The process of balancing is the closest thing to a behavior in the eyes. The person is accustomed to by virtue of the natural formation of the human being, in terms of the installation of the eyes in the two sockets horizontally parallel to the line of the earth standing on it. The balanced action is desirable for the viewer that suggests acceptance. In all color relations, there must be a psychologically acceptable balance (Graves, 1951, p. 20). For example, the use of contrasting colors to form a different color unit. It is necessary to balance and distribute in balance over a certain area. This balance is in particular in agreement with our psychological acceptance of it, which falls under a force, the good distribution of the color line that attracts our attention. One of the most important requirements for color balance is to describe the nature of the color according to the family to which it belongs. The degree of its brightness and saturation with light, and the degree of that illumination. Is the color in the circle of colors, Oswald close to each other on the color scale of the solar spectrum or is it in contrast field (Abbou, 1982, p. 121). The balance of color depends on the extent of the coordination of its degrees, as well as on the extent of the expansion of the area or surface. It occupies what surrounds it, and the degree of coloration of the surrounding

surface or its neutrality. Colors are divided in their balanced chromatic relations into chromatic harmony and chromatic contrast.

2.1.5.1. Color Harmony Relationships and its Systems

Harmonious relations in poetry and music became measurable for a long time. As for the colors, it remained far from the measurement and for a long time. The main reason for this is that the sensory side in this subject is stronger than the objective side. However, the efforts of scientists and workers in the field of color enabled them to reach an objective reality, which is that the harmonious color system is a phenomenon of life and nature, and it can be accessed laboratory. The color harmony is in several forms (see Figure 2.19) (O'Connor, 2010, pp. 267-268),

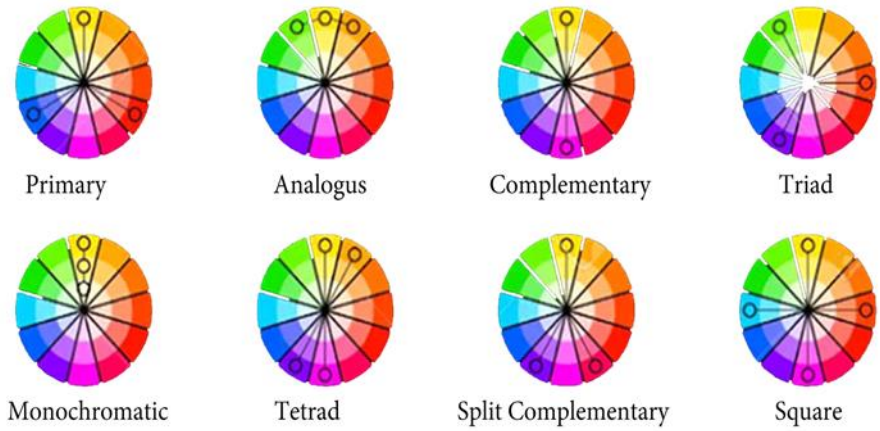


Figure 2. 19. Types of Harmony (Kliever, 2015).

- **Achromatic Harmony**

It consists of white, black and gray tones. Which is between the gray scales, Figure 2.20 shows the use of Achromatic Harmony in interior space.

Figure 2. 20. The Vipp Shelter by Vippm Bold Examples of Achromatic harmony Interiors (Kauldhar, n.d.).

- **Monochromatic Harmony**

This consistency depends on one color that change either in intensity or in light value, in addition, the repeated use of such coordination's leads to a feeling of boredom. It can be seen this consistency in the relationship between the colors of any triangle of the Oswald system. Figure 2.21 shows the use of Monochromatic in interior space.

Figure 2. 21. In L.A office, designed by Rapt Studio, bold examples of monochromatic interiors, (*Ten bold examples of monochromatic interiors*, 2016).

- **Analogous Harmony**

It consists of adjacent colors that do not exceed three colors from one color circle, and they are unified due to the common color among them, such as red, yellowish red, and yellow. Although these coordination's are more diverse than the previous ones, they do not address the problems of the dimensional phenomenon, as shown in Figure 2.22, the use of Analogous Harmony in interior space.

Figure 2. 22. Yoshinoya Japanese fast food restaurant Hong Kong design by Sum Sing / Sing Studio, (Retail, 2012).

- **Complementary Harmony**

It consists of opposite colors within the color wheel, as the sum of them forms and completes the basic tripartite color system, red, yellow, and blue. These harmonies provide maximum color contrast within the same color wheel, at the same time providing a balance between hot and cold colors in the environment (see Figure 2.23). There are two sets of tertiary and quaternary color harmony. To ensure the success of these harmonies in the interior spaces of restaurants to create a state of attraction, they must be used with a specific light value and color intensity (Al-Jalabi, 1998, p. 133). Determining the number of Complementary color harmonies varies depending on the type of color wheel used and the number of its colors, which determines which colors correspond to the other on the opposite side, which is the complement color to it.

Figure 2. 23. Using complementary color harmonies in fast food Lagos Nigeria, design by Armonia Interni Srl (*Fast food lagos Nigeria*, 2017).

A. Binary Color Schemes

Every two colors opposite and on either side of the diameter of the color wheel form an integrated color scheme such as red, green, yellow, violet, blue and orange. They are within any color circle of the color sold, where their colors are equal in light value and intensity, which enables us to obtain these formats.

B. Triadic Color Schemes

The colors that make up these formats are chosen so that their locations on the color wheel are an equilateral triangle. As in the layout consisting of red, yellow and blue. Or an isosceles triangle consisting of a basic color such as yellow and the two adjacent colors to its complementary color such as bluish-violet and reddish-violet. Some of these formats are strongly contrasting to be of main colors, and others are less strong, consisting of secondary colors.

- **Quadrilateral Formats of Colors**

These formats share the group of colors whose positions on the color wheel are a square shape, a rectangular shape, or four colors consisting of two complementary colors opposite each other on the color wheel with the two colors adjacent to one of them.

- **Hexagonal Formats**

The locations of the common colors in these colors are a hexagonal shape, and the four-color formats with black and white colors can be a hexagonal format as well. It can be said that it is possible to determine the color harmony relationships on the color circle (see Figure 2.24) (Al-Jalabi, 1998, pp. 135-136).

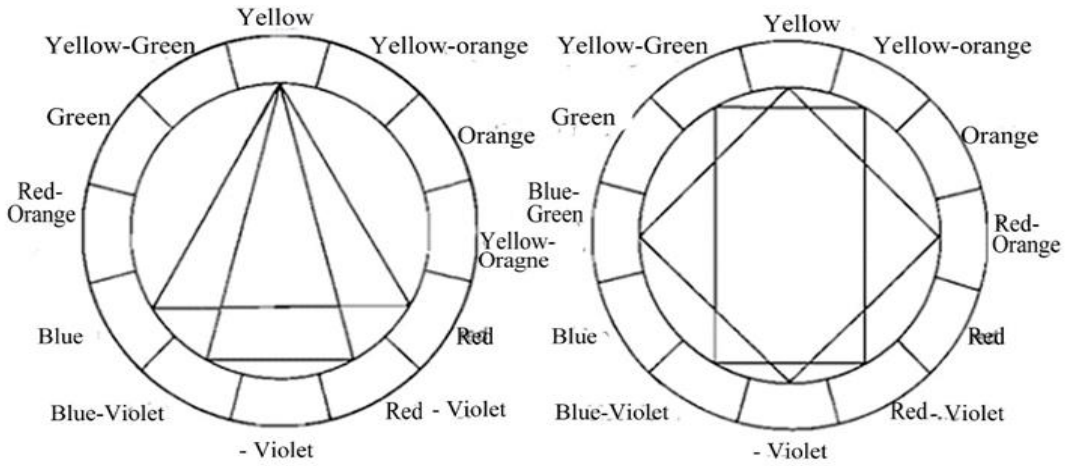


Figure 2. 24. Building harmony of triads and quatrains, (Al-Naimi, 2005, p. 46).

2.1.5.2. The Seven Contrast of Colors

It can be said that contrast is when there are obvious differences between two things. When this difference reaches its maximum. This contrast can be either diagonal or polar. An example of this is the contrast between black and white, long and short, big and small, cold and warm. When the difference between them reaches an extreme, it is called a polar contrast (Al-Dabbagh, 2010, p. 67). The perception of contrast is through the human senses and through comparison. For example, the line is long when it is placed next to a short line, but the same long line is short when it is placed next to a longer line. This also applies to color contrast, where it is determined whether it is weak or concentrated based on the same concept. When examining the effects of color, it is possible to identify seven different types of contrast. These types should be studied separately. Each of these types is unique in its kind in terms of artistic values and visual, expressive and symbolic effects. Overall, they constitute the main source of color in the design, (Hagen E. , 1961, p. 32).

Many experiments and studies have been conducted on the effects of color contrast. Johannes Itten, has classified the contrast into seven types:

1. Contrast of hue
2. Light – dark contrast
3. Cold – warm contrast
4. Complementary contrast
5. Simultaneous contrast
6. Contrast of saturation
7. Contrast of extension

- **Contrast of Hue**

It is the simplest type of contrast and can be distinguished visually easily and clearly when using color pigments with high intensity. As in using the color group consisting of, yellow, green and red or blue, red and violet and others. Where it is easy to pay attention to the contrast, it is most intense when using a color group consisting of the three main colors, red, yellow and blue. The use of contrast found in folklore arts such as costumes, ornaments, ceramics and others. In addition to the chromatic effects on the decorations of the interior spaces and furniture in the Middle Ages, contrast used not out of aesthetic pleasure only, but for the purpose of creating innovative decorations in the interior spaces.

Figure 2.25 shows the types of hue contrast that can be summarized as follows:

a. The strongest expression of color contrast occurs through the use of yellow, red, and blue,
b. Use yellow red blue white black,
c. Contrast with greater gloss,
d. The same colors as shown in Figure 2.24, but using shadows and tint,
e. Mix chessboard in yellow, red, blue, white colors,
f. The use of colors with a great deal of luster with delusions and clinics Tins,
g. High gloss colors (Hagen E. , 1961, p. 33).

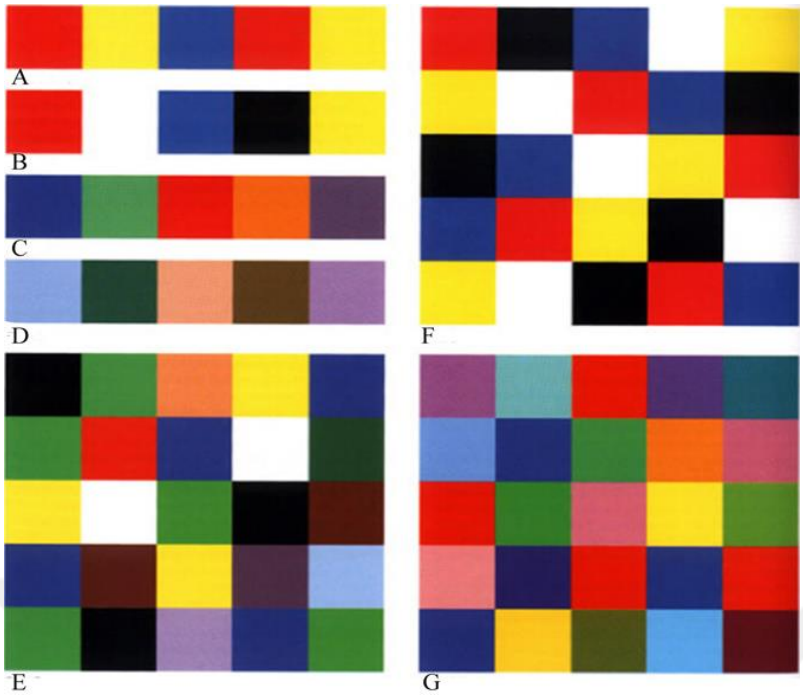
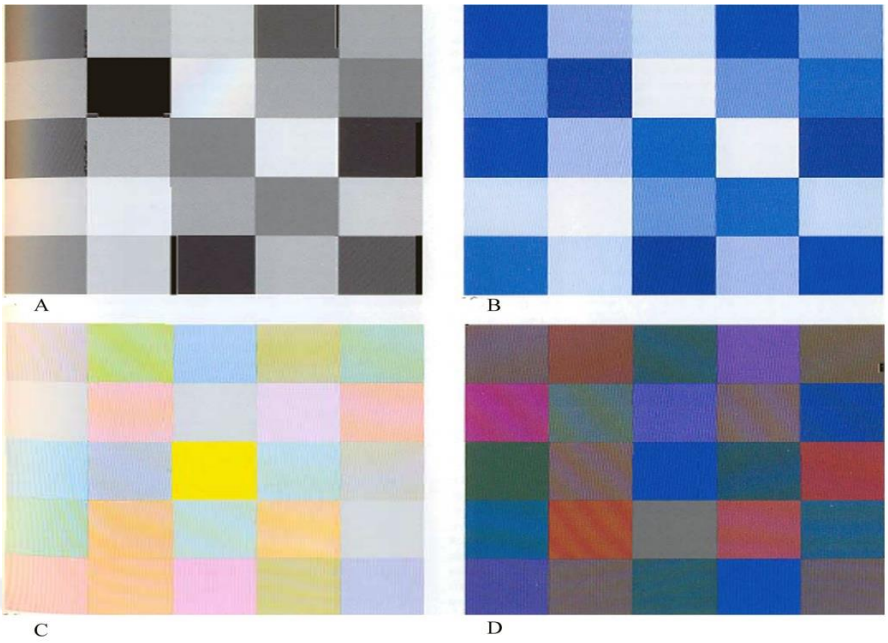


Figure 2. 25. Types of the contrast of Hue (Hagen, 1970, p. 35).

- **Light – Dark Contrast**

This contrast can be obtained from the use of white, black, and grey gradients and their equivalent colors in terms of luminous value. In this type of contrast, it is difficult to evaluate the luminous value of the conjugated colors, as you must take each of them separately to evaluate their luminous value. Figure 2.26 shows some contrast patterns between dark and light, as follows:

a) Light-dark composition in black, white and gray.
b) It is the same as the previous configuration, but it is blue.
c) Colors with equal brilliance.
d) Colors of equal darkness (Hagen E. , 1961, p. 44).



Figur 2. 26. The contrast of Light and dark, (Hagen, 1970, p. 39)

- **Cold – Warm Contrast**

Experiments have proven that there is a difference in the subjective feeling of a person of heat or cold between a workroom dyed in bluish green and the other dyed in reddish orange. Cold colors calm the blood circulation, while warm colors activate it. Figure 2.27 shows that there are some models of contrast between cold and warm color, as follows:

a) The strongest contrast in cold and warm, which includes red-orange, blue, and green.

b) Reflection of proportions in A.

c) Shows a reddish-purple warm in relation to blue.

d) Appears cooler reddish violet compared to orange,

e) It is a fluctuating contrast between cold and warm colors.

f) Adjusts to cold and warm in red.

g) Adjusts to cold and warm green. (Haddad, 1993, p. 66),

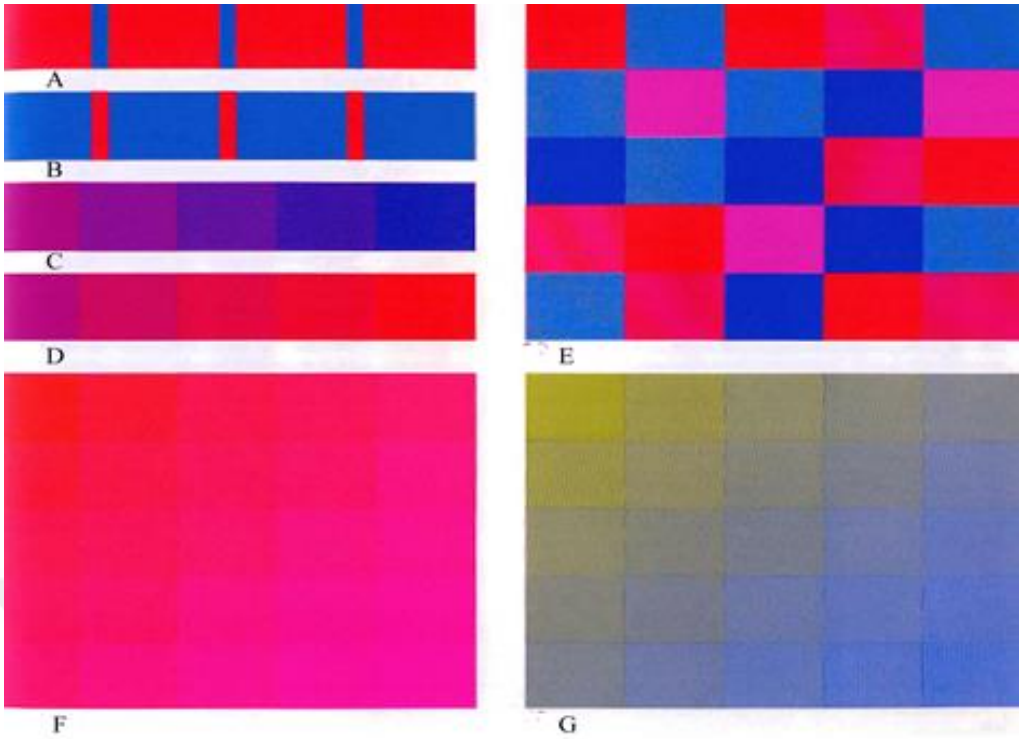


Figure 2. 27. The contrast of Warm and cool, (Hagen, 1970, p. 47).

- **Complementary Contrast**

Any two colors a complementary term if the result of mixing the two pigments is a neutral lead color, while physically mixing the light of two complementary colors produces a white color. These two complementary colors confirm the existence of the other and give it strength and clarity. There is always a single complementary color for each color in the color circle. The After image indicates that the eye needs the color that gives it balance, but in the absence of it, it gradually works on its formation. The use of integrated colors in a balanced manner gives a stable effect to the inner space. Figure 2.28 shows that there are some models of integral variance, as follows:

a) A to F Mixture strips of six complementary pairs.

b) G composition in the complementary pair red/green mixtures.

c) H square combination of two complementary pairs, for orange/blue and red-orange/blue-green (Hagen, 1970, pp. 50-51).

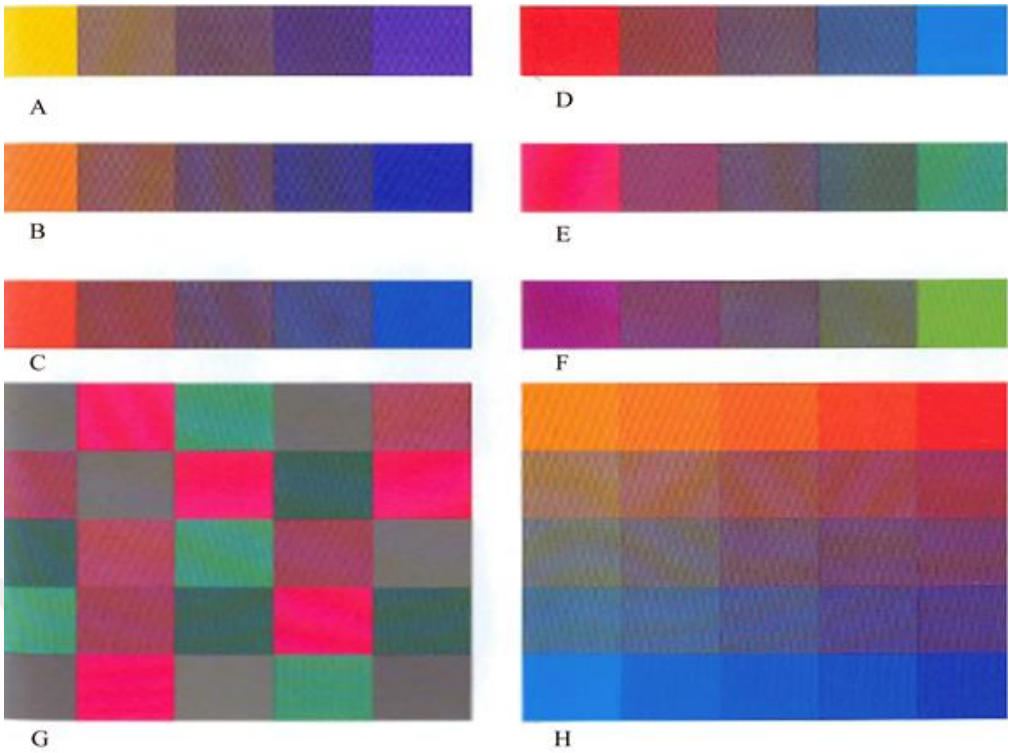


Figure 2. 28. The contrast of Complements, (Hagen, 1970, p. 51).

- **Simultaneous Contrast**

It results from the fact that when the eye looks at any color, it simultaneously needs the complementary color to reach balance, or it generates it, if it is not presented to it. This happens because of a subjective sense and not an objective factor. It cannot portray this color. This kind of contrast creates stability and visual balance. Figure 2.29 shows that there are some models of simultaneous variance, as follows:

a. A to F in each of the six squares placed a gray square, which perfectly matches the surrounding color in brilliance. Each gray square complements the color of the floor. The synchronization effect becomes more intense with the square's main color
b. G Three gray squares surrounded by orange. These boxes are slightly different among themselves. It can be seen that the first lead color appears bluish and increases in intensity, the second is neutral and suffers from simultaneous modification, and the third contains an admixture of orange (Hagen, 1970, pp. 52-53).

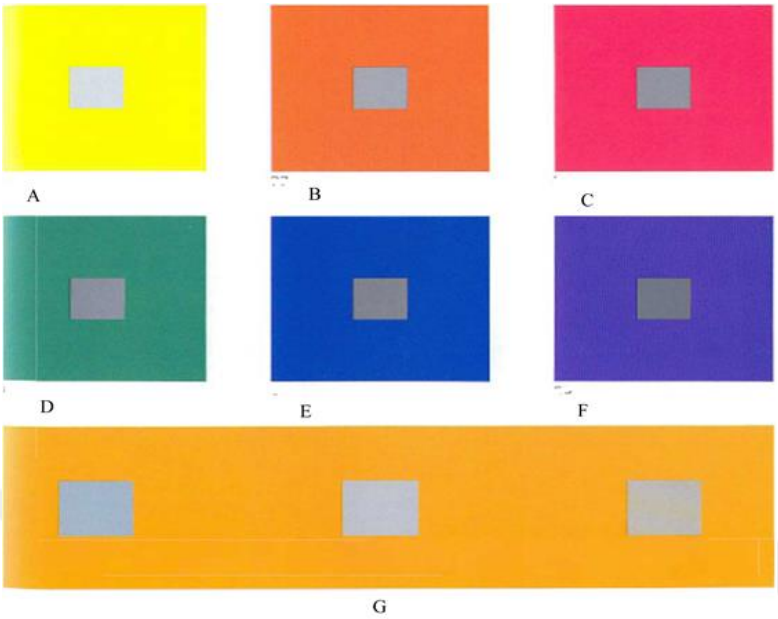


Figure 2. 29. Simultaneous contrast, (Hagen E. , 1961, p. 53).

