Investigation of Academic Workplaces of Jordan through Color and Lighting

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ABSTRACT

Color and lighting are amongst the very significant aspects of our lives; they create an environment that can make users' life psychologically comfortable. They also have a powerful effect on the external and internal environment and contribute to users' productivity, state of mind, behavior, and general well-being. Understanding proper use of color and lighting in the interior space can help for solutions to create functional spaces in different workplaces. It can also help to improve the quality of life of the occupants and make these spaces aesthetically attractive.

Workplace interior design is one of the key areas in job satisfaction therefore it has a direct relation with the users' production. The aim of this research is to find out the impact of color and lighting on the performance of employees in workplaces, focusing on academic staff of universities in Jordan, to understand the relationship between color and lighting in the work environment and the factors in which impact their productivity in it.

The research consists of literature reviews on color and lighting, especially in workplaces, in order to understand the interior design related problems in the staff offices of design-related faculties of Jordan. The research also includes a questionnaire survey for the purpose of this research.

Keywords: Color, Lighting, Workplaces, Interior Space, Space Quality.

ÖZ

Renk ve aydınlatma hayatımızın en önemli unsurlarındandır; kullanıcıların hayatlarını psikolojik olarak rahatlatan bir ortam yaratırlar. Ayrıca dış ve iç çevre üzerinde güçlü bir etkiye sahiptirler ve çalışanın üretkenliğine, ruh haline, davranışına ve insanların genel refahına katkıda bulunurlar.

İç mekanda renk ve aydınlatmanın doğru kullanımını anlamak, farklı iş yerlerinde fonksiyonel mekanlar yaratmak için çözümlere yardımcı olabilir. Ayrıca kullanıcıların yaşam kalitesini iyileştirmeye ve bu alanları estetik açıdan çekici hale getirmeye yardımcı olabilir. Çalışma mekanlarının iç tasarımı, iş tatmininde kilit faktörlerden biridir, bu nedenle çalışanın işi ile doğrudan bir ilişkisi vardır.

Bu çalışmanın amacı, üniversitelerin akademik personeline odaklanarak işyerlerinde renk ve aydınlatmanın çalışanların performansı üzerindeki etkisini ortaya çıkarmak, çalışma ortamında renk ve aydınlatma arasındaki ilişkiyi ve verimliliklerini etkileyen faktörleri anlamaktır.

Araştırma, Ürdün'ün tasarımla ilgili fakültelerinin personel ofislerinde iç tasarımla ilgili sorunları anlamak için özellikle işyerlerinde renk ve aydınlatma ile ilgili literatür taramalarından oluşmaktadır. Çalışmada ayrıca bu araştırmanın amacına yönelik bir anket çalışması yer almaktadır.

Anahtar Kelimeler: Renk, Aydınlatma, Çalışan Performansı, İşyeri, İç Mekan.

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Chapter 1

INTRODUCTION

1.1 Background

One of the greatest axioms of knowledge is that each science has a set of foundations and elements that make that science a wide field of knowledge that gives positive results to serve humanity and achieve happiness in its general life. And the science of interior design, which is a solution to the problems of interior space aesthetically and functionally, and distributing them in a thoughtful manner in line with the requirements and needs of individuals and their behavior to practice their daily activities and their practical duties in designated spaces, its elements are used to achieve the goals and objectives that give great success to the work institutions in which the design elements have been implemented effectively and accurately.

Color and lighting are essential components of any space. They provide the visual and health conditions necessary for the user to feel comfortable inside the place. These components must be studied and worked out thoughtfully in order for them to function properly. It must also be coordinated with the allocated space system. This requires the study and experience of designers and architects. However, the interior designer must realize that these systems do exist and must be aware of how they affect the quality of the interior environment (Ching, 2018; Hoonhout, 2009).

These successes are especially evident in the educational and university institutions in particular, as the university faculty member is the leader of the educational process within the university, and therefore universities seek to provide a suitable work environment for instructors in an environment that meets mental, physical and psychological needs in order to develop high-quality output (Maher, 2012; Hipple, 2005).

Design elements such as color and lighting are very important aspects that influence the behavior of an individual, their giving, their production, and loyalty to their work, which thus increases belonging and reduces problems. For the purpose of this thesis, the study focuses on the workplaces as the offices of faculty members within a university campus (Haqanes, 2007; Kuller, 2006).

This study emphasizes the great importance of the needs of the faculty members' offices, focusing on issues related to color and lighting, to comfortably exercise their work-related activities, and to obtain more positive results.

There is an influence of design elements such as colors and lighting in the offices of faculty members on their behavior within the university and the direct relationship between designing teachers' offices and activating scientific design elements and their behaviors in giving and production (Obeidat, 2017; Kuller, 2006).

Color and lighting are the two basic elements in visual perception, as they play a major important role in the functional and aesthetic perception of spaces, and the harmony between them creates an experience for a user that enables him to have a distinguished productive giving, as the lighting and color systems form the interior

scene of the office space that contributes to achieving social familiarity and psychological impact. To users, this leads to outstanding production and efficiency. Psychologists prove that the environment has a significant impact on causing changes on behavior (Obeidat, 2017; Kuller, 2006).

The more the environment is consistent with the person's needs, the more attractive it becomes that makes the person belong to the workplace and increases his productivity and the quality of his production (Kuller, 2006; Wicker, 1997).

Color and lighting are two main elements that can make a space an attractive place for a person to stay and exist, developing his energy and positively influencing his psyche in building intimate relationships with other colleagues at work and building social relationships that have an active role in production and creativity.

Some studies have shown that color and lighting affect mood and behavior positively and on the other hand lead to physiological effects (Kuller, 2006; Wicker, 1997).

The effects of color and lighting also interacts between psychological mood and performance (Kwaller, 1996).

It is worth noting the natural illumination of sunlight in the design process has an important effect on the accuracy of visual perception on the one hand and the rationalization of electrical energy consumption on the other hand. Finally, color and light are some of the most important and strong elements on which the interior design is based, as they verify the person's belonging to the place, improve his psychological and physical mood, and support his creativity and production.

1.2 Problem Definition

The interior design of the workplace can affect the productivity of the individual and may also affect job satisfaction. Especially during the Covid-19 period, the design of individual workplaces has become even more important especially for the academic staff of the universities. Negligence in design may negatively affect the users in particular and the performance of the work in general so that it reduces the interaction and may lead to negative situations (Whiteoak, 2014; Lee, 2017).

The main problem of this study is to focus on the relation between color and lighting and the satisfaction of the users (academics) in the workplace design of staff offices in Jordan Universities. It is aimed to investigate the main problems in interior design of staff offices in selected Jordanian universities.

1.3 Questions of Study

The designer should study all related aspects when designing the workplaces, especially for people within the field of design, so that the work environment becomes more creative, interactive, and with the highest possible productivity (Lee, et al., 2017). This study focuses on two main study questions:

- What are interior design related problems in the academic-staff offices of design-related faculties of Jordan; especially in relation to color and lighting?
- To what extent do the issues related to color and lighting affect the user satisfaction of university-academic staff in their workplaces?

1.4 Aims and Objectives of Study

The aims and objectives of this study is to find out problems considering the interior design of academic workplaces. The study especially focuses on problems related to color and lighting in the workplace.

Conducting a field study on a group of academic members of design-related faculties of universities in Jordan, the study aims to determine the issues related to the design of academic-staff offices.

The objective of this study is to examine the factors considering the design of staff offices especially focusing on color and lighting. Accordingly objectives of the study are to;

1- Analyze the relationship between academic staff and the physical work environment.

2- Analyze the factors affecting the interior design of workplace focusing on color and lighting

3- To analyze workplace design in a way to improve the users' experience.

1.5 Limitations of Study

This study focuses on interior design-related problems in the academic-staff offices of design-related faculties of Jordan; especially in relation to color and lighting.

The study centers on the academic members of the design-related faculties which are; the departments of Architecture; Interior Architecture; Industrial Design; Visual Design; Graphic Design and Fashion Design in Yarmouk University, the University of Jordan, and University of Petra. The main reason for selecting these universities is

that they have the highest number of students in Jordan. Moreover, Yarmouk University (1962) and The University of Jordan (1976) are the oldest universities according to the date of establishment. In addition to their presence in important locations in Jordan, the different sizes and areas of their academic offices and the presence of a special character, they have been selected for the purpose of this study. These 3 universities also have the highest number of academic staff and their staff is continuous. Therefore these are the main reasons the study is limited to the staff offices of these three universities out of 15 universities in Jordan. Additionally, regarding Yarmouk University, the researcher studied there for 4 years and also has many personal contacts in all three universities, which has helped to conduct this survey.

1.6 Methodology of Study

The researcher relies on the use of the descriptive-analytical method, which is based on identifying the elements of the visual sample, which was 80 study samples from professors in the faculties of design-related at Yarmouk University, University of Jordan, and University of Petra and describing their nature and the quality of the relationship between variables and their causes and its direction, and determining its reality on the ground by conducting a field study using the study tool, and the tool was a questionnaire. Therefore, this study is limited to only the architecture faculties and design departments of the stated universities and limited to the staff offices focusing on color and lighting issues.

The researcher relies on the use of the descriptive-analytical method, which is based on identifying the visual sample elements, which were 80 study samples out of 100 samples (Krejcie & Morgan, 1970).

This study sample consists of professors and assistant professors in the design-related faculties which are; the departments of Architecture; Interior Architecture; Industrial Design; Visual Design; Graphic Design and Fashion Design. The universities where the questionnaire survey has been conducted are Yarmouk University, The University of Jordan, and University of Petra. Describing the nature and quality of the relationship between variables, their causes and direction, and determining their reality on the ground by conducting a field study using the study tool. The tool is a questionnaire in the form of direct and easy questions for the reader, divided into 5 sections, the first section is about lighting, and the second about the colors, the third about the quality of the internal environment, the fourth about the furniture and the fifth about the external view, and each section contains. 5 Questions, Each question contains 5 answers ranging from Agree, Strongly Agree, Neutral, Disagree, Strongly Disagree according to the Likert scale, and has been distributed online due to COVID-19, for the purpose of this survey to reach original findings and thus to be resulted as informed suggestions. The researcher has visited these spaces before and has taken pictures there. However, the visits were not many because of COVID-19.