- **Contrast of Saturation**

Saturation depends on the purity of the color in question. Contrast in saturation is the contrast between an opaque color and a diluted color. As the color can reduce its saturation or purity by adding white, black or gray. Colors can also reduce their purity by adding a complementary color to them. It is preferable to use in this contrast one color in its full purity with the same color in addition to white and black. Figure 2.30 shows that there are some models of variation in saturation and as follows:

A to D central squares model containing 25 squares. The colors: bright yellow, orange, red, and blue are placed in its Centre. Its four corners are natural lead color. Mixing it with the pure original color forms shades of color with reduced saturation (Hagen E. , 1961, p. 57).

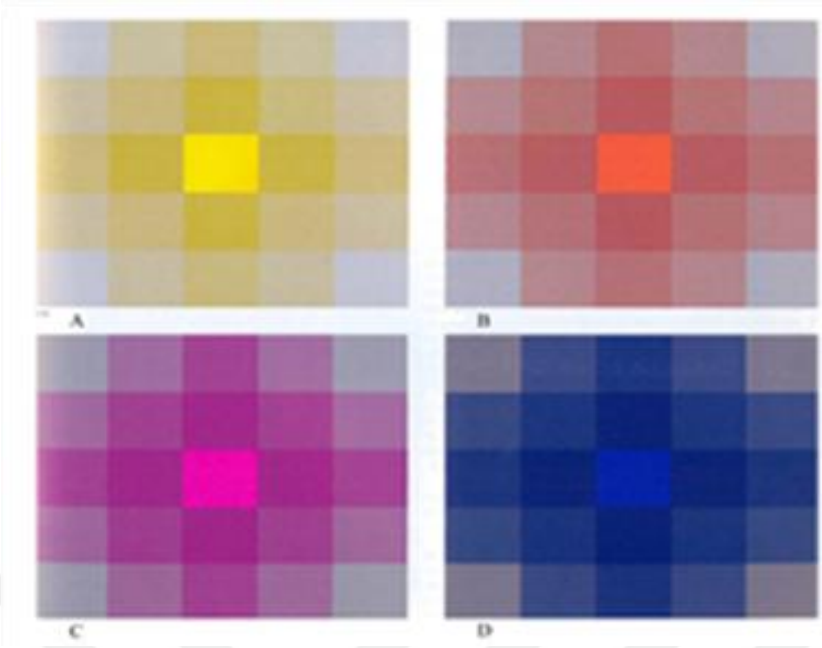


Figure 2. 30. The contrast of saturation, (Hagen, 1970, p. 57).

- **Contrast of Extension**

Contrast by extension is related to the relative area of the patch occupied by two or more colors. Which means contrast can happen between big and small or a lot and a little within the color formations. The color is placed anywhere and in any size. However, in order to achieve the desired balance, it is necessary to wonder about the size of the accompanying colors. There are always two factors that determine the purity of a color which are brilliance and extension. As for the luminous value, it must compare the pure colors on a neutral gray background.

Figure 2.31 shows that there are some models of variation in the extension and as follows:

a) A to C harmonious proportions of the complementary color space
b) Yellow: Violet.
c) Orange: blue = 1/3: percentage.
d) Red: green.
e) D is a circle of primary and secondary colors in relative harmony.
f) E equal proportions of red and green.
g) F a little red with a lot of green makes red.
h) Very active (Hagen E. , 1961, p. 55).

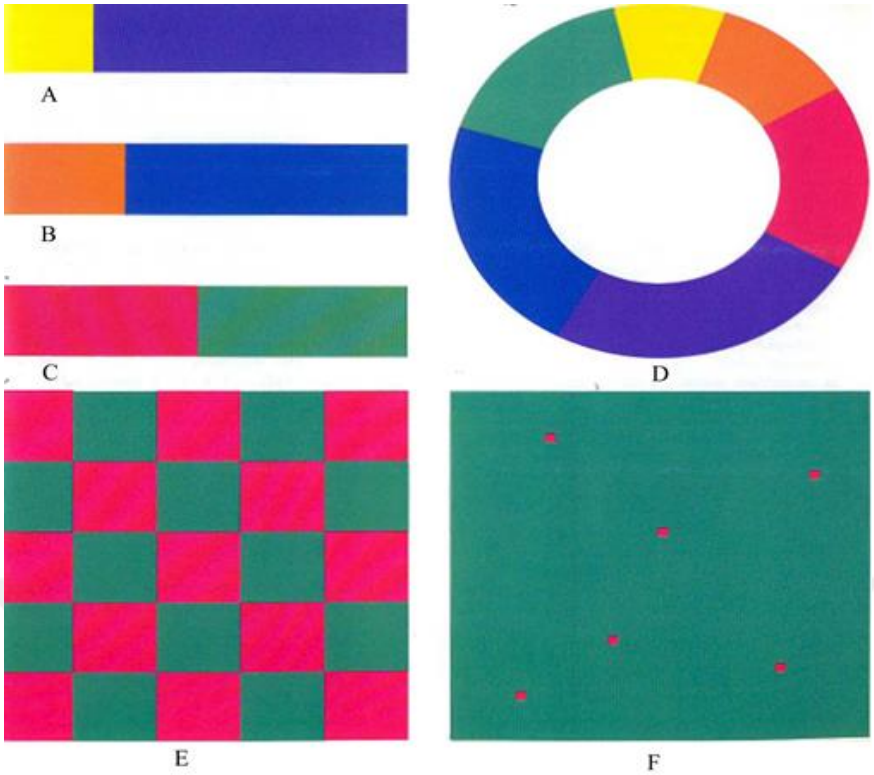


Figure 2. 31. The contrast of extension, (Hagen E. , 1961, p. 55).

2.1.6. Visual Tension Relationships

This type of color relations combines two or more colors that cause visual tension. Some artists and architects have used this type in recent times. This method is called, transitional style, which is not based on any of the previous rules in collecting colors. Figure 2.32 shows the use of Visual Tension in interior space of fast food restaurant. An example of this is the relationship between yellow and black, or red and black ligatures that help visual tension within small areas because they are tiring for the eye. It is used within the previous coordination systems, whether they were adjacent or integrated. This is to separate them, or to separate two groups of colored formations (Nima, 2007, p. 40).

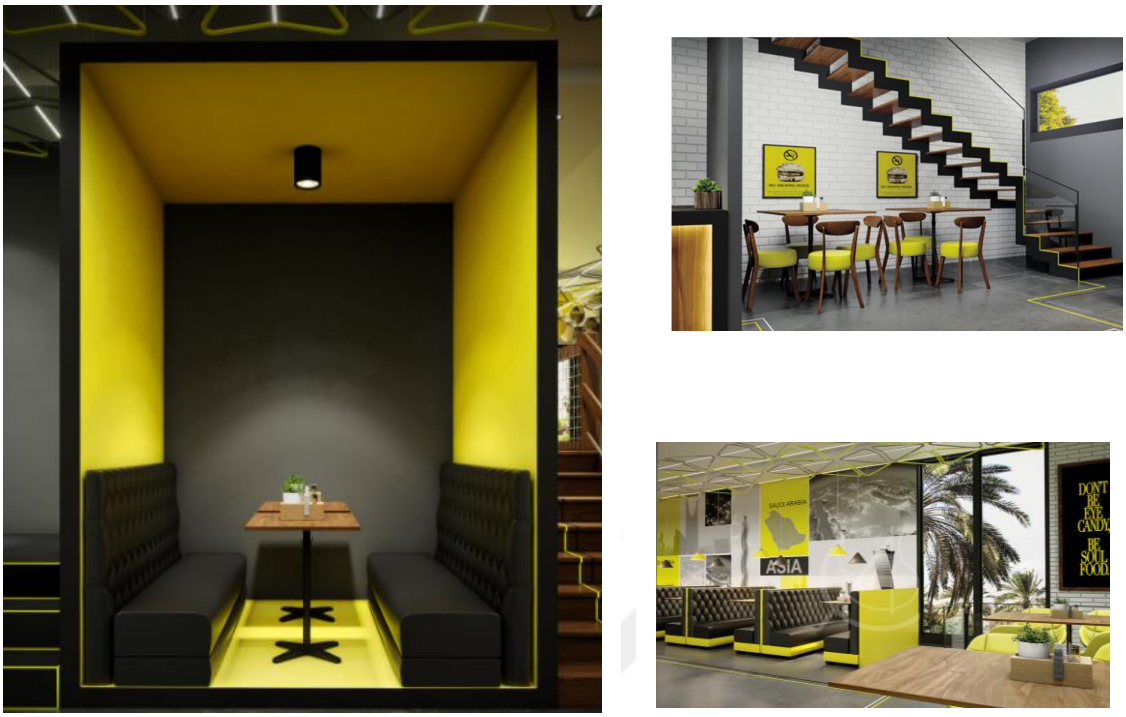


Figure 2. 32. Yamy, fast food restaurant, design by Comelit Architecture (*Modern fast food restaurant interior design* , n.d.).

2.1.7. Color and Structural Relationship

Color is one of the important elements in the success of the artwork, whether it is a plastic work or an interior space. Therefore, a good choice of color scheme will enhance the acceptance of the interior space by the user.

As it is known, the use of natural and artificial materials in interior design is one of the basics when creating an interior space, all of these materials are either naturally colored such as wood, or artificially colored such as aluminum. All these colors, even if their color is different in origin, play a key role in bringing out the interior space. Whether using its color or color texture. Therefore, color has a significant impact on building formative relationships in the interior space, and it will address the most important of those relationships.

2.1.8. Color, Mass and Space

Color is one of the elements of plastic formulation, as it shares with texture in defining shape, mass and space. It represents the surface separating them. Color is an attribute of mass and represents an important element of enriching spatial expression. The

prevailing method was to add color to the mass and space at a later stage in the interior design of the interior spaces. This method has shown over time its failure, which made the designer engage in changes to the color scheme in an arbitrary way that may eventually lead to an unsuccessful chromatic organization, (Al-Qadi, 1975). User does not respond to the lifeless space, but responds to the spaces that attract and excite him, those stimuli resulting from the color change in those spaces. The difference in the impressions generated by the color change within those spaces is what gives the final impression of the design work of those spaces. The function of space is to involve its mass to choose the appropriate color schemes to show the fourth dimension, which is the expressive dimension that generates feelings and impressions towards that space.

2.1.9. Color and Texture

Color and texture are inseparable twins. Their entity is linked together in the designer's own passion, where they are an expressive meaning that affects the human feeling of the recipient. Texture shapes the outward appearance of the surfaces of the various formations and shapes. The application of this element to the surfaces as a textile covering distinguishes them from the rest of the surfaces of the composition. Every natural or synthetic material has a tactile composition, which makes the color characteristic of the texture. This is for a simple physical reason, where every natural or artificial substance has a color. The colors represent the reductive or symbolic feature of texture (Khafaji, 2001, p. 6). The rays that transmit the characteristics of color and the reflective surface are transmitted to the eye through the following optical characteristics:

1. Regular bright optical reflections: They are the reflections that occur without diffusion, and they take place according to the laws of reflection.

2. Diffusion reflections: They are the reflections in which the reflected light is scattered and there is no bright ray dominating the reflection state, and this is what happens on matte surfaces (see Figure 2.33).

3. Mixed reflections: They are reflections of one part bright and the other part diffuse (see Figure 2.34).

4. Transparency: a characteristic of materials with transitional reflections of a part of the light falling on the surface of the material and allowing another part to pass through the material. Transparency is of several degrees, according to the percentage of light reflected or passing through the material (Khafaji, 2001, pp. 7-8).

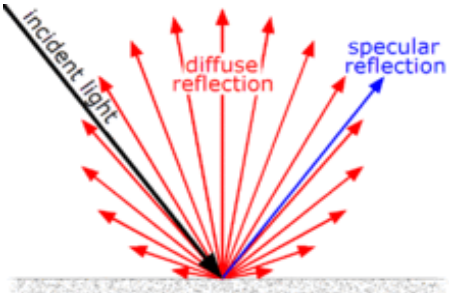


Figure 2. 34. Diffuse and specular reflection from a glossy surface, (*Diffuse reflection*, n.d.)

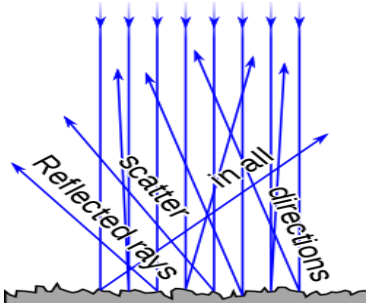


Figure 2. 33. Diffuse reflection from an irregular surface, (*Diffuse reflection*, n.d.).

2.1.10. Color Formation

The color represents one of the important elements of formation in the interior spaces; the chromatic formation is defined as the method of assembling a group of colors together within a harmonious or contrast coordination of its color parts constituting that formation. Which must achieve color balance to be comfortable for the recipient. Color formation has a specific psychological function and effect that may differ from the functions of the colors that make up it and its psychological effects (Badrany, 1991, p. 60). There are two types of relationships forming the formation; the first is the relationship of the part with the part, and for example, the relationship of the red color with the orange color. In addition, the other is the relationship of the part with the whole, for example, the relationship of green color with a hot color group. In both cases, color formation is formed either complex or uncomplicated, that turn determines the general character of the space, or defines a specific shape or size, or show The relationship of certain parts with the general characteristics of the space, or giving certain psychological impressions to the recipient such as the feeling of attraction, pleasure, enjoyment and excitement within those spaces. Color and light form the

visual elements that, by their interaction with each other, form visual formations. This formation is represented in the physical elements of the interior spaces, walls, ceilings, and floors as well as the complementary elements of those spaces such as furniture (Haddad, 1993, p. 61). The elements of the chromatic composition are represented by the chromatic project that constitutes it, and the dimensions of the colors used in the chromatic project, hue, value, and intensity. Determining the pigments used in the chromatic project that is formed for the formation is in three ways (Badrany, 1991, p. 45):

1. The first is the same dominant color in space, with a variety of values and intensities.
2. The second is the same as the dominant pigment with one of the secondary pigments that may be homogeneous or antagonistic to the dominant pigment.
3. Finally, using an anti-space dye, or perhaps repeating the secondary dye of the space-dominant dye with simulating other dyes.
4. The method of linking color aggregates in the interior space is to achieve chromatic balance by repeating the color attribute (hue, value, and intensity). Which are as follows:

a) Stability of dye and change in value and intensity.
b) Stability of hue, value, and change in intensity.
c) Stability of hue, intensity, and change in value.
d) Changing the hue with constant value and intensity.
e) Changing the hue, intensity and stability of the value.
f) Changing the hue, value and stability of the intensity.
g) Change the hue, intensity, and value (Al-Naimi, 2005).

The elements of the interior space used by the color combinations are classified into:

1. Front, middle, rear.
2. Main space area, boss.
3. Secondary with small spaces.
4. Vertical, horizontal.

Determining the hue, value and intensity of these elements is done in relation to the lighting and texture of those elements. The color juxtaposition and the physiology of color (Badrany, 1991, p. 79). Figure 2.35 Shows samples of the color formations.

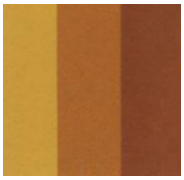
Use intensely hot dyes And medium values that give comfort and balance the heat of these dyes		
Use intensely hot dyes And medium values that give comfort and balance the heat of these dyes		
The use of hot dye in a few areas to send movement, activity and balance of cold pigments in the space		
Heavy use of cold dyes, And high values that motivate movement and achieve balance in space		
Use intensely hot dyes, And medium values that give comfort and balance the heat of these dyes		

Figure 2. 35. Shows samples of the color formations of some interior spaces, (Nima, 2007, p. 51).

2.1.11. Color Scheme

The paragraph focuses on multiple dimensions of the color decision, which is Color Scheme, and the psychological effects of those projects. Ching, mentioned two main types of color schemes:

1- Interconnected dye projects based on a single dye or a series of homogeneous dyes that encourage unity and homogeneity. Variation can also be mediated by varying values and intensities, or the use of a small amount of different pigments as accents.
2- As for the other category, they are contrasting pigments that depend on the associations of complementary or main colors, and these projects are more rich and varied because they include warm and cold pigments.

Hales, mentions eight color schemes (Hales, 1978), including:

- **One or two color with black and white or gray**.

Figure 2.36 shows the used of two color with black and gray in fast food restaurant.

Figure 2. 36. 88TH street fast food bar designed by Forbis Group, Cracow – Poland, (*Modern fast food restaurant interior design* , n.d.).

- **The monochromatic color scheme**.

This project uses one color with different shades, such as:

a) Deep blue green.
b) Medium blue green.

c) Pale blue green.

Figure 2.37 shows the use brown color with different shades in interior space of a cafe.

Figur 2. 37. Brickwork for red-toned interiors of Bentwood cafe in Melbourne, design by Ritz & Ghougassian, (Levy, 2018)

2.1.11.1. The Analogous Color Scheme

This project uses adjacent colors in the color circle, such as yellow and yellowish green, or red or red-orange and orange. Figure 2.38 shows the use of analogous color scheme in interior design of the restaurant.

Figure 2. 38. Restaurant Interior Design Color Schemes, design by, SF home décor, (Weblog, 2020).

2.1.11.2. Analogous Color Scheme plus Complementary Accent

This project is based on the selection of a group of homogeneous colors with a complementary movement located on the opposite side of the chromatic circle, such as the selection of colors:

a) Green + yellow green + violet.

b) Red + orange + Yellow + violet.

c) Red + yellow orange + Yellow+ violet

Figure 2.39 shows the use of Analogous color plus complementary accent in interior space of restaurant.

Figure 2. 39. Restaurant interior design color schemes, (Weblog, 2020).

2.1.11.3. Complementary Color Scheme

This project focuses on choosing two opposite colors at an angle of 180 degrees in the colors circle, , such as followings: -

a) Green + red.
b) Violet + yellow,
c) Blue green + red orange,

Figure 2.40 shows the used of complementary color scheme in interior space of the restaurant.

Figure 2. 40. Restaurant interior design color schemes. (Weblog, 2020).

2.1.11.4. Near or Split Complements

This project provides a wider range of colors and shades resulting from them (see Figure 2.41), such as yellow orange + red + blue green.

Figure 2. 41. Near or Split Complements on color wheel, done by researcher.

2.1.11.5. Double Split Complements, x

Such as choosing the following project in which the two upper ends refer to the two colors, Yellow orange& Yellow green, while the two lower, ends refer to the two colors, Red violet& Blue violet (see Figure 2.42).

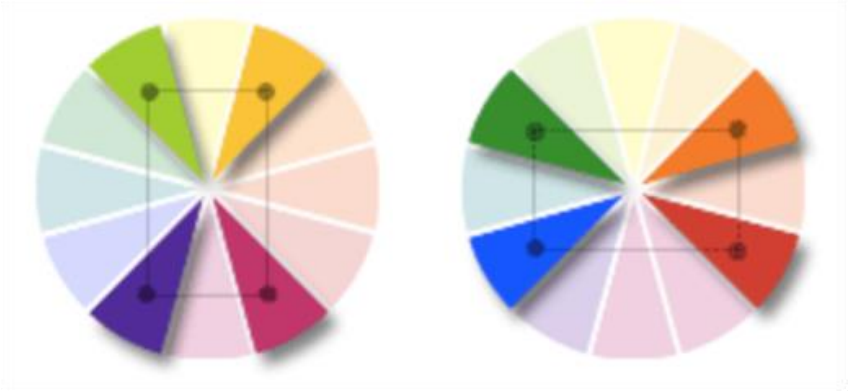


Figure 2. 42. Double Split Complements x, (*Color terms & schemes*, 2022).

2.1.11.6. Triads Color Scheme

The choice includes the three main colors: red, yellow, and blue (see Figure 2.43). The color values are classified according to the correlation of color with black and white, adding black to the dye results in a shade, and white to the dye results in a tint, and adding white to black produces gray also, mixing shadow, light color, and gray together produces a tonality. (Hussein, 1978, p. 187).

Figure 2.43. Triads Color Scheme, done by researcher.

The color values extracted in the form of equations:

- White + color = tint
- White + black = gray
- Black + color = shade
- Tint + gray = shade = tone

The laws related to the color value can be obtained according to the following for the following:-

- Color + tints + white

- Color + shade + black.

Because of the importance of the chromatic decision, especially the choice of chromatic laws and their effect, how to combine them with the subject on the scenes, refers to the following:

(1) The project of choosing one or two colors with white and black or gray may not provide excitement and dynamic movement unless the color is specified in the warm color family such as red or yellow.

(2) The project of monochromatic chromaticity may not provide excitement and dynamic movement.

(3) The project of harmonious colors provides movement and energy, but it does not provide a contrast that leads to a feeling of attraction and excitement.

(4) The project of homogeneous with complementary movement represents a step towards color contrast, although the increase in the number of pigments may weaken the contrast.

(5) The complete pigmentation project achieves contrast and intensity of attention and achieves a great struggle for the presence of two opposite colors at an angle of 180 degrees on the color circle.

(6) The chromatic project in the form of a letter Y provides chromatic diversity, but the large number of pigments contributing to these projects may weaken the balance and stability of the interior space.

a) The chromatic project in the form of the letter X provides chromatic diversity, but the large number of pigments contributing to these projects may weaken the balance and stability of the interior space.

b) The three main colors project provides attraction, suspense and excitement, (Hussein, 1978, pp. 14-17).

It has been concluded from the previous that the type of colors contributing to the chromatic project, their numbers, and the angles connecting them effectively affect the resulting properties of the aesthetic phenomenon.

It is also possible to add the intensity variable or the degree of color saturation with the hue and the degree of brightness or value in determining the effectiveness of the color resolution. It can be emphasized that the forces of color contrast seem more likely

to attract attention and provoke movement. The harmonious colors provide a kind of simplicity and comfort, especially if the cold color family is adopted.

2.1.12. Lighting Decision

Light is an aesthetic factor that contributes to creating an atmosphere conducive to achieving the goals of the interior space and creating its own mood. Light is more important in defining space and showing form, as there is no visual perception of the color of the interior space without it. Despite the employment of other senses, visual perception remains the dominant factor. The quality of light affects All interior space scene, especially through the following characteristics (Ball, 1982, p. 95):

1. Brightness
2. Contrast
3. Color
4. Intensity

It seems that the use of creative control over lighting increases human comfort and facilitates functional needs, as well as contributes to awareness and aesthetic experience in the interior space. The types of lighting play a major role in the theory of light and colors, as their classification criteria vary, including two types: Natural Light and Artificial Light. The has been found that what interests this research is Artificial Light, which results from three levels of brilliance (Al-Qadi, 1975, p. 45):

a) High Brightness: The result of exposure to one or more exposed sources consists of Incandescent Light and Florescent Tube or both.
b) Low Brightness: This brilliance is achieved by light sources hidden from the line of sight.
c) Twinkle light: A lamp that is turn off and on automatically or by electronic devices. It is of two types; the first is turn off and on by itself. This type use for the purpose of decoration for holidays and occasions. As for the second type, it is an ordinary lamp that turn off and on by electronic devices connected to it. It is possible to obtain a large number of types of turn off and on. It is used in storefronts and inside the interior space, especially restaurants, in order to draw attention to an advertisement of the restaurant.

- **Lighting Functions**

Many studies and research have dealt with different types of classifications for the function of lighting; it has been found that classification of Alexander, Ching and Kwan are closest to the subject of the research.

2.1.12.1. Alexander Lighting Classification

Alexander classified artificial lighting based on its functions, which are as follows (Al-Naimi, 2005, p. 88):

General Lighting

A diffused lighting aims to create a comfortable viewing environment by reducing the contrast between the lighting effort and the surfaces surrounding the space. Where equipped a homogeneous level of illumination in the interior space.

Task Lighting

It represents confirmatory lighting, its goal is to illuminate relatively small areas and raise the efficiency performance by increasing the performance of the optical effort by relying on special and small lighting.

Accent Lighting

It includes different types of Spot Lighting aiming to provide attraction points and rhythmic patterns of light and dark within the interior space. This type of lighting is used to relieve the boredom of general lighting and emphasize the features of the space to be focused on. This type is a combination of diffuse and emphatic lighting.

2.1.12.2. Ching Lighting Classification

Ching classified artificial lighting based on its directions, as follows:

Direct Lighting

It is used to focus and emphasize the space or the object it contains, and this system is characterized by the strong shadows that result. Creates great contrast with shadows and shadows, providing the illusion that the dark area of space is difficult to see.

Semi-Direct Lighting

A small percentage of the lighting of this type is directed to the opposite side of the direction of the light flux, this lighting tends to soften the shadows caused by direct lighting. In addition, achieve a little contrast.

Semi-Indirect Lighting

This lighting occurs in a manner opposite to the previous one, as a large percentage of the lighting is directed opposite to the direction of the light flux, while allowing a small percentage to pass towards the surfaces facing it. In addition to achieving a little contrast with the increase in visual comfort.

Indirect Lighting

The light flux is directed towards one of the entire surfaces such as the ceiling, creating a delusional feeling of its height. The light reflected from it can complement the feeling of the interior space, but it creates a kind of boredom, especially when the ceiling works as a distraction for the reflected flux.

Diffuse Lighting

This system equips an equal flood light in all directions. It has no effect to equal the dimensions of the lighting flux from space surfaces.

Direct-Indirect Lighting

This system also provides an equal light flux for the ceiling and floor, and a little for vertical surfaces (Ching & Binggeli, 2012a, pp. 250-251).

2.1.12.3. Kwan Lighting Classification

Kwan classified artificial lighting based on its contemporary interior design function; it can be said that this classification is the closest to the topic of our research, the classification of Kwan was as follows:

Hotspot Light

It is a single lighting unit or a group of units focused on a specific space for distinguishing it from the rest of the spaces. Where these spaces are affected by reflecting the falling light. For the purpose of distinguishing it from the overall space, this type of illumination is achieved through the use of a single objective lamp or a single lamp on the floodlight path (see Figure 2.44), The Ropponji Restaurant[1], focused lighting has defined a small space for conversation about the total space (Kwan, 2010, p. 45).

Figure 2.44. The Ropponji Restaurant, design by Rockwell Group, Tokyo, Japan, 2003, (Kwan, 2010, p. 45).

Follow me Light

It is a series of light that is shed on the floor to determine the path of movement. This lighting helps direct attention away from the walls for the purpose of creating a specific path for users, this lighting is created through a group of lamps focused on the floor and at calculated distances, for the purpose of forming sequential lighting areas that form the path of movement (Kwan, 2010, p. 60). Figure 2.45 shows that the lighting

[1] The restaurant shows the use of hotspot on the centers of the tables, where this lighting formed the privacy of each table. (Kwan, 2010, p. 45)

of the path and the architectural structures of the interior space, as they were placed at equal distances to show the context of the movement and its time.

Figure 2. 45. Advertising offices, William A. Robinson, Inc. Design by Murphy/ John Chicago, 1985, (Kwan, 2010, p. 60).

Patches Light

It is a randomly distributed spots of light in the interior space; these spots disturb the interior space and furniture. It is possible to create this style of lighting using different types of lamps and are in different numbers as well. Light and shadow are created from different light sources and in different directions as well. This in turn will be complex shadows in which light and dark share on the vocabulary of the interior space (Kwan, 2010, p. 85). Figure 2.46 shows the American restaurant, one of the architect works of, Warren Planter intended that the lighting design for the restaurant would be a work of art in itself, as if it is a mixture between the imagination of light and shadow.

Figure 2. 46. American Restaurant, Designed by Warren Planter Kansas, 1974, (Kwan, 2010, p. 85).

Color Flood Light

The color flood is achieved by filling the interior space with highly saturated light, so that the total space and its occupants of the floor, furniture and people colored by the chromatic flux tint.

The blue moon space is one of the types of color flood. It is also possible that the color of the light is red. This type of lighting works to define or separate the different spaces. It is possible to note the use of, blue moon, in resorts, spa and monochrome rooms, as in blue light hotel (Kwan, 2010, p. 95). Figure 2.47 shows that there is the neon bar. The neon pink light strip is present in most levels of the interior space of the Wings Restaurant New York, 1982 design.

Figure 2. 47. The Wings Restaurant, designed by (Geoffrey Hassman) New York, 1982, (Kwan, 2010, p. 95).

Float Light

They are lighting units at floor levels, where the floor or its levels are made of transparent or semi-transparent materials, where any type of lighting unit is placed inside. This type of lighting provides different levels and colors of light. It is more used in discotheques, but it is also used in commercial activities and other entertainment (Kwan, 2010, p. 125). Figure 2.48 shows the extension of the lighting effect from the floor to the walls, which causes the cancellation of the visual transition between the horizontal and vertical plane, there is the possibility of changing the lighting to create different atmosphere similar to the atmosphere of discos.

Figure 2. 48. Bape, clothing fair, designed by, Wander wall, Tokyo. 2008, (Kwan, 2010, p. 126).

Light Body

The Light object is a three-dimensional physical object or an architectural element such as columns or balls. This object is lit from the inside to produce dim lighting, the effect of which is to give a distinction to the object in the interior space. The use of this lighting can form a relationship of harmony or contrast with the overall lights, by creating a slight difference in its illumination with the total illumination for the purpose of establishing a harmony relationship, or by having a large difference in the intensity of illumination for the purpose of creating a contrasting relationship (see Figure 2.49), (Kwan, 2010, pp. 138-137).

Figure 2. 49. Rain Nightclub, designed by Design Associates IV, Canada, 2002, (Kwan, 2010, p. 139).

Halo Light

This type of lighting is achieved when the object is separated from the background plane; either this separation is negative or positive. Negative when the object appears in the depth of the background and positive when the object is in front of the background. This pattern of lighting is obtained by placing the lighting hidden behind

the body for separating it from the background or in front of the body for pulling it into the background. This type can also be used in ceilings for directing the path of movement (Kwan, 2010, pp. 179-180). Figure 2.50 shows the use of halo lighting to create a cloud as a cloud for creating a space for rest around the seating areas in the cafeteria design offices.

Figure 2. 50. Seating areas in Foyer, Zumtobel offices, designed by, Dornbirn, Austria, 1992, (Kwan, 2010, p. 182).

Light Seam

A gradual lighting forms light boundaries between the vertical and horizontal levels in the interior space. It is created by placing lighting in a narrow space between the levels of space. It can be used to give an imaginary extension of the vertical and horizontal levels, or for the purpose of canceling the separations between those levels and creating an absolute imaginary extension of the spaces (Kwan, 2010, pp. 159-160). Figure 2.51 shows the use of light seam for the purpose of drawing attention to the vertical wall and camouflaging the narrow space of the restaurant.

Figure 2. 51. Zoe Restaurant, designed by Jeffrey G. Beers, New York, 1993 (Kwan, 2010, p. 162).

2.1.13. Interaction between the Color Resolution and the Light Resolution

When discussing color resolution and optical resolution, it confirms the obvious interaction between the two previous indicators and the difficulty of separating them. The color family to which the pigments used in the chromatic project belong and its characteristics. As for the optical resolution, it depends on the quality of the light source, the angle of incidence, the intensity level, and the color of the incident light on the visually received color values. Both decisions interacting with each other affect the properties of attraction, listening and excitement in visual perception. For example, the following cases indicate the importance of studying the color decision in an inseparable way from the light decision:

1- Increasing the intensity of the illumination leads to a decrease in the color saturation of the pigment on which the illumination falls.

2- The use of lighting with a warm tint gives a tone to the warm colors and makes the cold colors neutral. As for the use of cold tinted lighting, it weakens the strength of the warm pigments and gives a tone to the cold pigments.

3- The use of warm colors, high values, and high intensity gives a state of attention, tension and chromatic conflict. These advantages can be obtained from the chromatic resolution by increasing the contrast between shadow and light, to create tension within the interior space.

Therefore, it was emphasized relying on indirect or semi-indirect lighting, which gives a state of visual comfort. It also reduces contrast and to create a state of attention, attraction and excitement from the color conflict within the interior spaces of commercial buildings. As for the second aspect, it was found that the chromatic decision with its chromatic projects and its psychological effects participates with the luminous decision in the formation of the chromatic formation within the interior spaces of restaurants.

2.1.14. Conclusion

From what was mentioned in this chapter of our research, the following conclusion is reached:

1- Color can be defined from its basic components, which are known as Color Dimension, which include: Hue, Value and Intensity. The colors were classified into two types, including: Chromatic color such as red and blue etc., others, achromatic color, which are the neutral colors of white, black and gray. There is also another classification of color based on the apparent temperature of the color: which are Warm color and Cold color.

2- The color system is defined as organizing and arranging colors in a logical sequence to clarify their characteristics in the form of a circle with a three-dimensional sold in most cases. The pigments in the color system range from primary, secondary, and tertiary. There is also another classification for the color system pigments, which are main pigments, intermediate pigments, and secondary pigments. The Mansell system, the Ostwald system, and the NCS system are among the most important color systems.

3- All color relations must have a psychologically acceptable balance, whether in color coordination has, contrasts, or other relationships to form certain color formations. This balance is in particular consistent with our psychological acceptance of it, which falls under a force, good distribution of the color line to form the color formation that attracts our attention. Its elements are represented in the interior space, the elements of the interior space such as walls, ceilings, floors and pieces of furniture.

4- - The color decision has an impact on the scenes, as choosing a color scheme or two colors with white and black or gray may not provide excitement and dynamic movement unless the color is selected in the warm color family such as red or yellow. The monochromatic project does not provide excitement and dynamic movement, but the harmonious colors project provides movement and energy, but it does not provide a contrast that leads to a feeling of attraction and excitement. The homogeneous project with complementary movement represents a step towards color contrast, although the increase in the number of pigments may weaken the contrast. In addition, the full-pigment project achieves a contrast and intensity of attention and achieves a great struggle for the presence of two opposite colors at an angle of 180 degrees on the color circle. The chromatic project in the form of a letter Y provides a chromatic diversity, but the large number of pigments that contribute to these projects may weaken the balance and stability of the interior space. Likewise, the chromatic project in the form of the letter X provides chromatic diversity, but the large number of pigments contributing to these projects may weaken the balance and stability of the interior space. Finally, it has found that the three main colors project provides attraction, suspense and excitement. The harmonious colors provide a kind of simplicity and comfort, especially if the cold color family is adopted. Complementary colors can be used because of their psychological effect, as it gives an impression of joy, entertainment, fun and attraction. It reflects aesthetic values that make recipients have an increased desire to stay in space.

5- There are two types of artificial lighting sources according to its brilliance, which are the general emitted to the whole space and the private ones focused on specific areas of it. The lighting was classified as well according to its functional classification into three types. It can be considered Kwan’s classification closest to the subject of the research, as it combines between lighting and color, in addition to achieving different color relations.

CHAPTER THREE

3. COLOR PSYCHOLOGY

The ancient Egyptians used colors to treat diseases. They believed the sun was the source of worship for them and they understood that without the sun there is no life. They recognized the nature around them and used the vocabulary of nature in their daily lives. The floors of their temples were painted green, inspired by the green grass of nature. Blue was an important color in their lives as well, representing the blue of the Nile River and the color of the sky, Figure 3.1 shows the use of color for therapy.

Figure 3.1. Ancient Egyptians used color for therapy (*Colour History*, n.d.).

They built temples to heal ailments using precious stones and crystals. They placed the crystals in the direction of sunlight to obtain different colors of illumination. Perhaps the Color/ light therapy today is due to the ancient uses of ancient civilizations.

There are lists written on papyrus dating back to 1550 BC showing the use of colors in the treatment of diseases. The Greeks interested in color as a science of sciences. They abandoned the psychological aspect of color (*Colour History*, n.d.).

The Chinese have also practiced color therapy. Ching, documented the diagnosis and treatment of disease symptoms using color.

Carl Jung is considered one of the pioneers in color psychology in the twentieth century. He focused his interests on the characteristics of colors and their meanings as well as the possibility of using art in psychotherapy. His studies also focused on the use of color across cultures and times. He tried to create language or symbols to describe colors; he found this through his studies of Alchemical to understand the secret language of color (Riley, 1995, p. 307).

Color psychology is the study of colors as determinants of human behavior. Where color affects human perceptions that are not obvious, for example, the effect of color on the taste of food. Colors evoke specific feelings in humans as well. Colors can enhance the efficacy of placebos, as orange or red is used in stimulant pills. The effect of color on individuals varies depending on gender, age and culture. For example, men tend to consider women's red dress to enhance their attractiveness, but this does not happen to women. Although color association varies based on cultures, color preference is relatively uniform across gender and race (O'Connor, 2010, p. 67).

3.1. PHYSICAL ASPECTS OF COLOR

Color is not a characteristic of things, spaces or surfaces, but rather that feeling generated by certain types of light that the eye can perceive and the brain can interpret (Riley, 1995, p. 78); therefore, light is the main thing for vision to happen, and without light, we would not be able to distinguish the shapes or colors of things. The visible rays are what the eye can perceive, and they are the rays that are trapped between the rays with a wavelength of 700-400 millimeters. In addition, orange, and yellow, and green, and blue, and violet (see Figure 3.2).

Figure 3.2. Analysis of solar radiation by prism (Jacobson, 1948, p. 124)**.**

This discovery changed the natural phenomena of the color that is felt by the eye into arithmetic and standard language that is not intuitive. Although there are no less than seven million different colors that can be seen, the ability to see them lies in the extent of the eye’s response to the confined light waves 700-400 mill micron, and outside

these two limits, the human eye cannot detect the light waves (Ching & Binggeli, 2012b, pp. 107-109), or perhaps the light waves cannot excite the eye. To perceive the color red requires experience with red, which needs a wave of length 700 mill micron to be excited; therefore, its wavelength range is from 760-630 mm for the color red up to the shortest wavelength for the color violet. The wavelength range is measured from 450-380 for violet, 490-450 for blue, 560-490 for green, 590-560 for yellow, and finally 630-590 mill micron for orange (Ball, 1982, p. 114).

3.1.1. Explanation of the Physical Production of Colors

Colors cannot exist unless the light waves interrupt or reflect in a way that enables the eye to receive this information and transmit it to the brain. Four basic methods explain the production of color physically:

1- Dispersion: the color appears through the dissolution of light into the seven colors, which occurs when the light passes through a glass prism, and interference occurs between the spectral colors refracted through the prism.

2-Diffraction: The diffraction of light when it passes through a sharp edge or a small hole that can degrade into its seven colors.

3- Interference: the color can appear when the light passes through a thin layer of oil that does not allow the light waves to penetrate completely; the effect of flash appears on the surface when the light waves are forced to interfere with each other due to the composition of the layers of the body.

4- Absorption and Reflection: It is the most general way to produce different colors, when light falls on the body, part of the light waves are absorbed by the particles of the surface of the body, while other waves are all or part of them reflected from the surface. These reflected waves are picked up by the eye and transmitted to the brain as information about color, Figure 2.54 (Ladau et al, 1989, pp. 41-46).

3.1.2. Behavior of Light on the Surface of Substance with a Certain Pigment

Pigments and inks consist of Fine Ground Pigment Particles located within a layer of a non-colored and transparent material. When check under a microscope, these colored particles are often translucent and allow light to pass through, but they act as a color filter separate from the rest of the particles. When the light enters through the material, it polarizes, spreads and prevented from passing to the other direction, as a result of a collision with colored particles, which absorbs part of the color rays on it and reflects the other part or allows it to pass through it. Some rays are allowed to pass through but not the rest. After multiple scattering that takes place inside the surface layer, the result is a modified column of rays that is reflected back to the eye of the beholder, who senses it and perceives it as an impression of a single color, (Roy, 1980, p. 18), This substance, which determines the processes that happen to the light falling on it, determines the optical characteristics of objects, their surfaces, and the level of their optical richness.

3.1.3. Selective Absorption of Rays

As mentioned, the materials vary widely in Molecular Structure. Each surface behaves specific to the direction of the light rays falling on it. In principle, from all the amount of light falling on a surface a certain part of the material is absorbed, while the rest is either reflected or transmitted if the material is transparent. A phenomenon that explains a lot of the appearance of things and the colors of their surfaces is called Selective Absorption of Rays (see Figure 3.3) (Riley, 1995, p. 78),

In 1938, the French scientist Chevreueal clarified some characteristics of this subject, those yellow or red objects are not supposed to reflect only red and yellow rays beside white light. These objects reflect all kinds of rays that make us perceive and evaluate the color as yellow or red because the red or yellow rays are the dominant rays in the effect more than the rest of the rays. From a scientific point of view, the reflected or absorbed light from a colored dye or visible in daylight is not pure spectrally (Roy, 1980, p. 17).

White light is obtained by mixing the light of three main colors: red, green, and blue in the form of additions an additive process to their light waves. For example, it can

be imagined that one of these compounds that make up white light is absorbed from the surface on which it falls, and then the light will include the rest of the compounds. The surface of a yellow rose in sunlight absorbs the blue-violet compound of white light, while at the same time reflecting the red-orange and green compounds that are from the collective mixtures of light that give the yellow appearance. Likewise, the green leaf, which appears in daylight, absorbs red-orange and blue-violet, as it reflects the green compound to the human eye. Light does not create color unless it is filtered through molecules that absorb and reflect light waves called a molecular structure, pigment. It is responsible for the perceived special colors, and the molecular frequency determines which of the light waves will be absorbed or reflected, and then determine the color and pigment either inherent to the body or applied to it (Roy, 1980, p. 23).

Physicists distinguish between reflected light and reflected color. The reflected light is defined as the light that is not completely or partially absorbed by the surface of the object and is returned to the viewer and is colorless. When light falls on a soft surface, most of it is reflected. When it falls on a rough surface, it is reflected in different directions due to the different levels of the surface. Reflected color is defined as how our eyes interpret the light reflected from the body or parts that are not completely absorbed by the surface with the light reflected from the surface due to the color intensity not being saturated. For example, a black body absorbs all the light falling on it, while a white body reflects most of the light falling on it. An object appears transparent when its molecular structure allows most of the light to pass through the object without any absorption or reflection (Al-Ghazi, 2000, p. 5).

Figure 3.3. Vision, reflection, absorption, and refraction of light rays, (Al-Ghazi, 2000, p. 6).

3.1.4. Physical Mixing of Colors

Physicists refer to two types of color mixing, which are as follows: Mixing colored lights and mixing colored pigments.

3.1.4.1. Mixing Colored Lights

Also called collective color mixing, it is the mixing of light rays that comes from adding new light waves. It is made by using colored rays to produce chromatic light. The result of mixing depends on the amount of basic lighting added and its distinctive characteristics. When mixing two basic colors, light rays in certain proportions, a colored light with a third complementary color is produced. For example, when red light is mixed with green light, it produces yellow light that is complementary to blue light (Riley, 1995, p. 89). When two complementary light colors are mixed, white light is produced (see Figure 3.4). The complementary lights are: red compliments blue and green, cochineal compliments green, cochineal compliments green and yellow, bluish cochineal compliments yellow and blue compliments yellow and red. As for the light intensity, when the mixed lights are homogeneous, the output intensity will be high, and when the lights are inhomogeneous, the output intensity will be low (Ball, 1982, p. 116),

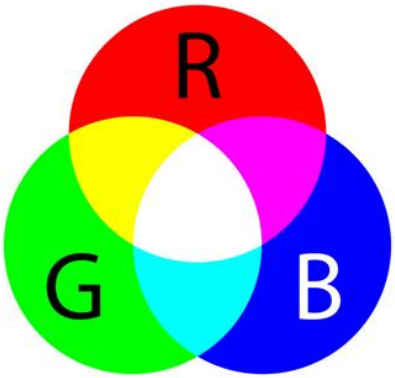


Figure 3.4. Mixing colored lights, addition color mixing (Abbou, 1982, p. 109).