Table 1: Total Number of Staff and Departments of Studied Universities Limited for this Study

The name of university	Number of staff Faculty of Architecture	Departments located under the faculty
Yarmouk University	39	Department of architecture Department of design interior design Graphic Design Industrial Design Fashion Design
The University Of Jordan	34	Department of architecture Department of interior architecture
University Of Patra	27	Department of architecture Department of interior architecture

1.7 Structure of Study

Figure 1: Structure of the Study

Chapter 2

COLOR IN INTERIOR DESIGN

In this chapter, as one of the main factors in interior design, and one of the main focuses of this study, issues related to color; color basics, color and perception, and color in interior design, will be studied to underline some important points. This chapter will be used as background information for the analysis of the case studies of this study.

2.1 Color Basics

The word ‘color’ used by natural scientists means a physical phenomenon resulting from the analysis of white light, while color in the meaning of the word is a physiological effect resulting from the effect that occurs in the retina of the eye from receiving light reflected from the surface of a certain element, whether it is caused by a colored substance or colored light. It does not exist outside the human nervous system (Alawadhi, 2005; Amber, 1980).

Color is a physiological trace produced in the retina, which is what we see when colorants physically modify light so that the human eye can see it. Physically white color is the accumulation of seven different colors s the analysis of white light into seven colors. Color is a characteristic of all light-emitting surfaces, without light, there are no colors.

Therefore, color is one of the most important visual elements because it carries energy with visual content that contributes to sensory and mental perception (Hasan, 2016; Todorovic, 2008).

Color from the physical point of view is formed through the absorption of the rays through the shape surface.

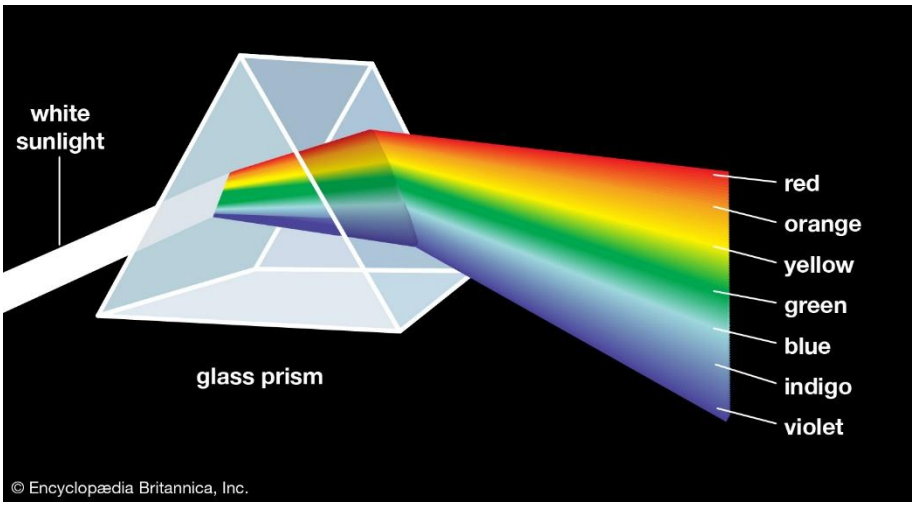


Figure 2: Formation of Color (URL 1)

Colors are one of the most important elements in the interior design because, through the color, the sense of the visual beauty of the interior design and the integration of its performance happens, and it also reflects the functional expressive elements of the design. As it absorbs, according to its atomic structure, certain radial waves, and reflects other radial waves of the colors of the spectrum, and these reflected waves that the eye sees form the color of the surface, and thus the true color of a surface can only be seen under white rays.

When the colors saw, it is the result of sunlight or light rays falling on an object, so that body absorbs some of the rays and some reflections on the retina, and the color is seen (Aziz, 2016; Birren, 1991).

Therefore, color is a natural characteristic of the properties of things, and a scientific element as well as an organizational element, and its distinction is considered to be distinguished by the differences that are distinguished by the particular viewer.

2.1.1 Color Schemes

- **The Color Wheel**

The term color wheel refers to an explanatory organization of colors in a circular motion, showing the relationship between primary colors, secondary colors, and complementary colors (Todorovic, 2008; Amber, 1980).

- **Color Wheel Basics**

The color wheel consists of three primary colors red, yellow, blue, three secondary colors ‘colors created when primary colors are mixed: green, orange, purple’, and six tertiary colors ‘colors made from primary and secondary colors, such as blue-green or red-violet’ (Goethe, 2003; Aziz, 2016).

The most widely accepted color systems in academic grounds are Munsell, Ostwalt, Prang, and Chevreul, and here for the purpose of this study, the discussion of the color wheel will be based on a theory by Prang (Todorovic, 2008; Goethe, 2003).

Most of the color wheels are based on three primary colors, three secondary colors, and six intermediate colors that are formed by mixing the primary color with the secondary color, and they are known as tertiary colors, so the total number is 12

basic divisions. Some color wheels, on the other hand, are designed with four contrasting colors, making up 4 or 8 primary colors (Goethe, 2003; Aziz, 2016).