On the other hand, it has found that the way in which the color of a specific surface of a light source is indicated depends on the fibrous components of that source's rays. Therefore, the color translation will depend on the relative intensity of the spectral distribution of the wavelengths of the rays constituting the radiation falling on that

body. Figure 3.5 shows the difference in appearance between daylight and artificial lighting in the interior spaces. This is very important in explaining the change in the colors of the elements and vocabulary in the interior spaces, especially the spaces of restaurants, which differ according to the lighting inside the space. The subject of color translation is very important in evaluating the performance and choosing the appropriate light sources for lighting interior spaces.

Figure 3.5. The color translation of daylight is different from the color translation of artificial lighting (Al-Khalidi, 2008, p. 67)**.**

3.1.4.2. Mixing Colored Pigments

It is also called (subtractive color mixing), and it depends on mixing pigments, so new and different results appear from the pigments that have been mixed. It is a process of subtracting light waves, not adding them. If a yellow dye is mixed with a blue dye, it produces a green dye (see Figure 3.6).

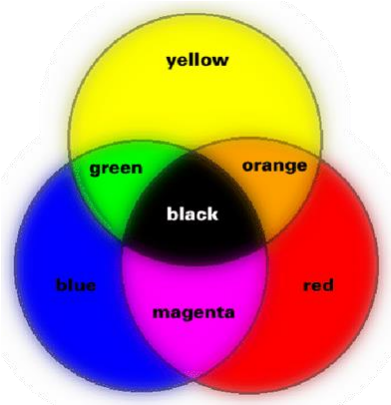


Figure 3.6. Mixing colored pigments, subtractive color mixing (Britannca, n.d.)**.**

This indicates that at the level of the pigment, if the primary colors are mixed, the intermediate colors will be produced, (Saleh, 1982, p. 61). The result of mixing any two primary colors is a color that complements the third primary color. Complementary colors are shown in an opposite manner on the color wheel. There are two basic laws of mixing pigments. The first states that mixing analogous pigments in the color wheel produces harmonious and closely related pigments. As for the other law, it is specific to complementary pigments, whereby mixing them produces neutral colors (Abbou, 1982, p. 85).

Mixing the basic pigments gives wide range of pigments more than what the secondary and tertiary pigments give, meaning the number of the resulting pigments is more than what get from the same degrees. However, there will be more loss in cost. There are four possibilities for mixing pigments to regulate the value: raising the value by adding white, decreasing the value when adding black, adding gray neutralizing the value, and finally raising or lowering the value when adding a pigment of a different value (Scott, 1951, p. 74).

3.1.5. Physiological Aspects Affecting Color Vision

The eye is the organ of the sense of sight, that feeling that is generated as a result of the eye's activity, observing the process. The process of seeing colors is affected by a set of physiological phenomena associated with the eye and its components that can give relaxing effects that achieve visual psychological balance in an unconscious way in humans. In this section, the most important physiological phenomena affecting color vision will be discussed, as follows:

3.1.5.1. Purkinji Phenomena

It is the change in the maximum degree of brightness in the visible color spectrum from yellow towards green. Colors with long waves, such as red, lose their luster when the light shining on them is reduced, more than they lose the luster of colors with short waves such as blue. This is because the retina loses its sensitivity to red first when lighting is reduced, then the rest of the colors gradually until it finally loses its sensitivity to green and blue. Red appears brighter than blue in bright light, while blue is brighter in dim light (Al-Jalabi, 1998, p. 67). This may explain part of the reason

why the ancient Iraqis chose the blue color at the Ishtar Gate in Babylon, where it could be seen better day and night.

3.1.5.2. After Image Phenomena and the Successive Contrast

The dimensional phenomenon is defined as the continuation of the sensory image in memory and mind after the disappearance of the external stimulus (Saleh, 1982, p. 165). If the eye adapts to a certain color by staring at it for some time and then shifting the gaze towards a white or gray surface and staring at it, the Complementary Color will appear on this surface. The white color will appear light green if you stare at a red stimulus or stimulus. This phenomenon is called, After Image Phenomena. This phenomenon occurs because of visual stress. When the retina adapts to a certain color, the red color for example, where the red color sensitivities in it suffer from temporary stress. When replacing the red catalyst with white color, the response of these sensors is less in their sensitivity to the total rays reflected from the white surface. At the same time, it is sensitive to the direction of the green color and works at full capacity (Konrad, 1961, p. 98). The important note is that this effect, the appearance of the complementary color on the white surface, is not a permanent effect, but the color spot appears to float in front of the eye, which confuses it and even disturbs it, resulting from staring at materials of one color.

3.1.5.3. The Dimensional Phenomenon and the Concept of Color Integration

The dimensional phenomenon is a physiological phenomenon used to show the importance of color integration in color design work. Complementary colors are often placed side by side to make their effect comfortable. Because the dimensional phenomenon of one of them reinforces the other color and in a reciprocal effect. It is good to note that the idea of integration in colors is based on their organization in the Color Wheel, where the colors are distributed on the diameter of a circle. All two opposite colors are considered complementary if the result of mixing them is a neutral gray color, Natural Gray – Black (Scott, 1951, p. 76).

3.1.5.4. Practical Models for the Effects of the Dimensional Phenomenon

There are many examples that show the effect of successive contrast and the dimensional phenomenon, whether positive or negative, in the environment. Perhaps

the well-known historical story in one of the pharmaceutical laboratories was one of these examples. It was noticed that workers in one of the production lines who were assigned to produce purple-colored boxes. Green dots appeared before their eyes. Putting green cutters around them solved this problem, so the green spots disappeared from their eyes. Laboratory officials realized that green was a dimensional image of the red-purple color. Another example of the dimensional phenomenon was the operating rooms in hospitals that were dyed white, as well as the clothes of patients and doctors, (Konrad, 1961, p. 123). Where the dimensional phenomenon was blurring the sight when staring at the red color of blood after moving to the surrounding white color, the red color appears in a way that disturbs the beholder, as a dimensional image of the red color of blood. The use of green or bluish-green color in the walls of the room, operating room and doctors' clothes eliminated this phenomenon. Which helps to reduce the negative effects of the dimensional phenomenon. On the other hand, the eye needs to perform its functions well to be given with every color its complementary color. If complementary color is not given, eye will generate it. Contrast is what gives complementary colors to create the necessary visual physiological balance, just as the balance between cool and warm colors creates a psychological balance in the human unconsciously (Jawad, 2013, p. 56). An example of this is the experiment carried out by the researcher, Louis Cheskin, from the Color Research Institute of America, where he painted the first room in green only, and the reaction was negative due to the rigid uniformity. While the second room used three light values from Green color, gradation from light green to dark green. The reaction was divided between negative and positive. As for the third room, it was painted in three shades of green, with a complementary color to one of them, which is red. The reaction towards them was positive by 94%; this experiment shows us the importance of integrated colors in creating chromatic design harmony with a physiological phenomenon, After Image Phenomena (Zhang & Kuang, 2017, p. 646).

3.1.5.5. The Phenomenon of Simultaneous Contrast

A single, isolated color is rarely seen in the visual field. Where it is often observed that there are different colors simultaneously. This creates a visual effect that is strongly related to the dimensional phenomenon. The eye generates the complementary color of the visible color and drops it towards the neighboring color or imposes it on it

(Zhang & Kuang, 2017, p. 667). The French chemist M.Chevreul made many experiments on this phenomenon, which he called Simultaneous Contrast (see Figure 3.7). He added what he discovered to the field of publications in which he was working. The phenomenon of simultaneous contrast can be observed between two complementary or non-complementary colors (Nima, 2007, p. 20). It can identify the effect of this phenomenon from an easy experiment by taking a gray lead square surrounded by a red background; the gray color has become tainted by a tinge of green, and the complementary color is red. It can be also observed this phenomenon between any two complementary colors, each color trying to make the other color tainted by a tinge of the complementary color to it. In the case of simultaneous achromatic contrast, the contrast makes the gray color appear dark against the light gray color in the background and vice versa. In addition, the simultaneous contrast effect is noticeable when the background color is saturated and surrounds the opposite color. However, when there are two close colors, they lose some of their lusters because of this phenomenon, unlike the adjacent and complementary colors, which appear more intense because of this phenomenon. The effect of this phenomenon diminishes when there is a Glossy contrast (Badrany, 1991, p. 121).

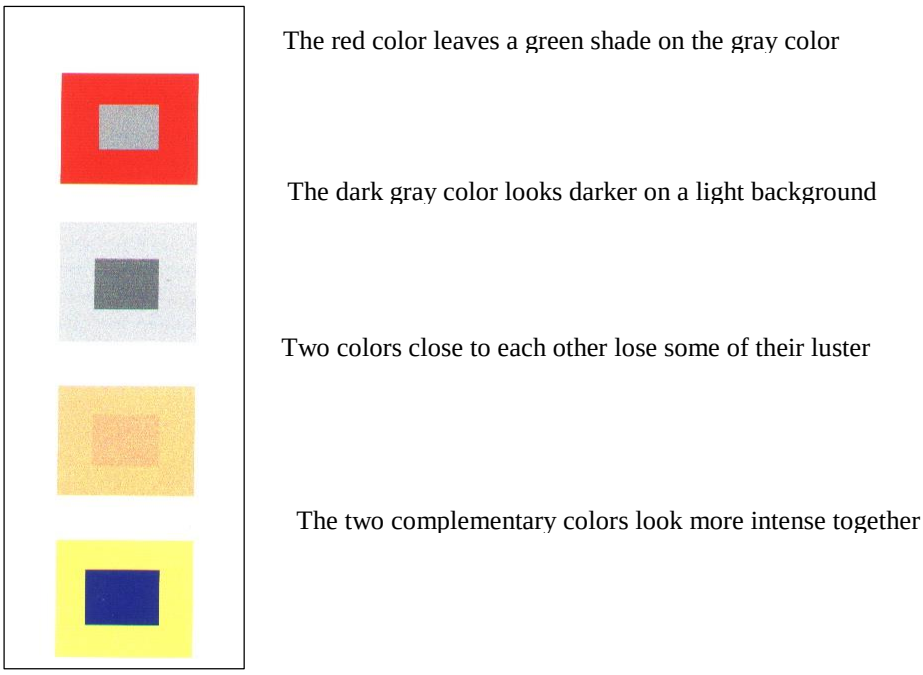


Figure 3.7. Simultaneous contrast of colors, (Al-Ghazi, 2000, p. 9)**.**

3.1.5.6. Vibration Phenomenon

The so-called, vibration occurs as a result of the effort exerted in the lens of the eye in the concavity or convexity for the purpose of projecting the focus of the image passing through the lens of the eye on the retina. Rather, it is behind it, as in the case of long-wavelength rays such as red rays, or in front of it, as in the case of rays with a short wavelength of blue rays (Jacobson, 1948, p. 120). While the yellow and green rays fall on the retina, directly and without the need to advance or fall back, therefore, yellow and green are two of the colors that are comfortable for the eye. Many scientists consider that aesthetics starts from physiology. The natural human eye receives a pen of light from outer space, so the green rays fall on the retina, the red rays behind the retina, and the blue rays in front of the retina, the distance between the focus of the red and blue rays. It is about 0.6 mm, this different focal point of capture may be the reason why it is difficult to see the blue color on the surfaces adjacent to the red color because it is necessary to bend eyes in order to see any color in a completely opposite way to the other (Scott, 1951, p. 98).

3.1.6. Physiological Aspects of Color

It has been recently clarified that color has physiological effects that combine physical and biological effects. Goldstein mentioned that stimulating a certain color is accompanied by a certain pattern of response in humans. It affects muscle tension, brain waves, and other functions of the nervous system. It elicits specific emotions and responses (Porter, 1997, p. 45). For example, it has found that exposure to bright light or warm colors such as red leads people to increase attraction, but on the other hand it leads to physiological phenomena and involuntarily these colors lead to disturbance and nervous tension and a great acceleration in the heartbeat. The warm colors increase the thermal range, while other colors such as yellow are characterized by their stimulating effect on the viewer, and the green color is characterized by its analgesic effect. All of these cases express the physiological effects of the colors (Haddad, 1993, p. 118).

There are a number of theories that explain the phenomenon of color vision with activities that take place in the cones or in the nervous system, but there is no theory that explains all the phenomena of vision definitively, and among these theories are:

3.1.6.1. Young’s Theory

It proposes that there are three types of receptors for light in the human eye that are identical in wavelengths, red, green, and blue, all other colors result from mixing these three colors together (Saleh, 1982, p. 45). This theory explains the resulting color combinations, but it lacks a proper explanation for the location of yellow in the color-related regions of the retina.

3.1.6.2. Hering's Theory

Known as the ant chromatic theory, it assumes that there are three pairs of receptors for color, each of which contains two opposite colors red and green, yellow, and blue, white and black. Perceiving the two ends of each pair at the same time, such as reddish-green and bluish-yellow, and if the two ends of one pair are of equal stimulus, it has found that one cancels the other, and the result that is seen is grey. D. Jameson and L. M. Hurvich proposed a modern version of Hering's theory in which he presented a quantitative and mathematical explanation for most of the factors related to color vision, such as: color mixing, color blindness, and color phenomenon (Porter et al, 2009, p. 67).

3.1.6.3. Franklin's Theory

It suggested that the primitive eye consisted of rods that receive only the gray world, and later developed and divided into cones sensitive to blue-yellow color. Cones are sensitive to yellow divided into red and green receptors. This theory has a relationship with color blindness, which results from one or more groups of receptors that are partially or completely weak. The color blindness and the grid areas of the color and the color afterimage can be explained by this theory, but it is difficult to explain the merging of the red and green displayed by looking at both eyes and producing yellow color on the basis of the double processes in the retina (Porter et al, 2009, p. 76).

There are theories regarding color mixing, where one theory asserts that color mixing is a phenomenon that goes back to the retina of the eye. Another indicates that the mixing of colors is a phenomenon that goes back to the cerebral cortex and perhaps Corpus coliseum, which connects the two halves of the brain. One of the scientists directed light of a certain color to one eye and light of another color to the other eye

without mixing the two lights outside the retina; he found that the visible color is exactly as it happens when mixing light and directing it to both networks at the same time, and this proves the occurrence of some color perception processes and mixing colors behind the retina (Saleh, 1982, p. 56).

3.1.7. The Effect of Color Perception on Environmental Assessment

Color does not only create subjective and objective impressions, but affects their evaluation and perception of time, size, weight, temperature and noise, as it was found that there are basic common reactions among most people towards color, taking into account the civilizational , cultural, economic, geographic, and religion factors, public taste tendencies and the cultural level. The process of perceiving color affects our perception of the surrounding environment, many of its elements are:

3.1.7.1. Perception of Volume

The user's luminous value is one of the most influential factors in perceiving the interior space. Light and pale colors seem to increase the size of the room, as do cold colors and small pattern, while light and saturated colors make the room appear smaller, as well as warm colors. Therefore, colors can be used to practically influence the dimensions of the room. Small narrow room. It is recommended to use light colors to make it look bigger and wider. These colors should be lighter than the floor. Dark colors are used to make large rooms smaller. As for the high ceilings, dark colors are used to make them look lower (Lioyd & Mullwe, 1986, p. 98).

3.1.7.2. Perception of Weight and Size

In general, the darker color appears heavier, while the lighter and less saturated color makes the thing appear less dense, if the two colors have the same light value and intensity, the warmer color appears heavier. An applied example of this thing is that heavy machines in laboratories are often dyed in a dark green color to give a feeling of heaviness and confidence in them. However, the yellow color will show them as unbalanced.

3.1.7.3. Estimation of Time

Although there is a contradiction in the relationship of time with color, it seems that there is a relationship to color in the process of perceiving time, and there is a belief that the environment with warm colors has more time than estimated, and in the environment with cold colors the time is less estimated (Mahnke & Mahnke, 1987, p. 160).

3.1.7.4. Perception of Temperature

The hypotheses confirm that color has a force that makes people feel warm or cold. Experiments diagnosed a difference of 5-7 degrees Fahrenheit in the subjective sense of heat and cold between a room dyed in bluish green and the other in reddish-orange. The person's feeling of cold in the bluish rooms was up to 59 F, while the red room needed to lower the temperature to 52-54 F to make the person feel the same degree of cold. The conclusion reached by the Norwegian study, Colark 1972, deals with the same topic. It found that in the rooms with blue color, the thermostat needs to increase the thermostats 4 F more than in the red rooms, so it is preferable that the comfort rooms be in turquoise, light blue and bluish white to give a kind of sense of cold (Al-Khalidi, 2008, p. 56).

Colors occur as a natural reaction and it is not easy to know the cause. An example of this is that one of the commercial establishments painted the walls of a hall where merchandise was displayed blue after it was white. Customers protested that the aforementioned hall was too cold and unpleasant. This surprised the institution's engineer, who knows very well that the temperature in the hall has not changed from what it was months ago. Then the same blue walls were painted in another color that mixed with the blue, so the walls looked orange. The seats were also painted this new color. The protests returned, but this time the complaint was about the heat in the room, although the original temperature did not change, so when they changed the orange color of the seats, the room changed and the complaints were removed. It is noted that the increase in sales results from the use of some colors that have a psychological effect without the other colors in advertisements (Sheikhani, 1994, p. 187).

Thermal rays are reflected from light surfaces and absorbed by darker surfaces. In general, cold colors should be added in locations where people are exposed to high temperatures and vice versa.

3.1.7.5. Perception of Noise and Sound

The phenomenon of the effect of sound on perceiving the colors of the surrounding environment has been studied from a group of psychologists such as ,Wenner Hienz, Karvken, Allen and Schwartz, who found that loud sounds and strong smells make the eye more sensitive to green, and less sensitive to red. So designers can benefit from the relationship between color and sound. As stimulating sensations, luster, and noise are associated with warm colors, and vice versa, people mentally associate bright red with highly saturated color, and rarely pay attention to stark blue or the plain green. This association or compatibility and accompaniment can be used in the visual modification of the sound and its problems, especially in the work environment. A noisy environment is subjectively noisy if it is painted in bright red color. And that sounds are more effective in dark-colored environments (Saleh, 1982, p. 59).

3.1.7.6. Association of Smell and Taste

Some colors collapse when they see a pleasant smell, as when seeing pink, pink, light yellow and green, and also other colors such as yellow, peach, light green, and clean green, and turquoise call for good taste. This explains the importance of color in accepting food products and perfumes. Colors, like drugs, must be taken in certain amounts, otherwise, their consequences will be not good (Sheikhani, 1994, p. 134).

3.1.8. Colorful Interior Environment Far from White

Recent cognitive and psychological studies show that most people enjoy colored interior space. However, some people enjoy the environment, Achromatic, with its purity and harshness, compared to the people who hold the same aesthetic values. People are linking non-colored environments with prison environments and find them similar and cool from life. This is what the Department of Psychology at Goteborg University in Sweden has reached, after conducting a series of questionnaires, which in total showed that the majority of people need color greatly. Their opinion is positive

about joyful colors because it creates a sense of enjoyment for them (Sheikhani, 1994, p. 176).

The white or off-white color in indoor and outdoor environments was and still is common to the extent that it is almost large, work on white walls began in 1955 and reached its peak in 1975, but Modern psychological and physiological studies have proven that the white color or close to it is not able to create an attractive and enjoyable environment, but in some cases that have been studied, it has a negative effect when used in some interior spaces. Man spends most of his time inside this environment and its walls. The need for color diversity and its feeling is to renew the activity and vitality and to find the appropriate comfort for the human being. Also, monotony causes relaxation, but it gives a feeling of boredom and reduces the vitality of users (Tahafi, 1993). The use of white as a white background for a subject colored with strong colors causes' eye fatigue as a result of the great color contrast that doctors do not recommend (Mahnke & Mahnke, 1987, p. 134). There are a number of facts proven by scientific studies are:

-People are negative about the poorly decorated and colorless environment.

- The color has psychotherapeutic effects for people who live in a poor, unresponsive environment.

- The monochromatic environment can be more humane by adding other colors (Lioyd & Mullwe, 1986, p. 87).

As for the interior spaces, Sndgrass explained his idea that man always suffers from fears in choosing the color to paint the interior spaces, especially the spaces of the living rooms, the sitting space, because of their direct connection with the human being. Where man tries to find the aesthetic image of these spaces during his stay in them. It is always hesitant that the color of space should be bright, dark, gloomy...etc. (Khafaji, 2001, p. 2). And does it compatible with the furniture or not. But the study recommends describing a first step to remove all these fears by making a color scheme that leads to a real understanding of the situation by arriving at a set of color formations that achieve the aesthetic condition (Scott, 1951, p. 67), it can say, a color that is

difficult to deal with may lead to a final surprise that leads to its stability and aesthetic space.

3.1.9. The Use of Color in Commercial Interior Spaces

The color presents different situations in the interior spaces. The color can be hot or cold, rich or poor, weak or strong and creating monochromatic, dual or triple color schemes, creating homogeneous or opposite color formations, pure or impure, historical or new, with projected or reflected colors. Accordingly, these states can change Sensory Perception. This affects our emotions, feelings and behavior within these spaces (Ladau et al, 1989, p. 87). As for the interior spaces in commercial buildings, the colors must appear appropriately for customers. It should try to meet their instinctive needs by providing comfort and familiarity to enhance social interaction, and finding color combinations that attract customers and longing them to enter and roam within the space. Then excite them with a commodity offered for purchase, which in turn will help to increase the shopping process. In general, there are four basic uses of color in the interior spaces of commercial buildings, I will address them in some detail for the purpose of clarification and selection of what is related to the topic of our research, and they are as follows:

1-Functional use of color: Certain colors are used to meet special needs whose purpose is purely functional, for example, (Hussein, 1978, p. 54):

(a)- Defining and expressing shape: Color complements the information given by light and shadows to give it a precise shape and expressive effect, and to give precise considerations in cases of complex relationships between shapes and shadows. This will help to define and understand the shape of and the positions of the bodies, (Hussein, 1978, p. 58).

(b)- Expressing the property of materials : The characteristics of the color matter of a body that reach the eye explain what happens to the light falling on the body of the processes reflection, refraction, and absorption. Thus, it is possible to identify the partial structure of the body from its behavior in the direction of the light rays falling on it.

(c) Reflecting and absorbing light rays: It is used to achieve the environmental suitability of the interior spaces by giving a feeling of coldness or warmth. The physical property of color works with the reflection and absorption of light and heat of dark-colored objects and surfaces, which leads to its transformation into heat and giving a sense of warmth. As for light-colored objects and surfaces, it has found that their surfaces radiate light rays falling on them and heat to the rest of the space. This makes them remain relatively cool and lead to giving a sense of coldness.

(d) Camouflage: Colors are used to make things unclear or to change the shape, size and apparent identity, such as using dark colors in places where dirt accumulates for the purpose of concealing that dirt.

(e) Clarity: The image is distinguished from its background when the color contrasts between the figure and the background. For example, the black color gets the highest clarity over the yellow color.

(f) Evacuation: The color gives the possibility to achieve an effective and comfortable vision in the interior spaces. The colors of the surfaces surrounding the space, walls, ceilings, and floors help in making the space luminous, such as the use of blue pigments in commercial interior spaces, which are brighter in dark lighting so that it can be seen clearly (Jacobson, 1948, p. 122).

2- Psychological use of color: Certain colors are used to affect the feelings and emotions of the recipient. There are two main uses:

(a) The use of color to influence the perception of some space indicators: By achieving illusion in perceiving the shape and size of space, time, temperature cold, scale, noise degree, and visual weight of the elements in the interior space in Commercial buildings.

(b) Using color to achieve emotional effects: From using color combinations to specific color projects to create an atmosphere that encourages attraction and enjoyment within the interior space. This is to create an exciting aesthetic image for the viewer and push him towards a positive response in his behavioral actions. Including the purchase that helps the success of the shopping activity in those spaces.

It has been found that this use falls within the focus of our research, to find the color formations that achieve positive emotional effects on the customer and push him to buy (Ladau et al, 1989, p. 114).

3-The symbolic use of color: through the use of color pigments with a certain symbolism to the viewer in the commercial interior spaces. To affect his awareness and understanding of the environment in which he is located (Jacobson, 1948, p. 124).

4- Aesthetic use of color: Colors are used to achieve aesthetic purposes by satisfying the aesthetic tastes of the general public, which are realized from three elements:

-The first element is the civilization, which gives us comfortable and reassuring color combinations because of its attractiveness to people.

- The second element is the style, which gives color choices based on the prevailing fashion.

- The third element is the Design, which gives color choices based on the contrast between unspecified colors for specific effects. Where the previous three elements constitute our aesthetic tastes (Ladau et al, 1989, p. 161).

It can be seen the possibility of integrating the two uses 3 and 4 within the psychological use of color, in order to influence the aesthetic values and symbols in the psychological dimensions of the human being through the ideas associated with them.

3.1.10. Conclusion

The following conclusions were reached:

1- Color is that feeling generated by certain types of light, the eye can perceive, and the brain can interpret. There is an overlap between a group of physical, physiological and psychological sciences to reach a true understanding of its effects, and formulate its relations in the internal environment of commercial buildings.

2- Colors cannot exist unless the light waves are reflected in a way that enables the eye to receive this information and transmit it to the brain. There are four basic

methods that explain the production of color physically, dissolution, diffraction, interference, absorption and reflection.

3- The Bukenji phenomenon recommends the use of colors with short wavelengths, such as blue, because it is more brilliant in dark light. As for the dimensional phenomenon, it indicates that the eye needs the color that gives it balance, and in the absence of it, it gradually works to create it; therefore, the use of integrated colors in a balanced manner gives a stable effect to the image, and creates a comfortable color design harmony for the human being.

4- Many scientists believe that aesthetics starts from the science of physiology, because yellow and green are comfortable colors for the eye, while colors with long wavelengths such as red rays are tiring for the eye, and colors with short wavelengths are more comfortable than colors warm.

5- The process of perceiving color affects our perception of the surrounding environment and many of its elements, such as our perception of size, weight, time, temperature and others, what is found the following:

-The use of cold colors and light colors increases the size of the space outwardly, unlike warm colors and saturated colors. As for warm and dark colors, they seem heavier than cool colors and light colors and are less saturated.

- Warm colors make time more than estimated, unlike light and cold colors that are comfortable for the eye, and the eye does not need to make any effort to realize them. Cold colors make you feel cold less than warm colors; because warm colors stimulate blood circulation, while cold colors calm it.

- Loud sounds and strong odors make them more sensitive to green and less sensitive to red; therefore, it is recommended to use cold colors in areas of noise, because warm colors stimulate sound and noise, unlike cold colors.

6- Color is used to achieve emotional goals by using color combinations for specific color projects to create an atmosphere that encourages attraction and enjoyment within the interior space. Which creates an interesting aesthetic image for the viewer that

pushes him to respond through his behavioral actions, one of them could be purchasing that helps the success of the shopping activity in those spaces.

3.2. EMOTIONS IN INTEROR SPACE

The psychologist Arnold defined emotion from the cognitive perspective, “It is the perceived tendency towards anything that is judged intuitively as good beneficial or away from the sensory evaluation as bad or harmful (Arnold, 1960, p. 182). This definition calls to believe and affirm that emotions are helpful, as they are considered a formative function that establishes a place in relation to our surrounding environment. As for the question about emotions in interior space being real life emotions or not, it is the same question about aesthetic emotions that evoke from artworks. Many researchers in the field of aesthetic emotions admit that the emotions that are in response to art are real emotions and the same emotions that practice in daily lives. This also includes the emotions in design outputs, which does not require special verbal formulations, but rather has the same formulation of emotions in everyday human events (Mahnke & Mahnke, 1987, p. 35).

An emotional response draws us towards certain people, things, or ideas and pushes us away from others. This means that although humans differ in their emotional responses the process that precedes an emotional response is universal (Alqaisi, 2019, p. 14). To facilitate an understanding Emotional response to design outputs, Desmet, has designed a model of the product’s emotions to represent this process. The model shows four main criteria in the process of eliciting feelings, namely, emotion, product, concern and appraisal, as the first three determine and their interrelationship whether the product provokes feelings or not (see Figure 3.8), (Desmet, 2003, pp. 4-5).

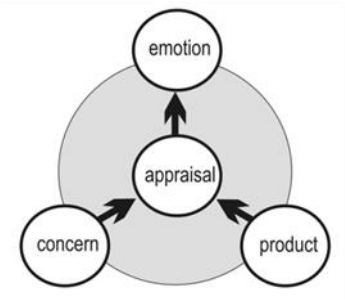


Figure 3.8. The basic model of product emotions (Desmet, 2002, p. 16).

Many studies have found that problems in emotions can include two axes. These axes are classified into pleasant and active and between pleasant and unpleasant, active and inactive (see Figure 3.9).

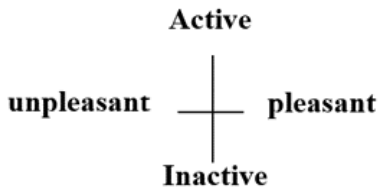


Figure 3.9. Axes of emotion, prepared by the researcher**.**

These axes have been built on the basis of many sensory measurements of the industrial product as emotional verbal vocabulary. Axes can be formed in the form of cone, cross, circle and rhombus. the most common model is the polar coordinates model of Russell, which is a tool for measuring emotional responses to products consisting of 28 An emotional vocabulary, verbal divided into four groups on the main axes of the circle, these groups represent half of the positive emotions and the other half of the negative emotions use to measure emotional responses to things and ideas, (Russell, 1980, p. 161). As well as similar models based on the polar coordinates model of Russell, which included a number of different emotional verbal vocabulary, model 69 emotional verbal vocabulary and model 41 emotional verbal vocabulary as well as model 25 emotional verbal vocabularies (see Figure 3.10) (Desmet, 2002, pp. 15-20).

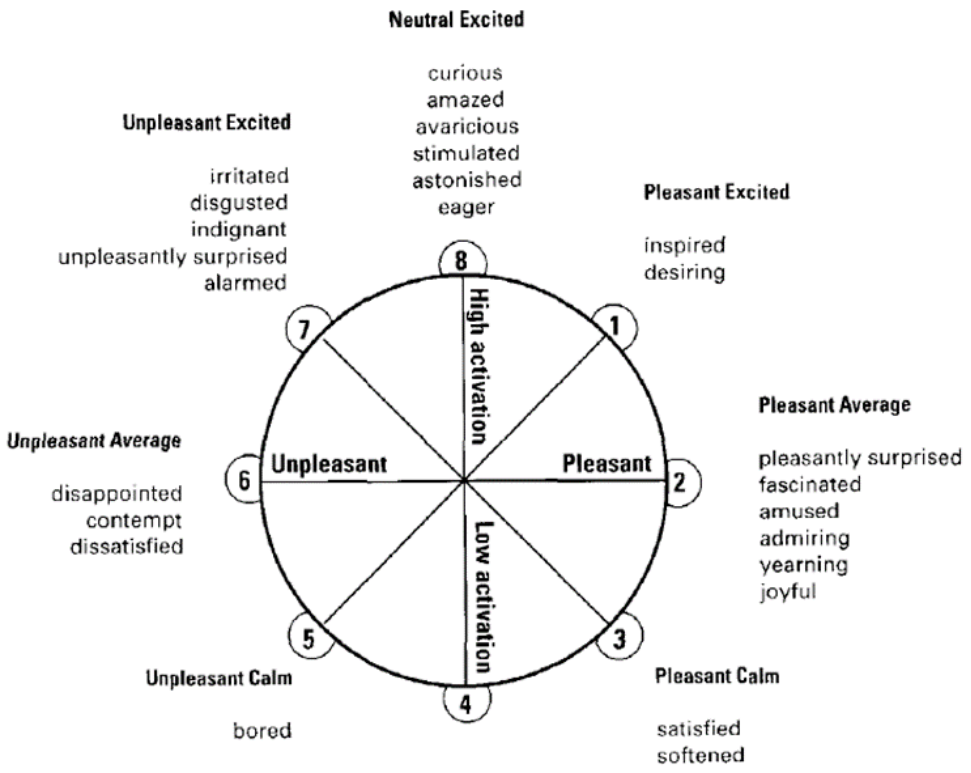


Figure 3.10. Categorized set of 25 emotions often elicited by product emotions it was based on the Russell polar coordinate model (Desmet, 2002, p. 51).

3.2.1. Color and Emotion

Color contributes to shaping the interior space in a fundamental and important way as it is more than just decoration. Color helps in explaining and clarifying the shape of the interior space. It can add meaning, context and identity to the interior space, color helps in the success or failure of the design and contributes to the affirmation of the personality of the interior space as well as granting individuality and a sense of calm or vitality and highlighting spaces and volumes to create different moods within spaces and volumes. It has been found that the color helps to enhance the excitement of the user and can have negative or positive effects on the psychological and physical side of the user. Color is one of the effective factors in the design, which conveys the feelings expressed by the designer (Jain, 2017, p. 10394). Color leaves a positive or negative psychological feeling because of its effect on the human nervous system, due to the surrounding social and cultural environment. However, this effect differs from one person to another, depending on gender, physical and social environment. , Our emotions play an important role throughout our lifetime because they enrich almost all

waking moments with pleasant or unpleasant qualities. Emotions guide and enrich high life. They provide meaning to everyday existence. This demonstrates that the relationship with our physical world is also an emotional one, so it is not surprising that researchers and consumer professionals have discovered that the emotions elicited by products enhance the pleasure of buying, owning and using these products (Brengman, 2002, p. 56). It has often been argued that the empirical or emotional quality of the products has become more important to the differential advantage in the market because the products are now often similar with respect to technical characteristics, quality and price. In some purchasing decisions, emotional responses are a determining factor.

Color is one of the important elements in the design of the interior space, not only as a decorative and aesthetic element, but in many cases, it adds meaning to the space and defines its identity. Color contributes to the success or failure of the design and also gives a specific emotional feeling based on the nature of the space and the cultural and social environment in which it is used. Quality and price are not the only factors in determining the success and marketing of the design because color has positive or negative effects on the sensory and physical side of the user (Jain, 2017, p. 10393).

The color leaves a negative or positive psychological feeling because of its effect on the human nervous system due to the social and cultural environment surrounding the human being. This effect differs from one person to another based on the difference between gender and the physical and social environment. Here are some of the emotional effects of different colors (Al-Naimi, 2005, p. 57).

Red: The true red color is the most vibrant and convincing of the rest. Expresses excitement, speed, passion, strength, joy and danger. It attracts immediate attention and brings objects or images to the fore, due to its strong influence on the automatic nervous system. Red color can stimulate a feeling of warmth and comfort. It is often used in spaces that require attention or focus when referring to specific areas in the interior space. It is the strongest among the warm colors and thus can change spaces and volumes to a more stimulating and energetic look (Jain, 2017, p. 10396).

Blue: Blue has been a symbol of loyalty, hope and faith since ancient times. Blue is a desirable color as it is cold, unemotional and unfriendly. The light blue to medium is

characterized by being particularly pleasant and comfortable. Looking blue slows down your heart rate, breathing and temporarily lowers your blood pressure. Some shades of blue can be sharp and difficult so they should be used with care. The blue color may make the space seem larger than it is. The use of dark blue color expresses respect, loyalty and trust, so it is used in cultural and administrative spaces.

Yellow: From the psychological aspect, yellow is considered one of the most colors in generating happiness, as it is a color associated with warmth, optimism and joy. Bright yellow hues can form interesting focal points against the background of natural colors, especially in interior spaces. Pure yellow lifts our spirits and self-esteem.

Orange: A stimulating and invigorating color that appears friendly, open, cheerful and adventurous. It has the energy of red and the happy and friendly qualities of yellow. Orange is a vibrant color that is best used in areas that are not intended to relax in stimulating the color as it provides warmth, control and vitality. The bright orange color is very high in clarity, making it ideal for warning signs and for attracting attention even when used in small amounts (Brengman, 2002, p. 76).

Green: Pale green is the most relaxing and calming color and is the color of nature. It offers complete refreshing comfort as it lies between cool and warm on the color wheel. It has healing powers and is one of the reasons why hospital walls are painted to calm patients and visitors. The light color of it can create the impression of intimidation when used in the interior space. Dark green is also associated with balance and growth, indicating a state of high productivity (Yassin, 2007, p. 34).

Black: Black is a mixture of all colors that are completely absorbed. It creates an atmosphere of mystery. The meaning of the color black in psychology is to create protective barriers from external emotional stress. It also means strength, control, fear and unfriendliness because of the psychological force that it affects the user. Black indicates self-control, agitation, independence, strong will, giving the impression of power and strength. Deep black can cause mood swings and create an adverse environment so it is best to use some colors with black to lighten it and reduce its negative energy (Al-Qadi, 1975, p. 89).

White: symbolizes purity, innocence, goodness and truth. It is clean, healthy and harmless. Although white is a neutral color, it is considered a great color because of its association with snow and ice. It provides a sense of reconciliation and creates a comfortable environment, as it indicates an equal balance of all colors of the spectrum, it represents both the negative and positive aspects of all colors (Yassin, 2007, p. 76).

3.2.2. Emotional Connotations of Color

Color is an important factor for the visual appearance of interior space, so studying the emotional effects of color is an important role in marketing products. Some studies in the field of marketing have shown that it is possible to use color to communicate the personality of the brand, so it is important for the designer to have a wide knowledge of the use of colors in different products in addition to the changing meanings and emotions of those colors, it is possible for a pattern of users to interact with them positively without others (Al-Naimi, 2005, p. 45). Although there have been many attempts to classify users' responses to different colors, each person sees colors differently due to the physiological and emotional impact of color. It is affected by other factors, including past experiences, culture, religion, natural environment, gender and ethnicity. Making color decisions depends on identifying the audience of users to convey a healthy emotional color message from the designer to the user, (Labrecque, 2022, p. 718).

Different colors have different emotional connotations, for example, the feeling of being awake is the result of the effects of the red color. As for feelings of relaxation, they are associated with blue tones. Positive emotional feelings are pleasant feelings that can positively affect the acceptance of internal spaces. Lots of studies have been done to determine the emotional meanings of color among these are studies conducted in the United States to determine emotional color feelings, (Labrecque, 2022, p. 712). Alqaisi, summarized it thus, that these studies have divided those emotions into two types, and the first is functional, which is the type of colors that meet needs or contribute to solving a problem. The second type is social sense, which refers to emotions, attitudes, states or social acceptance, as shown in Table 3.1, a summary of the emotional values.

Emotional Vocabulary						color
Anger (S)	Speed (S)	Love (S)	Excitement (S)	Energy (S)	Pleasure (S)	
		Low quality (F)	Cheap (F)	Happy (S)	Efficient (S)	
		Healthy (S)	Environmentally friendly(F)	Envied (S)	Taster (F)	
	Trusted (F)	Cooperating (F)	High quality (F)	Efficient (S)	Masculine (S)	
			Female (S)	Trustworthy (S)	Fancy (S)	
			Forceful (S)	Sophisticated (S)	Authoritarian (S)	
				Exciting (S)	Warm) (S)	
					Sharp)(S)	
	Deadly (S)	Scary (S)	Expensive (F)	Sophisticated (S)	Depressing (S)	
			Pure (S)	Safe (S)	Happy (S)	

Table not: The letter attached to the emotional value (F) denotes the functional classification of the emotion, while the letter (S) denotes the social sensory classification of the emotion.

Table 3.1. Shows a summary of the emotional values of some colors sourced (Alqaisi, 2022, p. 106).

3.2.3. The Relationship between Color and Emotion

The way users respond to emotional stimuli of different colors varies greatly in the Singh study, people's preference for blue was the best choice 35%, followed by green 16%, purple 10% and red 9%. The blue and green color is due to the factors of the biological history of the users, as the ancestral environment was an agricultural environment in which colors are available in nature. Blue is from the blue of water and green is from green while orange, yellow and brown are less common, respectively (Desmet, 2002, p. 55), color preference may depend on the temperature in the user's environment. People in cold environments often prefer warm colors such as red and yellow, while people in hot environments prefer cool colors such as blue and green. It was found that introverted people are more attracted to calm colors, while extroverted people prefer warmer colors. Some studies have shown that the difference in gender has a significant effect on color preference, as some studies indicate that women and men prefer warm colors for women and cool colors for men, respectively. The black, white and lead colors of color systems or shades, they had a positive effect on males more than females (Scott, 1951, p. 78). One study was conducted to test whether the color of clothing makes a person appear more sexually attractive. It found that heterosexual men and women who wear red clothes are more likely to attract romantic attention than women who wear clothes of other colors. The study also showed that the color and its choice for women did not affect the evaluation of other women. Another study indicated that men who wear red clothes are more attractive than women. Another study stated that the elderly prefer the color blue, while the yellow color was more preferred by young's and this is due to the yellow color being associated with happiness. Also, children prefer colors they find it enjoyable, comfortable and changeable, while the effect of color preference for adult's changes easily (Diana et al, 2011, p. 67), another study showed that cultural environment has a strong influence on color associations. It showed that people from the same geographical area, regardless of race, will have the same color preferences. Color preference also differs in different cultures. For example, in one study, color relations with emotion for study participants from Germany, Mexico, Poland, Russia and the United States showed that the color red was associated with emotional vocabulary anger, strength, and activity. However, people from Poland associated feelings of

anger and jealousy with the color purple while Germans linked yellow with jealousy. This highlights that different cultural influences have a significant impact on understanding color and its association with emotion (Desmet, 2018, p. 300).

3.2.4. Measuring Emotions

It is clear that the pleasure of use, that is, the pleasure one experiences from owning or using a product belongs to the emotional realm and not to the rational realm. The difficulty in studying emotional concepts such as pleasure of use or pleasure of emotional enjoyment is that they seem as intangible as they are important. What's more, rather than being an emotion in itself, enjoyment may be the result of a wide range of possible emotional responses. For example, the pleasure that one enjoys when watching a movie. One will experience all kinds of emotions, such as fear, amusement, anger, comfort, disappointment, etc. It is instead of a single isolated emotion. This includes the use of industrial products as well. The combination of these feelings contributes to the experience of fun, as knowing the process of feelings, i.e. how to trigger feelings, can enhance our understanding of what makes us enjoy interacting with any type of product. However, so far little is known about how people respond emotionally to products and what aspects of design or interaction elicit emotional responses. Or a tool can enable us to measure emotional responses and support the study and exploration of relationships between subjective emotional responses, objective interaction, and design characteristics. Given this application purpose the instrument must be able to measure both subtle, low-intensity and mixed, more than one emotion being tested simultaneously emotions and additionally requires that the instrument be language-independent (Hirschman & Holbrook, 1982, pp. 47-50).

The search for tools to measure feelings has a long history traditionally, as attempts have been made to measure feelings in the field of psychology and sociology, during the past twenty years consumer and marketing researchers have developed tools that measure emotional responses and consumer experiences. As a result of the widespread use of computers in our daily lives, the computer has an important role in measuring emotions. Measuring emotions entails looking at some basic issues an important consideration is deciding what kind of emotional experience is required. There are important differences between feelings and phenomena related to emotions. As for the

emotional response aspects, it is important to determine which aspect of the emotional response to the evaluation. Attention is usually focused on the emotional experience or subjective assessment of emotion in some cases, though other phenomena such as emotional awareness are the ability to recognize feelings in oneself or others, or emotional expression and emotional regulation (Desmet, 2018, pp. 285-289).

3.2.5. Emotion Measurement Methods

Before one can measure feelings one must be able to describe feelings and distinguish them from other states. Unfortunately, this is a problem that has yet to be resolved. Although the concept of emotion appears to be a general concept, it is very difficult to come up with a solid definition. When scanning emotion research in psychology, one finds different concepts and perspectives. In the past 100 years, psychologists have provided a variety of definitions of how emotions are defined and studied. Their explanations each focus on different manifestations or components of emotion. Since there is no empirical solution about which component is sufficient or necessary to define emotions, the most preferred solutions at present are to argue that emotions are best treated as a multifaceted phenomenon consisting of the following components: behavioral reactions: for example approaching, expressive reactions, e.g. smiling, physiological reactions such as heart palpitations and subjective emotions (e.g. feeling euphoric), each instrument purported to measure emotion actually measures one of these components. As a result, the number of tools used and the variety of methods for measuring emotions are abundant. Today's emotional measurement tools range from simple pen and paper rating scales to dazzling high-tech equipment that measures brain waves or eye movements. Here are some types of tools for measuring emotions, (Larsen & Prizmic, 2006, pp. 345-347).