The circle of colors is limited to a specific group of colors included in it that have been clarified before, but there are other colors that have not been classified within but exist, which are not primary, secondary or tertiary colors, but rather a group of unsaturated colors with shades and gradient tones called neutral; It harmonizes and corresponds with a large number of them when used together in a correct manner, and it includes many colors, most notably: black, white, beige, gray, and brown (Alex clem, 2019).

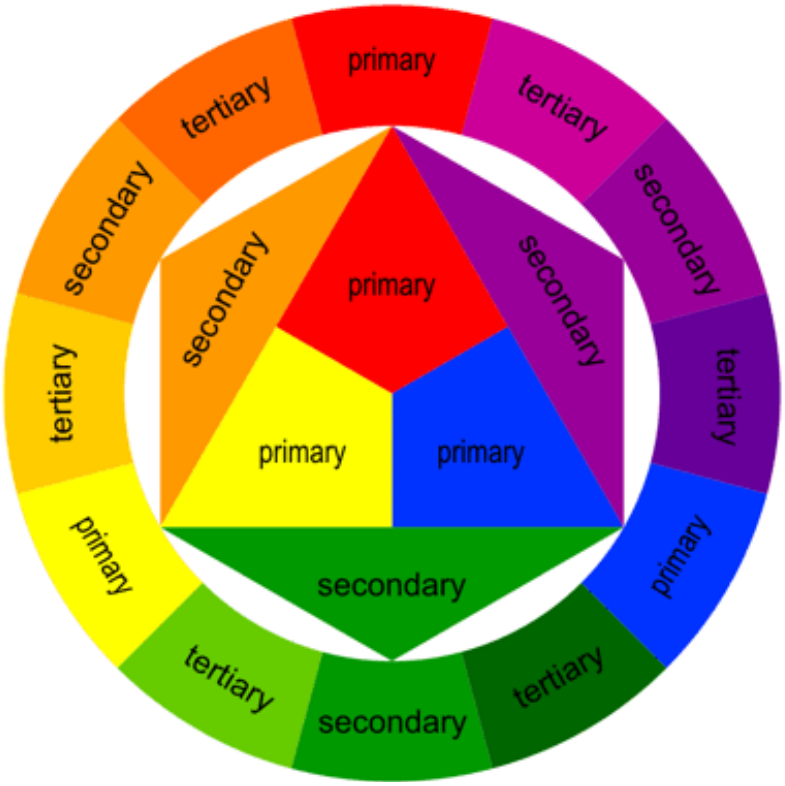


Figure 3: Color Wheel (URL 2)

The fundamentals of understanding color theory (Schemecolor, 2021).

In color theory, the colors are organized to a color wheel and grouped into 3 sections:

1- Primary colors, Secondary colors and Tertiary colors.

Table 2: Color Schemes (Schemecolor, 2021)

COLOR	Name	CMYK: (CMYK color model)	RGB: (RGB color model)	Hex: (Hexadecimal)
	Vivid Red	0,1,0.905,0	(255, 0, 24)	#FF0018
	Deep Saffron	0,0.352,0.827,0	(255, 165, 44)	#FFA52C
	Maximum Yellow	0,0,0.745,0	(255,255,65)	#FFFF41
	Vivid Green	1,0,0.812,0.498	(0,128,24)	#008018
	Deep Blue	1,1,0,0.023	(0,0,249)	#0000F9
	Maximum Purple	0,1,0.067,0.474	(134,0,125)	#86007D

- CMYK color (also called the four-color process) is a method whereby a combination of tiny transparent dots of four ink colors: cyan, magenta, yellow and black are printed. Different combinations of large and small CMYK transparent dots overlap each other to create a wide spectrum of colors (Starmer, 2005).
- The most commonly used color profile in the world of computers, TV screens, and mobile devices are RGB. RGB is the process by which

colors are rendered onscreen by using combinations of red, green, and blue (Starmer, 2005).

- A HEX color is expressed as a six-digit combination of numbers and letters defined by its mix of red, green, and blue (RGB). Basically, a HEX color code is shorthand for its RGB values with a little conversion gymnastics in between (Starmer, 2005).

- **Vivid Red**

The approximate English language name for the #FF0018 hexadecimal color code is Vivid Red. Its closest web safe color is #FF3346. The tints, tones and shades are displayed below (Öztürk, 2012).

Primary red works well with yellow, white, tawny-orange, green, blue, and black. Tomato red works well with cyan, mint green, sand, creamy-white, and gray. Cherry red works well with azure, gray, light-orange, sand, pale-yellow, and beige. Raspberry red can work well with white, black and damask rose.