3.2.5.1. Non-Verbal Tools for Measuring Emotions

They are called non-verbal tools because they do not use language, instead they use specialized devices and equipment to measure the emotional effects of a person.

This type of tool is considered as one of the important tools for obtaining accurate results, and one of its advantages is that it works accurately integrating multiple

cultures within the different levels of education as well, although it requires in many cases, expensive equipment and also highly trained technicians.

Psychophysiological Methods

It is one of the most common physiological measures, and it refers to indicators of the autonomic nervous system ANS, including indicators of respiratory performance, such as oxygen uptake, and cardiac work such as blood pressure and heart rate, heartbeats and electrical cutaneous measures, such as attaching the skin to electrodes to measure sensory responses (Mauss & Robinson, 2009, p. 208). Some studies suggest that certain patterns of ANS function correspond to specific emotions for example, finger temperature drops less with anger than with fear, and others suggest The ANS scales are most useful for assessing the general emotional dimensions of valence both negative and positive, such as arousal and activation. Other methods provide information relevant to emotion by evaluating the functioning of the central nervous system CNS (Mauss & Robinson, 2009, p. 23). One of these methods is electroencephalography, in which the electrical activity of the brain is measured through electrodes placed on the scalp affected by emotional responses, and emotional performance is assessed using neuroimaging technology, for example, functional magnetic resonance imaging or tomography. These techniques are providing a more accurate assess the location of brain activity compared to EEG, and thus identify brain structures and circuits associated with specific emotions (Mauss & Robinson, 2009, p. 25). This category includes tools that measure the expressive or physiological component of an emotion through an expressive reaction such as smiling or frowning, facial expression, voice and posture associated with emotion. Where each emotion is associated with a specific pattern of expression, for example anger comes with a fixed look, drooping eyebrows, pressed lips, strong and active movements and usually in a loud voice Tools that measure this component of emotion fall into two main categories, those that measure the face and those that measure vocal expressions. Facial expression tools rely on theories that link expression features to distinct emotions. Examples of these theories are the facial movement coding system, and the maximum discriminatory facial movement coding system (Ekman & Friesen, 1999, p. 35). In general, visual expressions captured on still images or short video sequences are analyzed. Micro-expressions that are not visible to the naked eye can also be measured

because the activity of the facial muscles for these expressions results in electrical potentials in the electrical measurement of the facial muscles. Muscle electrical conducts this by determining the voltage from two electrodes located on the surface of the skin over a specific muscle group. Acoustic instruments are based on theories that link patterns of audio signals with emotions. These instruments measure the effects of emotion in multiple audio signals such as the average pitch, changes in pitch and intensity, speaking rate and quality. Which can be called Voice and Expression (Cacioppo et al, 2008, pp. 182-183).

The main advantage of non-verbal tools is that they are independent of language, can be used in different cultures, and the second advantage is that they are unobtrusive because they do not disturb the participants during the measurement. In addition, it is often mentioned that these tools are less subjective than self-report tools because they do not depend on the assessment of participants. For emotional experience, this class of tools has many limitations. These tools can only reliably assess a limited set of "basic" emotions such as anger, fear and surprise. Some studies have found that the accuracy of these tools ranges between 60-80% of six to eight basic emotions. These tools cannot assess mixed emotions (Ekman & Friesen, 1978, p.122). The main advantage of psychophysiological measures is that they have the ability to overcome the potential unwillingness or inability to self-report feelings. They are less prone to intentional distortion than self-reported measures. With regard to the ability, there are some cases of measuring emotional responses of individuals who are less conscious and therefore less able to report. Therefore, this method is more accurate. As for the drawbacks of psychophysiological measures, the other main consideration in relation to these measures is their practicality, as the management and control of these measures require labor-intensive for both participants and researchers. Moreover, these procedures are costly and require great training for researchers (Desmet, 2018, p. 290).

3.2.5.2. Verbal Instruments for Measuring Emotions

The verbal instruments for measuring emotions are divided into two parts:

Verbal self-report tools

They are tools that usually assess the subjective sense of emotions, such as feeling happy or inspired. It measures the emotional state a person is going through, the subjective emotional experience. It is the most common method for assessing emotions. Each emotion includes a specific feeling, which is a basic and irreducible type of mental element. Self-report tools require respondents to report their feelings using a range of rating scales or verbal protocols. It is the most common method for assessing feelings. Self-reports usually include surveys, that can be done manually or online. It can also take other forms, for example, personal or telephone interviews (Larsen & Prizmic, 2006, pp. 340-342).

Self-reports of emotions have high authority in that they measure what they are supposed to measure. Whose stakeholders, respondents or recipients may accept results from self-report measures more readily than less direct and transparent measures, such as the use of blood pressure monitors to assess emotion? Another advantage of self-reports is that the reality of emotions is cognitive and self-referential in nature. Self-report measures have an advantage over control measures because in order for control measures to be valid each of the following requirements must be met:

- The emotional state of the person must be translated into observable behavior.

- The behavior must be translated into reality so that it can be observed.

The observer must be able to infer a person's emotional state accurately from the observed behavior, while this is not required in self-reports. It does not require expensive equipment self-reporting procedures although some of the more complex technologies may require equipment such as laptop computers or joysticks. Self-report measures are usually more convenient and cheaper than alternatives such as psychophysiological measures (Chan, 2009, pp. 309-310).

Rating scales can be grouped to represent any set of emotions. Can be used to measure mixed emotions. The main problem is that it is difficult to apply it between cultures. In emotions research, it is known that translating emotional words is difficult because, for many emotional vocabularies, no single, direct translation is available. Therefore, cross-cultural comparisons are known to be problematic because of the difference in the emotional vocabulary for expressing feelings (Chan, 2009, p. 314).

***Observational Measures**:* Observational Measures are one way to complement self-reporting methods in observing and recording behaviors such as laughing or screaming, which are related to specific emotions using behavior-based rating scales, for example coding behaviors so that it can be examined frequencies, patterns and correlations displayed emotions. Recently, emotion researchers have begun to systematically assess postures and other whole-body movements for emotional content. Using this approach, it can be assessed emotions by focusing on body postures such as the degree to which the chin is pointed up and the wide chest to express pride. Assessment of whole body postures is important as many emotional experiences, pride cannot be deciphered from vocal behavior or other observations except for body movements (Cacioppo et al, 2008, pp. 189-190).

There are other monitoring methods that focus on facial movements, such as anti-social smiles. Which can be distinguished by observing the wrinkles near the eyes that have been developed in humans, there are several procedures for evaluating facial behavior encoded by emotion. One procedure is called a facial movement coding system. It is a coding system that focuses on 44 different facial movements associated with the experience of emotions. The second method involves the use of electromyography. Electrical output from facial movements is evaluated and can reliably measure facial indicators of emotion. This latter technique is particularly useful for assessing the sudden response such as feelings associated with fear and anxiety (Ekman & Friesen, 1999, pp. 55-58).

***Emoji**:* In many cases, facial expressions provide a means of conveying feelings, which is often more effective than verbal expressions. The accumulated experience of humans in understanding and translating facial expressions, in addition to technological progress and the emergence of various applications for online

conversation, has paved the way for the emergence of emoji's[2]. Emoji have been widely used during these applications. This non-verbal tool has recently been harnessed in creating self-reporting tools for measuring feelings and emotions (Alqaisi, 2020, p. 295). Recently, many of these tools have been designed for different research through the use of, emoji to measure the emotional responses of industrial and other products to the consumer. These instruments are the most accurate and common in measuring the emotion of an industrial product compared to other instruments. It is accredited in research and dissertations completed at Delft University[3]. Most of the research done in the field of design and emotion has relied on emotional vocabulary from the Russell's polar coordinate model (see Figure 3.11), by fully adopting some of those terms or developing their concept and connotations to suit the particular cultural and social environment of the research. The emotional vocabulary used in those questionnaires ranged from two contradictory words to 14 items. The samples of the respondents were design students, their numbers ranged between 20-150 male and female students, in addition to the involvement of administrators and teachers in some research. With regard to the selection of expressive images that are synonymous with emotional vocabulary, some research relied on forms that are already available in conversational applications via the Internet, such as, Messenger, WhatsApp, etc. Expressive faces were designed in other research with the help of technicians, Figure 3.12 shows designing emoji faces (Hirschman & Holbrook, 1982, p. 93), this methodology will be adopted by the research later in the selection of emotional vocabulary and the sample of beneficiaries.

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[2] Emoji: A single word and plural ,Emojis or Emoji, which are images of different expressions, drawings, lines or smiley faces used in electronic me ssages and (web) pages. This word is originally a Japanese word, which means diagram, the letter Emeans image, and (Emoji) means letter. They are formed in different groups of expressions such as facial expressions, common things, places, and types of weather, animals, and others. They largely represent emoji expressing types of feelings, instead of writing, emoji are used to represent the meaning of writing within the image or layout (Blagdon, 2013, p. 6).

[3] Delft University of Technology, Delft, The Netherlands, is the oldest and largest engineering and technical university in the Netherlands, ranked in 2020 among the top 15 engineering and technical universities in the world (The University of Lahore, 2020).

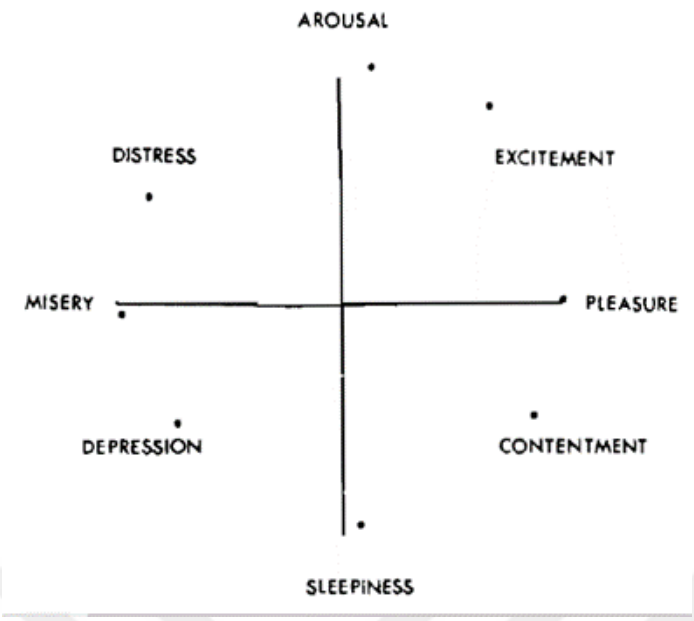

Figure 3.11. Russell's polar coordinate model (Russell, 1980, p. 1164)**.**

Figure 3.12. Designing emoji faces with the help of professionals (Adam et al, 2013, p. 3).

Measuring emotions using emoji is one of the most accurate and reliable tools, especially in measuring general emotions, exciting, interesting, bad etc. It does not require high training for those in charge of the research and it can be accomplished in record time, so it is inexpensive compared to other means of measuring emotions. This type of measurement, like other verbal measurement tools, is inaccurate and unhelpful when used within a multicultural context. This is because the form and understanding of the meanings of emotions differ from one culture to another, so it is very accurate within a harmonious cultural and educational sample, and most of them are design students (Alqaisi, 2020, p. 290). It uses verbal vocabulary and emoticons, and non-verbal use technological sciences, such as heart rate monitors, etc. Each group has good and bad characteristics. Verbal measurement tools are good in measuring

emotions in the case of sample consistency and are inexpensive, while non-verbal measures are useful in measuring emotions and cultural pluralism, but they are expensive, Table 3.2 shows the mechanisms of measuring emotions, so it can be said that the emoji tool is the ideal tool that will be used by the researcher in obtaining the results as it is accurate, inexpensive and fits the research objectives.

Disadvantages Considerations	Advantages	Examples	Measurement type
Rely on people's ability and willingness to provide real reports on their emotional experiences The possibility of inflating the relationship estimates due to the difference in the common method	- High face validity Well suited for assessing self-referential perceptions -Convenient and cheap in management	Paper and pencil or online surveys Today's Surveys Experiments - Sample Surveys Moment by moment thrills - interviews	Self-Report
Expensive - time consumption May not strongly relate to self-reports It is not a measure of the experience of feelings	May overcome the inability or unwillingness of people to make true reports of feelings - Provides rich data -Useful for checking emotional display/expression	- Behavioral observation Face coding - Coding of written or oral accounts	Observational
Inaccurate and unhelpful when used within a multicultural context Rely on people's ability and willingness to provide real	- It does not require high training for the searchers One of the most accurate and reliable tools	Paper and pencil or online surveys Today's Surveys	Emoji’s

reports on their emotional experiences The possibility of inflating the relationship estimates due to the difference in the common method	high validity Well suited for assessing self-referential perceptions -Convenient and cheap in management	Experiments - Sample Surveys Moment by moment thrills -interviews	
expensive -it is not practical - time consumption May not strongly relate to self-reports Very useful on multicultural participants	Requires high training based on research, accuracy in the results	Use of measuring devices Nervous system , devices that Absorption of oxygen, Electrical measures of the skin and EEG devices	Psychophysiological

Table 3.2. Comparison of the mechanisms of measuring emotions, prepared by the researcher.

3.2.6. Previous Studies of Measuring Emotintions

There were number of studies that dealt with the measurement of emotions in multiple disciplines. But there were limited number of studies in the design discipline. Those have mentioned that are related to the topic of our research.

The Emotional Effects of Colors in the Industrial Product, Alqaisi, 2022.

The research problem was represented by the following question: How can the preference for colors and their emotional associations in the industrial product be revealed? The aim of the research was the detection of systems for measuring emotions in the industrial product and determining the preferred colors and their emotional associations for the industrial product by the consumer. While the limits of the research were designing a chair in seven primary and secondary colors, Table 3.3 shows a sample of those chairs, in addition to choosing 7 emotional vocabulary, as shown in Table 3.4, the emothions that chosen. 101 students in the Design Department were

surveyed for the purpose of reaching the results of the research. And its emotional connections to the industrial product by the consumer, and the most important results were:

1- Preferring cold colors in industrial products, primarily violet and then blue.

2- Positive emotional vocabulary of cold colors, on top of which was attractive, blue and violet in the foreground.
3- The cool colors in total had the highest percentage of preference for positive emotional vocabulary, while the warm colors were negative (Alqaisi, 2022, pp. 106-117).

Attractive	Fascinating	Acceptable	No comment	Annoying	Awful	Tiring

Table 3.3 Seven emoji's represent your chosen emotional vocabulary (Alqaisi, 2022, p. 114).

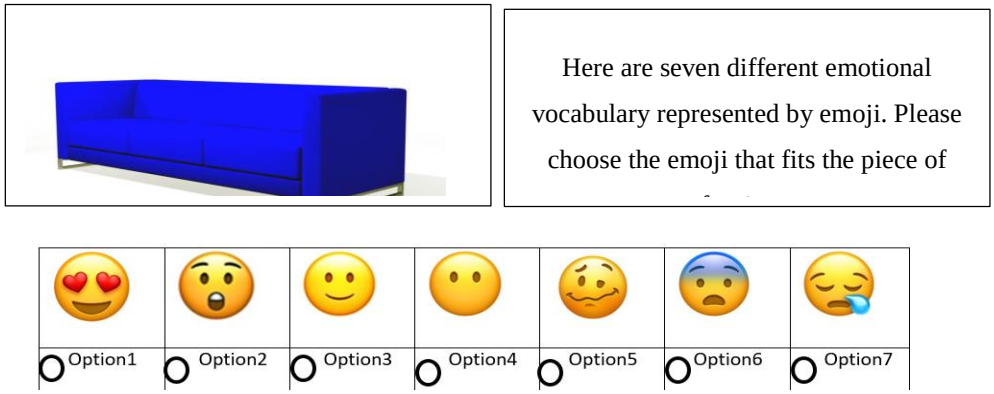

Table 3.4. Sample questionnaire questions, (Alqaisi, 2022, p. 117).

Evaluate Industrial Products Emotionally Using Emoji, Alqaisi, 2020.

The research problem was summarized as there was no tool in the Arabic language that used emojis for the purpose of emotionally evaluating industrial products. The importance of the research was to find a tool for professional designers and design students to identify the emotional trends and desires of users towards products, which provided the designer with an emotional database for new and implemented designs.

The objectives of the research were to design a verbal and a visual emotional circuit, then to use it to evaluate industrial product, and chairs, emotionally. Based on the theoretical framework and previous studies, he designed a verbal Circumflex (see Figure 3.13) and another using emoji (see Figure 3.14). A sample was selected from seven chairs of different models for the purpose of measuring emotion. The sample of the respondents was selected from among the students of the College of Fine Arts, University of Baghdad, and their number was 89 male and female students between 19 and 35 years old.

The research has reached some results, including:

1- Designing of the verbal emotional sensory circuit.

1- Designing an emotional sensory circuit using emoji's (Alqaisi, 2020, pp. 288-302).

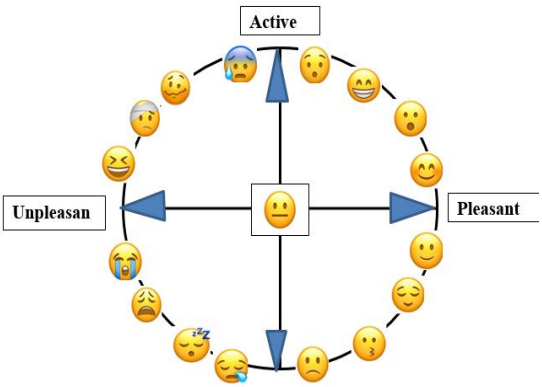

Figure 3.14. Mohammed Emoji Circumflex, (Alqaisi, 2022, p. 115)

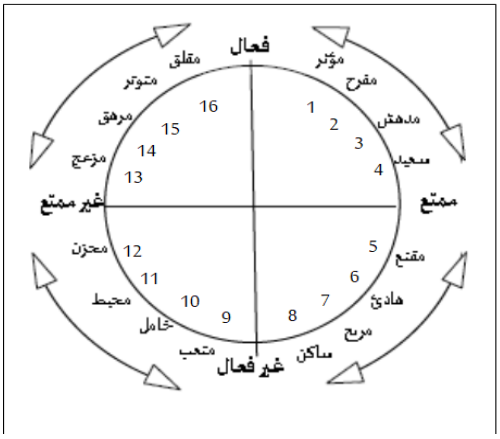

Figure 3.13. Mohammed verbal Circumflex, (Alqaisi, 2022, p. 115)

Values and Emotions; an Empirical Investigation in the Relationship between Emotional Responses to Products and Human Values, Desme, 2003.

The aim of the research was to reveal the relationship between industrial product design and emotional responses. A new non-verbal tool was used to measure 14 emotional vocabulary on industrial products. This emotional vocabulary is drawn through animated cartoon characters using dynamic expression of the face, body, and

voice (see Figure 3.15). These cartoon characters were shown within a questionnaire on the computer screen to the participants in the questionnaire to measure their emotional reactions about 6 cars of different models with silver or light gray colors. The sample of participants in the questionnaire was intentionally selected from 40 people distributed among people whose ages ranged from 18 to 27, 10 males and 10 females, as well as10 males and 10 females for the age group 40-60. One of the most important results was that the Alta 147 car had the most pleasant feelings, while the Fiat Meltbla model achieved the most unpleasant feelings (Desmet, 2003, pp. 1-7).

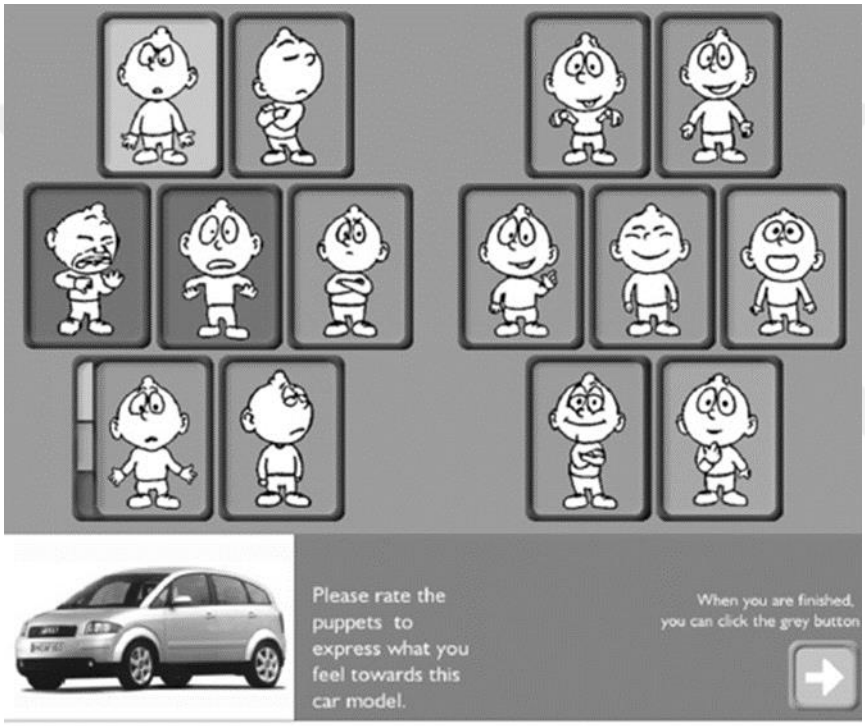

Figure 3.15. Product Emotion Measurement instrument interface, (Desmet, 2003, p. 4).

Beyond Happy-or-Not: Using Emoji to Capture Visitors' Emotional Experience, Daniela, 2020.

Museums are among the sites that evoke feelings, and people usually visit to satisfy their feelings about the archaeological exhibits as a cultural value as well as the way. They are presented. Therefore, evaluating the experiences of visitors to museums is one of the important things to develop the museum's performance. This is the essence of the problem of the current research. The feelings of visitors towards the museum are often subjective feelings that are difficult to express, but emoji's are one of the

tools that help to show those feelings in an understandable and easy way, especially in the spread of these emoji's and their use in correspondence and in various applications on the network, providing in many cases Traditional questionnaires and interviews to measure the feelings of visitors in museums, but they are not accurate and require a lot of time, so it was relied on designing a questionnaire form of 9 emoji (see Figure 3.16) , that illustrate a group of different emotional feelings. It was shown randomly to some museum visitors. The study found that emoji's have a good ability to accurately and smoothly record the feelings of museum visitors (Danielade et al, 2020, pp. 1-21).