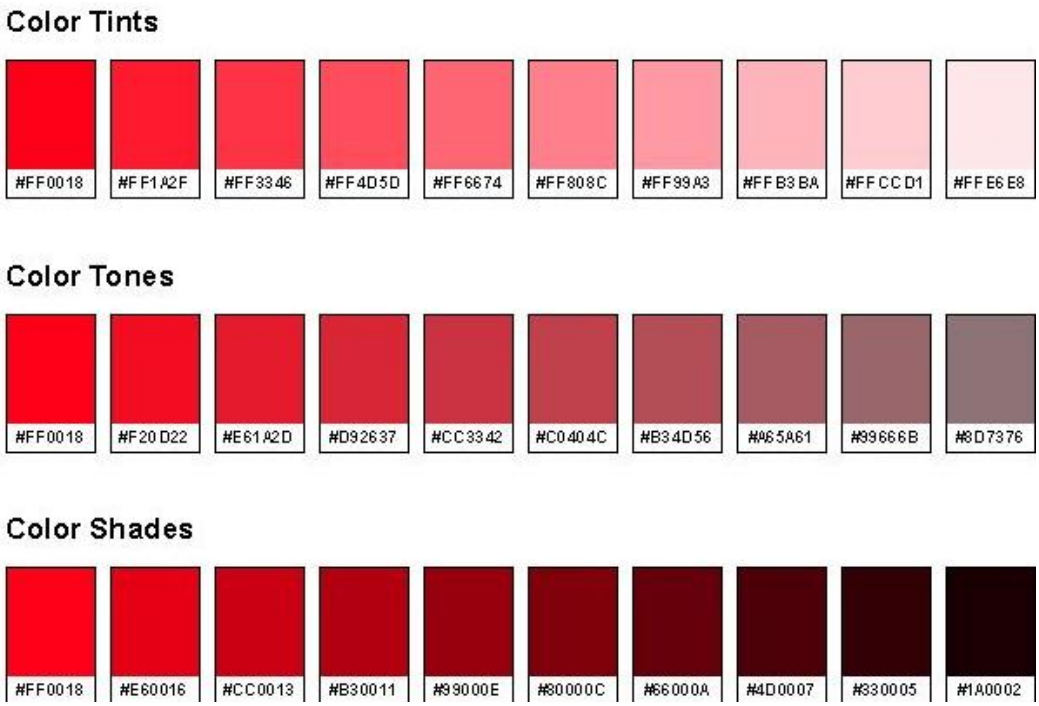


Figure 4: The Tints, Tones, and Shades of Red Color (URL 3)

- **Deep Blue**

The approximate English language name for the #0000F9 hexadecimal color code is Blue. Its closest web safe color is #3333FA. The tints, tones and shades are displayed below (Öztürk, 2012).

Acting as a neutral in some cases, blue pairs well with virtually every other color, including vibrant hues like orange or red and more muted neutral tones like beige and gray. Here are some of our favorite color combinations that showcase blue's easygoing beauty.

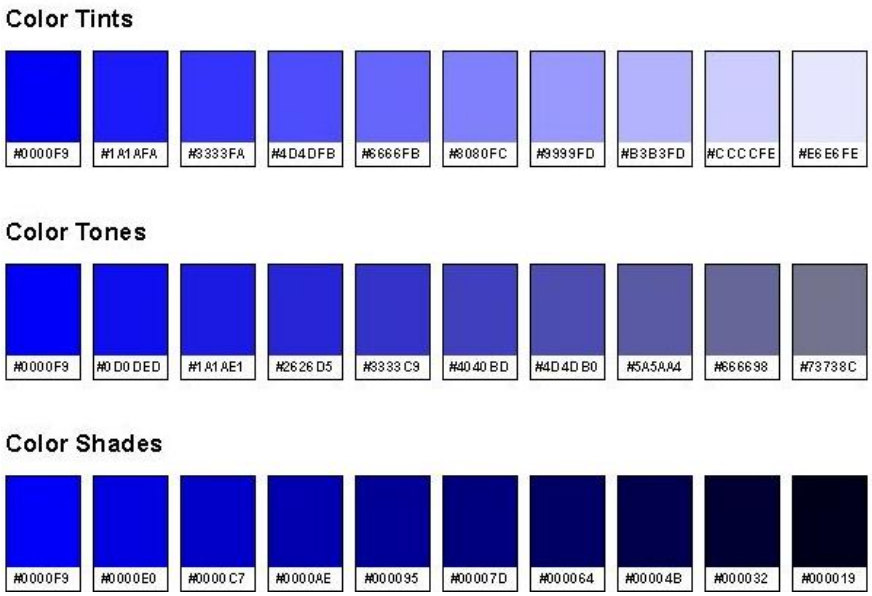


Figure 5: The Tints, Tones, and Shades of Blue Color (URL 4)

- **Maximum Yellow**

The approximate English language name for the #FFFF41 hexadecimal color code is Maximum Yellow. Its closest websafe color is #FFFF67. The tints, tones, and shades are displayed below (Öztürk, 2012).

One of the best qualities of yellow is that it goes great with nearly every other color—white, orange, green, pink, blue, brown. To build the perfect yellow color scheme, pick one or two shades of yellow to use as accents, plus a dark neutral and dose of white for a balanced color palette.