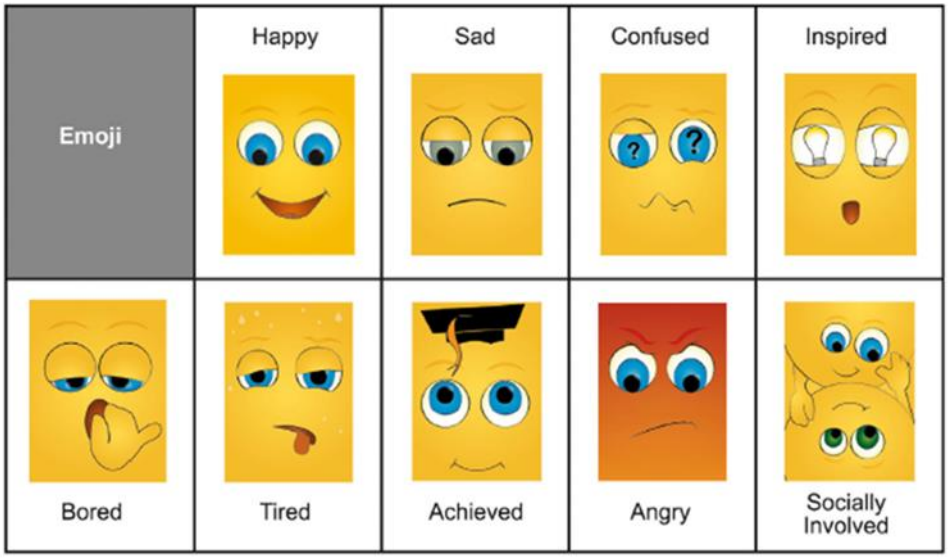

Figure 3.16. The emoji icons used to capture visitors' emotional experience, (Danielade et al, 2020, p. 10)**.**

Design and Development of an Empirical Smiley-based Affective Instrument, Adam, M., 2012.

The aim of the research is to develop emoji's to create a tool from a grid 3×3. Arranged from the top left of the column is negative and from the top right of the column is positive (see Figure 3.17). This will be allowing the learner and users to express their feelings during their use of industrial products. This tool was created and developed through a large number of questionnaires through the internet. The number of respondents was 285 females and 700 males, aged from 105 to 15. It became easy to integrate these emoji's into conversations in any messaging system linked to the internet. This tool has achieved a set of goals for users of the Internet, which are:

1- Allowing emotions to be expressed briefly without the need to use long words

4- Allowing the manifestation of these emotions as an independent system without affecting the traditional textual methods, but rather they are integrated with them (Adam et al, 2013, pp. 30-34).

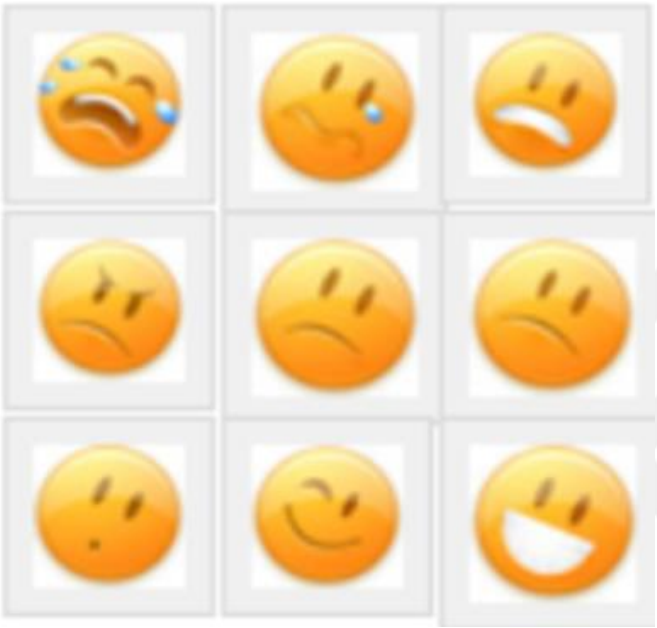

Figure 3.17. 3x3 grid, (Adam et al, 2013, p. 25)**.**

A 2D Pictorial Scale for the Assessment of Food Elicited Malt, Alexander, 2018.

Research in the field of food experience measurement has traditionally relied on a pattern of formulating questions directly to the customer, while this research relied on the development of a network of emoticons, which were language-independent graphics. This tool has a self-measurement of the excitement related to food. It was composed of 17 emoji symbols figure based on its design on the emotional network of Russell, the words were replaced by emoji symbols, and these symbols were chosen intentionally to represent the sensory response to food (see Figure 3.18), the sample of the respondents consisted of 28 students distributed 18 females, 10 males. Emoji achieve subjective and accurate results without the need for written language and can accurately measure emotions related to food (Alexander et al, 2018, pp. 1-21).

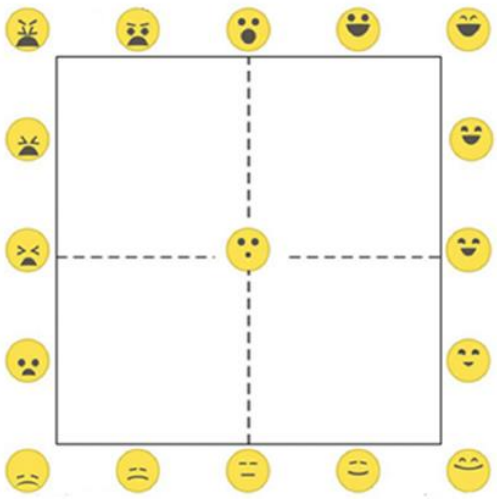

Figure 3.18.The Emoji Grid: an emoji-labeled Affect Grid for the measurement of food-related affective associations, (Alexander et al, 2018, p. 5)**.**

The Influence of Emotions on Decision-making Processes in Management Teams, Tran, V., 2004.

The thesis aimed to study the extent to which emotions affect decision-making in departmental leadership. 4 Groups of emotions were selected, achievement emotions, dealing with emotions, alienation emotions and hostile emotions to measure the extent to which these emotions affect information sharing, alternative generation, evaluation and team cohesion. Those feelings were calculated through traditional methods and then verified those accounts using emoticons by designing, the wheel of emotion (see Figure 3.19). An intentional sample of 106 managers participated in the questionnaire. They were distributed in groups of 4-7 Individuals, each team had to act as a virtual board of directors for the purpose of simulating routine work. One of the most important results was that despite the importance of individual achievement emotions for the individual's well-being and self-esteem, they are in a negative relationship with the decision-making process (Tran.V., 2004, p. 7).

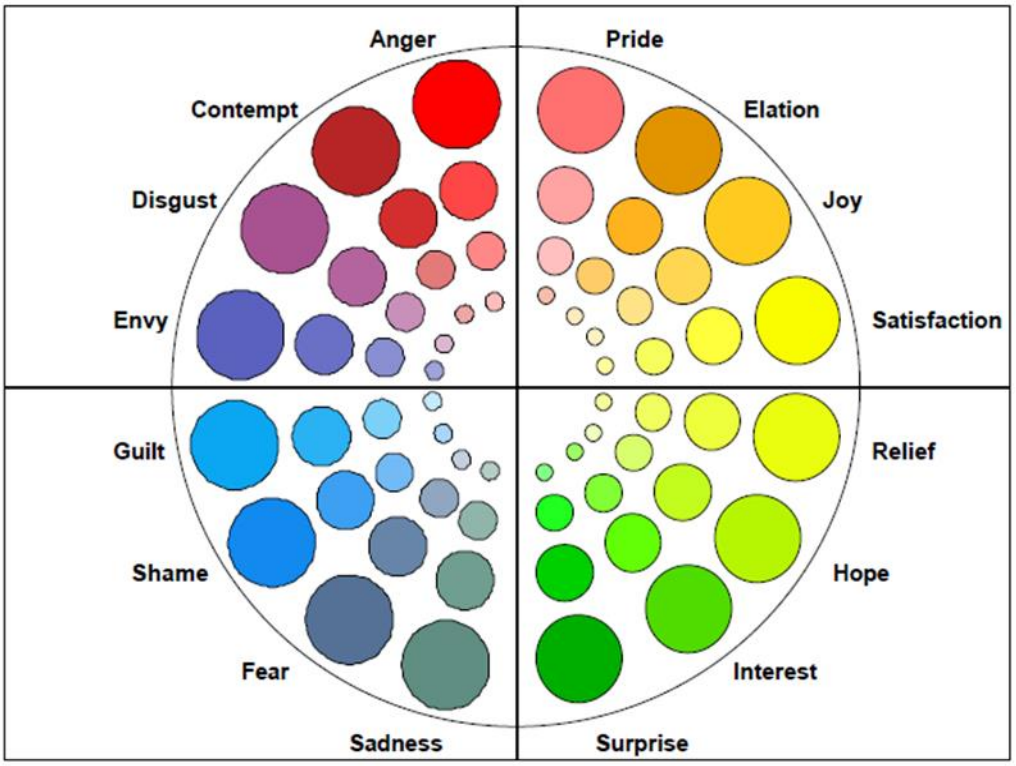

Figure 3.19. Tran emotional wheel (Tran.V., 2004, p. 335).

3.2.7. Discussion of Previous Studies

The current research agreed with previous studies in aspects, including the selection of a sample of intentional respondents, and differed in other aspects, including the number of emoji's. Regarding the details of the difference and agreement, Table 3.5 shows the comparison of previous studies.

Form Design	The number of emoji's	Sample models	Respondents sample	Objective of Emoji used	Research
Depending on Russell Circumflexes	7	Chair design in seven primary and	Intentionally 101 Students ,66 Females and 35 males,	Measuring the Emotional effects of Colors in the Industrial product	Alqaisi M

		secondary colors			
Depending on Russell Circumflexes	16	7 chairs of different models and uses	Intentionally 89 students ,65 females and 24 males	Designing verbal and Emoji Circumflex to measure emotions, for industrial products	Alqaisi M
Subjective	16	Routine simulation	Intentionally, 106 managers were distributed into groups of (4-7) individuals	The influence of emotions on decision-making processes in management teams,	Tran, Thesis
Depending on Russell Circumflex	17	50 food photos	Intentionally 28 students, 10 females and 10 males	Measuring the food experience	Alexander
Subjective	9	Museum visitors	Intentionally, some random visitors to museums	Evaluate the experiences of visitors to museums	Daniel
Subjective	9	A large number of questionn aires	285 female and 700 males	Develop emoji's to create a tool for learners and users to express their feelings	Adam
Depending on Russell Circumflex	14	6 cars	Intentional, from 40 people distributed among people between the ages of 18-27	The relationship between industrial product design and emotional responses	Pieter

Mohammed Emoji Circumflex	7	Virtual design digital space fast food restaurant colorful primary and secondary colors	males and females students of College of Fine Arts, Department of Design,	Measuring the Emotional influences of color in the design of interior spaces	Current research

Table 3.5. The table is showed a comparison of previous studies with the current research, source prepared by the researcher.

3.3. RESTAURANT

There are a lot of restaurants that provide take-away service, under which food is purchased from the restaurant but eaten elsewhere, as well as food delivery service, in which the restaurant delivers food to customers outside the restaurant. There are restaurants that provide these two services together. The restaurants differ greatly in the interior design and the nature of the offering within it, including a wide range of food and service models, which range from fast food restaurants, cafeterias, and medium-priced family restaurants to high-priced luxury restaurants.

3.3.1. History of Restaurants

Eating outside the home has a long history dating back to ancient Egypt 512 BC. There were some places to eat with limited customer service. These restaurants served onions, wild birds and grains (Spang, 2020, p. 55).

The commercial activity as a concept, restaurant began historically in ancient Greece and ancient Rome, which was called, Thermopolis. They were restaurants and bars, providing food and drink to customers (see Figure 3.20). The traditional Thermopolis consisted of a counter L shape with large storage containers containing either hot or cold food. The popularity of Thermopolis restaurants has been linked to the lack of kitchens in many residences, as well as the convenience and ease of purchasing

prepared foods for people. At that time, eating out was considered an important aspect of socializing (Ellis, 2004, pp. 371-376).

Figure 3.20. Thermopolis, which were restaurants and bars, providing food and drink to customers in ancient Greece and ancient Rome (Archeotravelers, 2020).

And then in China in the thirteenth century, they developed the concept of the restaurant in the Hank Zhou area. This area used to contain more than a million people. The idea of the development emerged from the development of a Teahouse space. This place was an enclosed space with outdoor seating serving intercity travelers. After many years these Teahouses started serving food to the locals. It was then the establishment of, Hank Zoo restaurants started. The restaurant offered different types of dishes, in addition to using the restaurant space for religious and social occasions (Spang, 2020, p. 89).

It was the first commercial activity termed as a restaurant that opened in Paris in 1765. It was called Boulanger. It was dedicated to selling soup. The name Restoratives on the front of the store was restaurants, this name referred to the soup and broth available inside. The name of the restaurant is derived from this sign, Restoratives, which refers to a general place to eat in English, French, German, Danish, Romanian and many other languages. While some languages differed phonetically, for example, in Spanish and Portuguese, the word was Restaurant (Lang, 2023).

During the French Revolution, aristocratic French families maintained their own gastronomic establishments. But the French Revolution reduced the numbers of these aristocratic families, so many chefs went to open free work opportunities after losing

their jobs. By 1804 Paris had more than 500 restaurants, which produced the greatest chefs in history and created many famous dishes. France was a pioneer in the development of restaurants. In the eighteenth century, this development included three phases for the period of the establishment of restaurants, namely:

1- Boulanger Restaurant, which was established in 1767.

2- The Chanbisean Mathurin Roze restaurant, which was established in 1766.

3- Beauvilliers Restaurant, which was established in 1778 (Malekshahi, 2013, p. 7).

The year 1794 was the year in which restaurants began to spread around the world, especially in America, when the first restaurant was opened in Boston, which was the Julians restaurant (Malekshahi, 2013, p. 8).

The concept and form of the restaurant has evolved throughout history. A restaurant as a current concept is a place to eat for a fee. However, eating food as a life activity has existed since the existence of man, as it is a basic need for survival. The ancient man ate his food without cooking (see Figure 3.21). Then, after he knew the fire, he began to cook his food. However, it was mostly eaten in the outer spaces around the place of residence or hunting. With the evolution of human habitation from caves to manufactured places, huts have provided a special place for daily food.

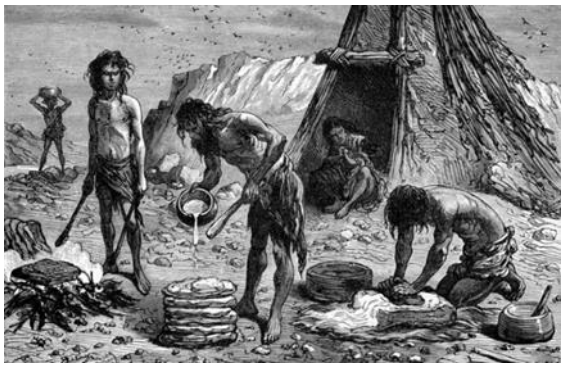

Figure 3.21. Represents eating in the external environment of ancient humans (Singh, 2016).

3.3.2. Restaurant Classifications

A restaurant is not only a place to eat, but to connect and socialize. When thinking about the design of the restaurant, good food quality alone is not sufficient for the

success of the restaurant, but there are other important factors that must be taken into account in the early stages of establishing the restaurant. Among these factors are the interior design, the way food is presented, the internal environment and others, because each restaurant has its own concept in the way and type of services it provides, and therefore there will be a special design idea and a specific space for this concept.

Restaurants are classified based on their excellence in something. The main factors in classifying restaurants are the food itself. For example, there are, vegetarian restaurants, seafood, meat, etc. or on the nature and origin of the food. There are, Italian, Chinese, Arab, Turkish, Indian and Mexican restaurants. They might classified based on the speed of serving food such as fast and delivery restaurants. Or may be classified based on their official appearance or location cost, service, or technology applications such as Automated restaurants[4] (see Figure 3.22) (Walker, 2011, p. 48).

Figure 3.22. To the right is a showing, automated restaurant. To the left shows Schockenki restaurant, (Walker, 2011, p. 42)**.**

The classification of restaurants ranges from inexpensive, modest and simple places to eat or eat to people who work nearby to expensive restaurants that serve food and wine

[4] The first restaurant was opened in 1791 in California in the United States. These restaurants have the interior design more like a factory than a restaurant, as they do not contain human service, but rather machines that put in money and food or drink comes out of it. Schockenki restaurant opened in London in 1919. The restaurant collects orders digitally and the food is delivered by means of the mobile belt source, (Walker, 2011, p. 33).

in a formal atmosphere. In the first case, restaurant customers usually wear casual clothes or work clothes, while in the second style, the uniform is one of the restaurant's traditions. The type of outfit and color depends on the culture and traditions of the society there. In restaurants with medium and high prices, customers usually sit at tables and are served by the waiter, starting from ordering food to paying the menu. In some restaurants, such as workplace cafeterias, which are usually in universities, laboratories, and others, the waiter service is not available, but the customer serves himself, starting by ordering food and drink and ending with paying the menu.

The means of transportation have a restaurant presence as an independent unit on ships to provide food for people, as well as in travel buses and in the railway system. A special train car was designated as a restaurant. A range of restaurants are also available at the stations of trains, planes, buses, cars and ships (Walker, 2011, p. 34).

Diversity in classifying restaurants based on food type, tourist class, and location, cultural or geographical environment has provided a number of ways to classify restaurants. It was adopted the classification mentioned in Zarei's study. It is the closest classification that fits with the context and topic of our research, which are:

3.3.2.1. Public Restaurants

The space of this restaurant has a comfortable and friendly atmosphere, moderate prices for food, as well as table services, which are served informally. It is appropriate to consider this type of restaurant as between the casual restaurant and the formal restaurant. There is a refined style of this type of restaurant that offers good types of food in addition to delivery services, taking into account that the interior design is excellent as well as taking care of the design of the façade (Malekshahi, 2013, p. 54). Among these restaurants are, Waffle House, Ponderosa Steakhouse, and Big Boy, Figure 3.23 shows the Big Boy Restaurant's[5] reliance on the anthropomorphic child

[5] Big Boy Restaurant Opened in 1949 in Ohio USA, a chain of restaurants founded in 1937 by Bob Wiam (Shatkin, 2022)

in its logo constitutes the use of common colors in that area, which helped in the promotion and fame of the restaurant.

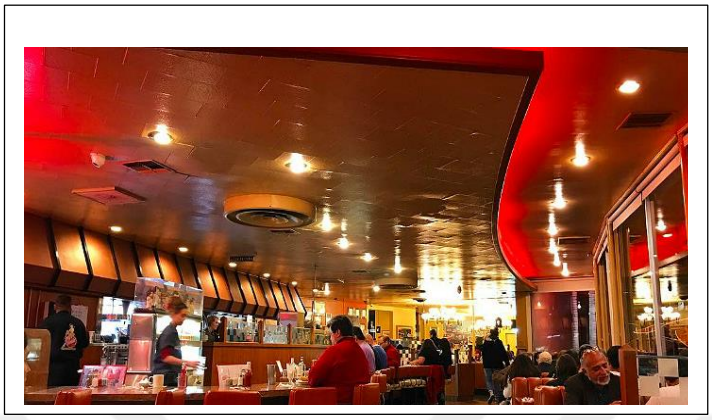

Figure 3.23. Big Boy Restaurant facade and interior design, (Shatkin, 2022).

3.3.2.2. Family Style

The family style type is very similar to general restaurants with some differences in terms of food presentation. . The food is served with large plates on the table as well as side dishes for appetizers. It requires the customer to bring the food himself. This type of restaurant is well known and widely spread in Asia, especially in Japan and China. This type of restaurant is emphasizing the social and family aspect and from this concept. The name of this type of restaurant is derived. Families gather, especially on Sundays, at large tables to eat and socialize (Malekshahi, 2013, p. 45). Among the examples of this type of restaurants are Chinese restaurants such as, The Eight restaurant, Old spaghetti factory, Chili’s grill (see Figure 3.24) (*Chili's grill & bar* , 2020). At Chili’s grill, the use of the color of the vegetable elements, which is the red hot pepper, as a facade for the front of the restaurant to give a sense of belonging to nature and to the quality of the hot food served. Natural colors were used in the interior design, such as lining the walls with brick and decorating the tables with ceramic tiles. These colors are derived from the prevailing social environment as well as the repetition of red pepper on the ceiling.

Figure 3.24. CHILI'S grill & bar restaurant in New England Region (*Chili's grill & bar* , 2020).

3.3.2.3. Fine or High-End Dining

This type of restaurant serves different types of food. Food can be made to order. The interior space and furniture for this type of restaurant are special.

In this type of restaurant, it is required that the service staff be highly trained as well as that they wear special uniforms. The menu includes three consecutive meals, soups, main meals, and desserts. These restaurants are usually small or family-friendly and do not have many branches (Spang, 2020, p. 60). These restaurants include, Jinwu jaocai, Fiamma steak house, Buffalo chop house and Chop Bloc (Gemma, 2015), the idea was to design the restaurant according to the type of food served, which is the aged dried, steak, so they used color as a tool to symbolize and promote the type and nature of food. Figure 3.25 shows the natural color of the old bricks were used in the walls to reflect the aesthetics of the old vocabulary and its connection to the idea of food itself. The natural colors of wood were used on the floor of the restaurant. The use of natural colors in bricks and wood pushes the user to create a love relationship with the nature of the place and thus with the type of food served.

Figure 3.25. Chop Bloc restaurant in Chelmsford USA, (Gemma, 2015).