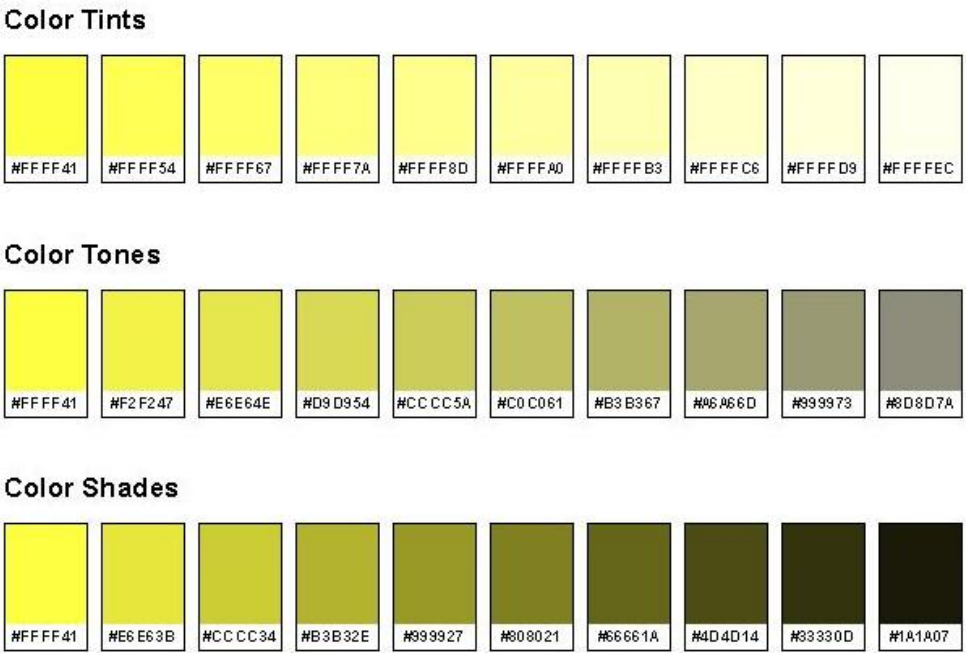


Figure 6: The Tints, Tones, and Shades of Yellow Color (URL 5)

2.1.2 Color Groups

To begin with, it is necessary to know the three primary colors, which are red, yellow, and blue, which are called primary colors. Mixing these colors produces all other light colors, including white, and when a beam of light is mixed, the result is often a brighter color than the individual colors.

There are three forms of mixing color (Abdelmagid, 2004; Birren, 1961):

1- Addition mixing: It is the sum or result of colored light rays, and is introduced into mixing in addition to optical mixing of color, which is the

addition of mixing by addition from a concrete surface when a tablet consisting of two or three colors is rapidly rotated around an axis.

2- Subtraction mixing: It includes mixing with dye, and it refers to the colored light rays remaining after the receiving surface absorbs some of the rays.

3- Mixing with white and black: When mixing white, it produces light or tinted color, and when mixing black it produces a dark shade, and when mixing the color with gray, it is called tone.

By analyzing visible light, it produces seven visible colors: red, orange, yellow, green, blue, and violet (Salah, 2004; Birren, 1961).

These colors are divided into two groups (Agoston, 2013; Bellizzi, 1992):

1- The group of warm colors: It includes red, yellow, and orange, and it is also called hot colors because it simulates the colors of fire, the source of warmth, and one of its characteristics is that it shows an area larger than its real area, as it is characterized by optical diffusion.

2- The group of cold colors: It includes blue, green, and violet, and it is named after the cold colors because it mimics the colors of the water and the sky, which are the source of coldness.

Table 3: Color Groups

Color	Group: Warm / Cold
Red-Primary Color	Warm
Yellow-Primary Color	Warm
Orange-Secondary Color	Warm
Blue-Primary color	Cold
Green-Secondary Color	Cold
Purple-Secondary Color	Cold

2.2 Color and Perception

2.2.1 Gestalt Principles

- **Gestalt Principles - Background**

"Gestalt" is a word of German origin meaning "unified whole". These principles were developed in the 1920s by German psychologists Max Wertheimer, Kurt Koffka, and Wolfgang Koller. They aimed to understand human perceptions that become meaningful through the perception of random stimuli surrounding them. That is, the mind "knows" what the eye sees by understanding a series of individual stimuli as a whole (Alawadhi, 2010).

Gestalt is one of the design theories of great importance that is based on several principles that are used as needed in the applied design.These principles consist of the laws of human perception that describe the way humans collect similar elements, assimilate patterns and simplify complex elements when a person perceives things and are used in the design so that Aesthetically pleasing and easy to understand (Todorovic, 2008).

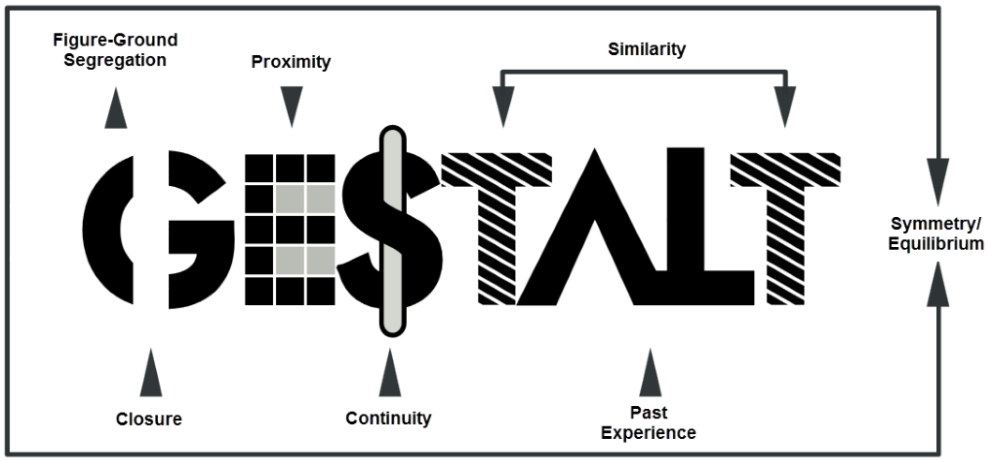


Figure 7: Example of Gestalt Principles (URL 6)

Gestalt principles concept is about the unified whole, which means using parts of visual objects of the shape in order to complete the full picture mentally.

Gestalt principles became one of the most popular principles of art in the twentieth century and were used as a reference that is taught in universities. Gestalts six basic principles:

1- Similarity

Similarity in design occurs when all the basic elements that make up a place are in themselves the same and have the same formal characteristics. When some objects appear similar to each other, the viewer sees the basic elements as part of the pattern or group. And through this effect, it is possible to create a homogeneous space in terms of the elements even though it is in itself separate, that is, it is not a single unit (Todorovic, 2008).

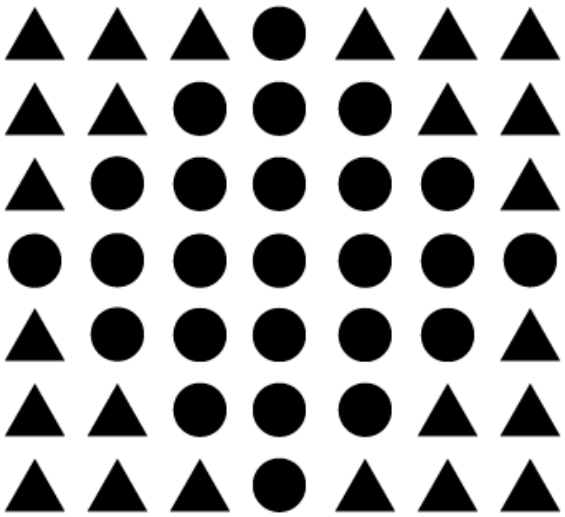


Figure 8: Example of Similarity in Gestalt (URL 7)

When this element is applied in offices, it leads to a feeling of comfort and lack of clutter, which is the goal.

Figure 9: Example of Similarity in Interior Design (URL 8)

2- Communication

It is that the eye coordinates from the beginning of the designed space in one direction, which is in great harmony with the infiltration of the elements in the place, communication is the principle by which the eye coordinates according to a specific path, curve, or straight line, or a path preferring to see one continuous shape instead of a group of divergent elements. . It is what can be used to refer to a specific element in the design by using a sequence across the designed space appropriate to the desired function (Todorovic, 2008).

Figure 10: Example of Communication in Gestalt (URL 9)

Figure 11: Example of Communication in Interior Design (URL 10)

3- Closure

Closure is a technique based on the principle of the eye tending to see closed shapes. It is used when the shape is incomplete or when the internal space of the design is not completely filled. However, the viewer perceives the design completely through his personal perception of the spaces. And this principle is used a lot in design spaces (Erdal, 2006).

Figure 12: Example of Closure in Gestalt (URL 11)

Figure 13: Example of Closure in Interior Design (URL 12)

4- Proximity

The principle of affinity depends on the convergence of a group of elements to create interconnectedness between them. And in the basic design of the component of a shape, they are similar to each other; it is possible to look at it as a single shape despite it being a group of different elements (Erdal, 2006).

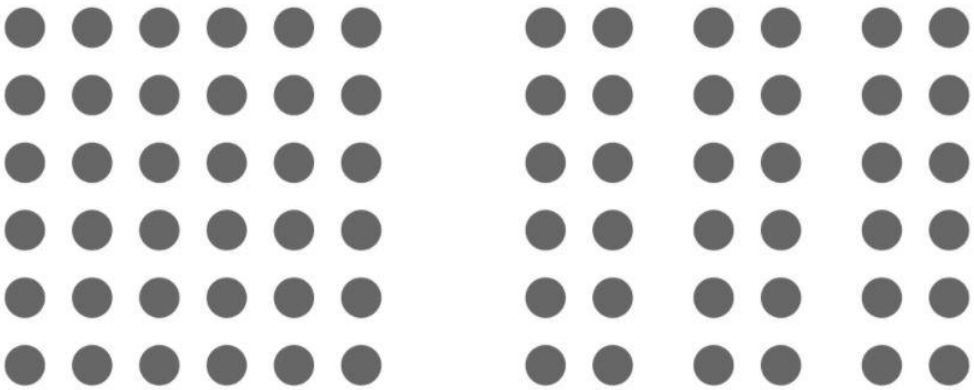


Figure 14: Example of Proximity in Gestalt (URL 13)