3.3.2.4. Fast Food or Quick Service Restaurant.

The concept of fast restaurants or quick service depends largely on the speed of food service and the speed of its preparation. Food is either pre-cooked, reheated or semi-cooked to reduce the serving time for food and customers. Food is served to the customer through paper or cardboard containers. It is possible that the concept of fast food is different spaces and some of them have an indoor space for sitting or an outdoor space or both there are restaurants and kiosks that do not have a seating area for customers. This style of kiosk restaurants are sometimes called street restaurants. In the first style, the interior design is simple and contains simple furniture consisting of simple chairs and tables. Yellow and red colors are predominantly used in the interior space. America is the first country that established this type of restaurants and then spread it around the world (Malekshahi, 2013, p. 64). Some examples of these restaurants are KFC, Burger City and McDonald. Figure 3.26 shows McDonald in Sydney airport. The interior space of this restaurant is three times larger than that of familiar restaurants. They used the natural colors of natural materials in addition to the green color of plants, because Australia adopted sustainable design. The use of these colors is different from the colors of McDonald's chain of restaurants. This explains the impact of the cultural and social environment in choosing colors for the restaurant space.

Figure 3.26. McDonald at Sydney Airport designed by Giant design opened in 2010, (*Giant:McDonald*, 2015).

3.3.2.5. Fast Casual

They are restaurants whose classification and services are between fast restaurants and regular restaurants. Their prices range between these two categories. This type of restaurant does not provide customer service and the food is of high quality. The space is more interesting than fast food restaurants. The kitchen is usually visible, and the food is prepared manually. The food is served in ordinary dishes instead of plastic (Malekshahi, 2013, p. 69). Among these restaurants are, Midmarket restaurant, Coffee house, Kublai khans Mongolian. Figure 3.27 shows Kublai khans Mongolian restaurant. The interior design depends on the cooking method, which is a frying pan, and a circular metal disc, the food is cooked in a semi-cooked manner in front of the customers. This method, which was characterized by all Mongolian-style restaurants, is one of the ways that encouraged the social aspect by establishing an atmosphere that the development of eating outside the home by Chinese families. The general color atmosphere is a family atmosphere, so the transfer of this spontaneous way of preparing food inside the restaurant has established the same color atmosphere outside to the inside and has created a social tradition inside the restaurant. The colors that were used in the interior design to the natural colors of the large-sized kitchen utensils, in addition to the colors that Asian families are accustomed to outside the restaurant (*Kublai Khans*, n.d.).

Figure 3.27. Kublai khan's Mongolian restaurant in Cebu, Philippines (*Kublai Khans*, n.d.).

CHAPTER FOUR

4. RESEARCH METHODOLOGY

4.1. MODEL

The descriptive analytical approach compatible with the research topic was chosen. Through this, description and measurement processes were performed to understand the emotional and sensory effects of colors in the design of fast food restaurants. This method was also used in conducting the survey, which included the design of two questionnaires. This method is also used as a basis for selecting samples, analyzing the results, describing them, and comparing them with the results of the questionnaire, in addition to selecting theoretical literature related to the research topic.

4.2. RESEARCH COMMUNITY

The research community included students of the Design Department, College of Fine Arts, University of Baghdad, because the study included results, especially the interior spaces of fast food restaurants in Iraq. The selection of the research community was carried out in the same context as the previous research in the field of emotional influences, which is mentioned in the theoretical framework of this research.

4.3. RESEARCH SAMPLE

1) It was chosen for the purposes of measuring the emotional effects of colors in general, six colors, three primary and three secondary, which are yellow, blue, red, green, orange, and violet.

2) A virtual interior space for a fast food restaurant in 6 different colors.

3) Students of the Design Department, University of Baghdad, Iraq, were selected as participants in the questionnaire. Their number in the first questionnaire was 218. As for the second questionnaire, the total number was 135. There was a time difference between the application of the first and second questionnaires two months. For the purpose of not overlapping the answers to each of them.

4.4. RESEARCH TOOLS

It was used the following research tools:

1) Seven emotional influences were selected and used in this research. Which was adopted from the research (Alqaisi, 2022) because it was chosen according to the Iraqi culture, which is consistent with the society and objectives of the current research (see Figure 2.65).

2) Use Google Forms to design two survey forms and distribute them electronically, which were used in this research.

3) Designing the first questionnaire form for the purpose of measuring emotional influences in general for six different colors representing, primary and secondary colors (See Appendix 1).

4) A virtual fast food restaurant space was designed with 6 colors, three primary and three secondary (see Figure 4.1).

5) Designing a second questionnaire form to measure the emotional influences of six different colors in a virtual fast food restaurant space (see Appendix 2).

6) 3ds Max program was used to design the spaces of fast food restaurants.

7) Photoshop program was used for the purpose of modifying images and shapes.

8) Google Engine was used to search for reaches and images.

9) Excel was used to extract percentages, sequence preferences, and calculate frequencies.

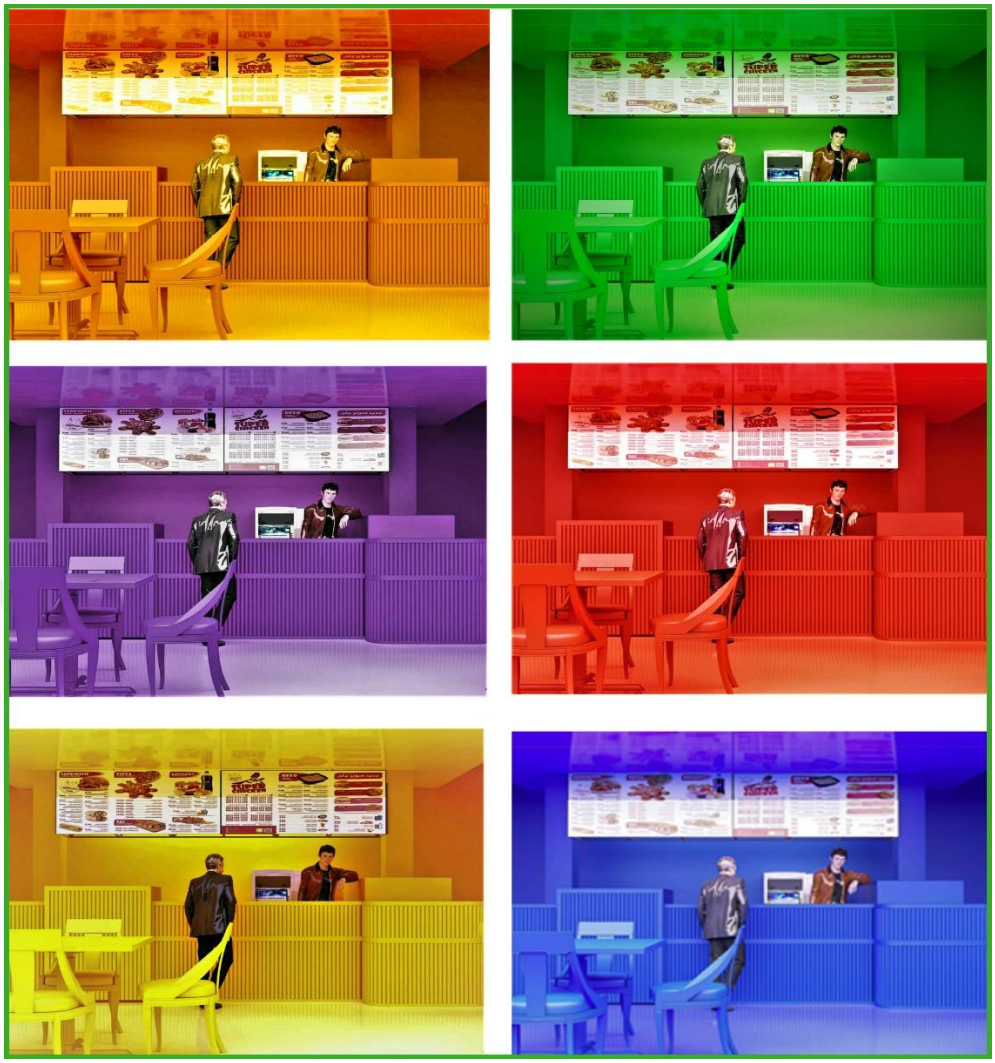

Figure 4.1. A virtual fast food restaurant space with six primary and secondary colors, designed by the researcher**.**

4. 5. THE AUTHENTICITY OF THE CONTENT

The validity of the first and second questionnaire used in the research was validated, by presenting the content of the form to a committee of experts and specialists in the field of design and scientific research methods[6]. It was approved after taking into

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- Assoc. Prof Dr. Ekhlas Abid Salman Interior Design Branch, Design Department, College of Fine arts, University of Baghdad.

account the views presented by the experts committee and in line with the research objectives (see Appendix 3).

4. 6. ANALYSIS OF DATA

The research relied on percentages of calculating the frequencies to determine the emotional effects of each color in interiors. Calculation of mean frequencies was used to determine preference for affective effects.

-Lect. Dr. Areaa Abdalkarem Husaen, Interior Design Branch, Design Department, College of Fine arts, University of Baghdad.

CHAPTER FIVE

5. RESULTS AND DISCUSSION

5.1. SURVEY RESULTS

In this research, two questionnaires were designed using the Google form in order to obtain results related to the purposes of this research. The first questionnaire contained questions related to the emotional evaluation of the primary and secondary abstract colors. The objective of the second questionnaire was the emotional evaluation of the primary and secondary colors of the interior spaces of fast food restaurants. It was designed virtual space for the purpose of the questionnaire, and it was presented in the primary and secondary colors, which included six colored spaces. Students of the Design Department, College of Fine Arts, University of Baghdad, were chosen for the purpose of the questionnaires. The selection of the participants in the questionnaires was based on presenting and discussions of previous studies related to researches similar to this research. The electronic questionnaires were distributed through means of communications such as WhatsApp, Messenger, and Telegram, 350 application forms had been sent to students, and the returned questionnaires were 218 of the first questionnaire and 135 of the second questionnaire. The ratio of the participants in the questionnaire to the total student's number of the first questionnaire was 62% and the second was 38%.

5.1.1. View the Results of the First Questionnaire

The results of the percentages of emotional vocabulary for digital colorful interior spaces for fast food restaurants:

The results of the first questionnaire related to choosing the emotional vocabulary for each of the primary and secondary colors, the red color achieved the highest preference, at 56%, for being Attractive, Table 5.1 shows the results of the percentages of emotional vocabulary.

Acceptable was the emotional word that fits the color yellow, as it achieved a 33.4% preference rate. The blue color was not described in the positive emotional vocabulary, as it achieved at 31.2% preference rate for being, Awful.

The color violet was described as, Attractive, according to a 23.4% preference rate. This is due to the fact that one of the components of the color violet is red, which has the highest percentage of preference.

Orange did not get any positive or negative emotional vocabulary. It was a 23.1% preference rate, which was the highest preference on, No Comments.

The green color achieved the highest preference rate of 21% of being, Acceptable.

Each color had different percentages of negative and positive emotional vocabularies. It is possible to describe each color based on the two highest percentages of preference. So the sequence and description of the colors are thus:

- Red was Attractive and Acceptable.
- Yellow was Acceptable and Annoying.
- Blue was Awful and Attractive.
- Purple was Attractive and Acceptable.
- Orange was No Comment and Annoying.
- Green was Acceptable and Attractive.

Table 5.2 shows that the red color achieved the highest positive emotional vocabulary preference score, which was 26.1%, Followed by purple 18%, yellow 17.3%, blue 16.2%, green 16.1% and orange 14.8%.

The blue color achieved the highest negative emotional vocabulary preference score, which was 15.1%, Followed by green 12.6%, yellow 12.5%, purple 11.3%, orange 10.7%, red 5.8%. Table 5.3 shows that the warm colors achieved the highest positive emotional vocabulary preference score, which was 19.4%, while the cool colors achieved the highest negative emotional vocabulary preference, which was 13%.

Primary and secondary colors	Percentages of emotional vocabulary						
	🤢	😯	😍	🙂	😶	😰	😪
	Annoying	Fascinating	Attractive	Acceptable	No Comment	Awful	Tiring
Red	9.6%	5.5%	56%	17%	4.1%	5.5%	2.3%
Yellow	20.3%	7.3%	11%	33.4%	10.6%	9.6%	7.8%
Blue	6.3%	8.2%	24.2%	16.1%	6.3%	31.2%	7.7%
Purple	9.8%	14.9%	23.4%	15.9%	11.7%	15.4%	8.9%
Orange	16.2%	15.3%	12%	17.3%	23.1%	6.4%	9.7%
Green	14.2%	9.6%	17.7%	21%	13.7%	13.5%	10.3%

Table 5.1. The results of the percentages of emotional vocabulary for primary and secondary colors, prepared by the researcher.

Primary and secondary colors						
The percentages of positive emotional vocabulary	26.1%	17.3%	16.2%	18%	14.8%	16.1%
The percentages of negative emotional vocabulary	5.8%	12.5%	15.1%	11.3%	10.7%	12.6%

Table 5.2. The results of the percentages of positive and negative emotional vocabulary for primary and secondary colors, prepared by the researcher.

Cool and warm colors	Warm colors	Cool colors
The percentages of positive emotional vocabulary	19.4%	16.7%
The percentages of negative emotional vocabulary	9.7%	13%

Table 5.3. The results of the percentages of positive and negative emotional vocabulary for warm and cool colors, prepared by the researcher

5.1.2. View the Results of the Second Questionnaire

The goal of the second questionnaire was to assign the emotional vocabulary in each interior space colored with primary or secondary colors.

Table 5.4 shows that the adjective "acceptable" received the highest percentage of 33.1% of the preference for the yellow interior space, 27% for blue interior space and 22.4% for purple interior space.

The adjective "annoying" received the highest percentage of 31% of the preference for green interior space and 26.7% for orange interior space. The red interior space did not get any positive or negative emotional vocabulary. It was a 22.7% preference rate, which was the highest preference on, No Comments.

Each colored interior space has got different percentages of negative and positive emotional vocabularies. It is possible to describe each interior space based on the two highest percentages of preference. So the sequence and description of the colors are thus:

- Yellow was Acceptable and Attractive.
- Green was Annoying and Awful.
- Blue was Acceptable and Attractive.

- Orange was Annoying and Acceptable.
- Purple was Attractive and Acceptable.
- Red was No Comment and Annoying.

The yellow interior space achieved the highest positive emotional vocabulary preference score, which was 32.7%, Followed by purple 14%, red 12.6%, orange 12%, green 4.8% and blue 14.8%. The green interior space achieved the highest negative emotional vocabulary preference score, which was 15.1%, Followed by blue 12.6%, orange 16.8%, purple 14%, red 13.2%, yellow 9.7% (see Table 5.5).The warm colors achieved the highest positive emotional vocabulary preference score, which was 19.2%, while the cool colors achieved the highest negative emotional vocabulary preference, which was 17.3% (see Table 5.6).

Digital Colorful interior spaces for fast food restaurants	Percentages of emotional vocabulary						
	🤢	😲	😍	🙂	😶	😰	😪
	Annoying	Fascinating	Attractive	Acceptable	No comment	Awful	Tiring
	18.2%	9.7%	14%	14%	22.7%	16.2 %	5.4%
	11.9%	7.6%	24.6%	33.1%	5.5%	7.6%	9.7%
	20.7%	1.5%	7.9%	27%	12.2%	24.9 %	5.8%

	13.9%	1.7%	20.3%	22.4%	13.9%	16%	11.8%
	26.7%	5.5%	7.6%	22.6%	14%	18.2 %	5.5%
	31%	5.5%	1.2%	7.6%	22.3%	22.5 %	9.7%

Table 5. 4. The results of the percentages of emotional vocabulary for digital Colorful interior spaces for fast food restaurants, prepared by the researcher.

Digital Colorful interior spaces for fast food restaurants						
The percentages of positive emotional vocabulary	12.6%	32.7%	4%	14.8%	12%	4.8%
The percentages of negative emotional vocabulary	13.2%	9.7%	17%	14%	16.8%	21%

Table 5.5. The results of the percentages of positive and negative emotional vocabulary, prepared by the researcher.

Cool and warm colors for interior space	Interior spaces for fast food restaurants in warm colors	Interior spaces for fast food restaurants in cool colors
The percentages of positive emotional vocabulary	19.1%	7.8%
The percentages of negative emotional vocabulary	13.2%	17.3%

Table 5.6. The results of the percentages of positive and negative emotional vocabulary for warm and cool digital Colorful interior spaces for fast food restaurants, prepared by the researcher.

5.1.3. Comparison of the Results of the First and Second Questionnaire

Table 5.7 shows that it is noted that the selected emotional vocabulary differs between abstract colors and colored interior spaces. This difference is due to the fact that the choice of abstract colors is emotionally associated with material or moral things in general. For the colored interior spaces, are mainly emotionally related to the desire for a colorful interior space to eat.

Colorful interior space	Highest score of emotional vocabulary	Abstract color	Highest score of emotional vocabulary
	No Comment		Attractive
	Acceptable		Acceptable
	Acceptable		Awful
	Acceptable		Attractive
	Annoying		No Comment
	Annoying		Acceptable

Table 5.7. Comparing the results of the first and second questionnaires, done by researcher.

5.2. RESULTS

The results obtained in the research are discussed as items:

1) It is preferable to use yellow color in the interior spaces of fast food restaurants in Iraq. Where it achieved 57% of the respondents were Acceptable and Attractive. Then the color Violet achieved 42.7% of being Acceptable and Attractive.

2) It is preferable to use a group of warm colors in the interior spaces of restaurants, as it f scored the highest percentage of positive emotions.

3) It is not advisable to use cold colors in the interior spaces of restaurants, as they have achieved the highest percentage of negative emotions.

4) There was a clear difference in the results of the questionnaire between the abstract colors and the colors of the interior spaces. In the first questionnaire, the red color got a percentage of 56% for being attractive. As for the second questionnaire, only 14% achieved being attractive. This confirms that emotional vocabulary choices for colors vary according to place and environment.

5) It is possible for designers to use any Color Schemes or Visual Tension Relationships or color relationship, whether it is contrast or harmony in the interior spaces of fast food restaurants, when it is taking into account the emotional effects of color or group of colors on the sensory side of the users.

6) Color is one of the important elements in designing the interior space, not only being aesthetic, but adding to the interior space a sensory value that defines its identity.

7) It is preferable when choosing the color in the interior spaces to achieve specific emotional feelings in line with the behavior and culture of the user. Which will create an atmosphere of attraction and enjoyment inside the interior space.

5.3. CONCLUSIONS AND RECOMMENDATIONS

1- It is recommended that designers and investors benefit from the results of this research in choosing the colors of the interior spaces of restaurants in Iraq.

2- The emphasis on the participation of design students in the faculties of design in the special questionnaires in the field of design research, as they are the most promising elite specialized in this field.

3- The current research tools help design students to measure and evaluate the emotional responses to their proposed designs.

4- Inclusion of emotional design and its measurements in design curricula in general and interior design in particular.

5- Using the results of the current research and its tools in the emotional characterization of the accomplished interior spaces or the spaces in progress.

6- Expanding the establishment of research in the field of design and emotions for Interior Service Spaces in Iraq.

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APPENDIX 1

An example of one of questions of the first questionnaire, prepared by the researcher.

Here are seven different emotional vocabulary represented by Emojis, please choose the emoji number that matches the color below.

- ☐ 1 ×
- ☐ 2 ×
- ☐ 3 ×
- ☐ 4 ×
- ☐ 5 ×
- ☐ 6 ×

APPENDIX 2

An example of one of questions of the second questionnaire, prepared by the researcher.

Here are seven different emotional vocabulary represented by Emojis, please choose the emoji number that matches the color of the interior space of the fast food restaurant

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6

APPENDIX 3

Approval of experts committee on the two questionnaires

University of Baghdad

College of Fine Arts

Postgraduate Design Department

Subject: Questionnaire review

I give you my best regards

To the honorable of Prof Dr. Faten Abbas Al-Asadi

For the purpose of completing the requirements of the master's thesis marked, ***Emotional influences of color in the design of interior spaces.***

The researcher hopes to be enlightened by your scientific opinion. Please review the attached questionnaire form.

Note that the aim of the research are:

- The research will investigate color relationships and measure their emotional effects in the design of interior spaces for fast food restaurants.

-The emotional sensory effects of the interior spaces of existing designs will be measured.

- It will recognize the importance of emotional effects as outputs in the design of interior spaces.

- It will be achieving the desired emotional effects in fast food restaurant spaces.

Signature: ---------

Expert's name : Prof Dr. Faten Abbas Al-Asadi

Workplace – Interior Design Branch, Design Department, College of Fine arts, University of Baghdad

Researcher: Mohanad Mohammed Ali AL-QAYSI

University of Baghdad

College of Fine Arts

Postgraduate Design Department

Subject: Questionnaire review

I give you my best regards

To the honorable of Lecturer; Lect. Dr . Areaa Abdalkarem HUSAEN

For the purpose of completing the requirements of the master's thesis marked, ***Emotional influences of color in the design of interior spaces.***

The researcher hopes to be enlightened by your scientific opinion. Please review the attached questionnaire form.

Note that the aim of the research are:

- The research will investigate color relationships and measure their emotional effects in the design of interior spaces for fast food restaurants.

-The emotional sensory effects of the interior spaces of existing designs will be measured.

- It will recognize the importance of emotional effects as outputs in the design of interior spaces.

- It will be achieving the desired emotional effects in fast food restaurant spaces.

Signature: ---------

Expert's name : Lect. Dr . Areaa Abdalkarem HUSAEN

Workplace – Interior Design Branch, Design Department, College of Fine arts, University of Baghdad

Researcher: Mohanad Mohammed Ali AL-QAYSI

University of Baghdad

College of Fine Arts

Postgraduate Design Department

Subject: Questionnaire review

I give you my best regards

To the honorable of : Assoc. Prof Dr. Ekhlas Abid SALMAN

For the purpose of completing the requirements of the master's thesis marked, ***Emotional influences of color in the design of interior spaces.***

The researcher hopes to be enlightened by your scientific opinion. Please review the attached questionnaire form.

Note that the aim of the research are:

- The research will investigate color relationships and measure their emotional effects in the design of interior spaces for fast food restaurants.

-The emotional sensory effects of the interior spaces of existing designs will be measured.

- It will recognize the importance of emotional effects as outputs in the design of interior spaces.

- It will be achieving the desired emotional effects in fast food restaurant spaces.

Signature: ---------

Expert's name : Ekhlas Abid SALMAN

Workplace – Interior Design Branch, Design Department, College of Fine arts, University of Baghdad

Researcher: Mohanad Mohammed Ali AL-QAYSI

CURRICULUM VITAE

Personal Information

Name and Surname : Mohaned Mohamed Alqaisi