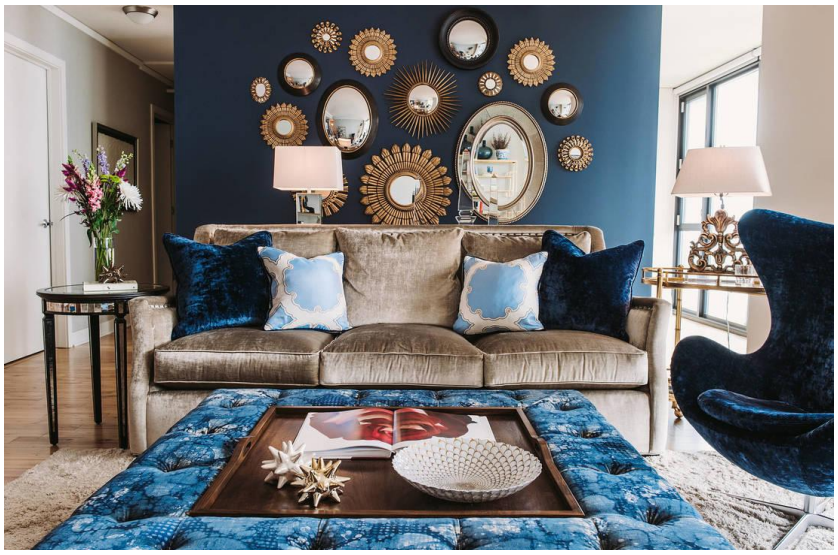


Figure 15: Example of Proximity in Interior Design (URL 14)

The shapes do not have to be regular to achieve the principle of closeness. Some shapes can be symmetrical, only to be arranged in a specific way to make the image appear larger. Affinity or grouping in space can be achieved through the use of some common denominators such as shape, color, texture, size, or any other characteristic (Erdal, 2006).

5- Shape / Background

Figure 16: Example of Shape and Background (URL 15)

Figure 17: Example of Shape / Background in Interior Design (URL 16)

Usually light and shadow are used in the shape / background principle, which helps to create a distinctive space within a group of shapes. This principle depends on the eye's tendency to see shapes and separating them from the surrounding background, the principle depends on the human eye's preference for seeing the image ‘the front body’ and the background on the basis of two different levels.

Whatever does not follow the shape is considered a background, and it is what can be used to create some important visual tricks and effects, especially when the artist or designer works to impart some intentional ambiguity (Alawadhi, 2010).

6- Symmetry and Order

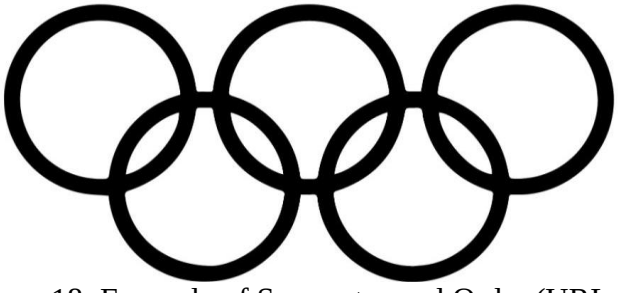


Figure 18: Example of Symmetry and Order (URL 17)

Figure 19: Example of Symmetry in Interior Design (URL 18)

This principle simply calls for not leaving any chaos or imbalance in any space because the viewer wastes time searching for imbalance or imperfection instead of focusing on realizing the true meaning of the spatial composition, when the design is organized gives a sense of harmony and balance, and the principle of symmetry can be achieved. When there is a proper balance and symmetry in the various elements of the design, which is what prompts the viewer to feel a sense of harmony.

2.2.2 Color and Geometry

To see fully requires three elements, which are classified into: light, object, and vision. If the three elements are not present, there is no vision, and these three elements exist in a three-dimensional space.

The spatial relationship and the characteristics of the three elements of vision are what determine how the objects appear upon vision. The geometry of the colorimetric defines the engineering conditions through which the object's display and lighting appear (Resnikoff, 1974).

Figure 20: Color and Geometry in Interior Design (URL 19)

The geometry of the light source is determined with respect to the object through the angular size of the light source, and this determination varies according to the distance that exists between the object and the light source. In order for the viewing geometry of the light, the observer, and the object to be determined correctly, these three elements must be combined with an optical system through the process of determining the level of direction and the relative angles of all these elements for the observer ‘or detector’.

Tool geometry does not have a major role in the degree of color seen or measured relative to most of the existing objects (such as colored papers, fabrics, non-metallic plastics, etc.) in terms of the process of varying the measured color tone, however, regarding colors It is related to the process of change that appears in an angle of light or angle of view) and therefore when you change any of these elements, the color appear different, according to the color geometry (Resnikoff, 1974).

2.2.3 Color and Light

Light is an electromagnetic ray visible to the human eye and is responsible for the sense of vision, so if it is a radiation that can be seen with the eye and its main source is the sun and it spreads in straight lines, and when it moves in straight lines, its lines shadows when it falls on some objects, so it is reflected or refracted, and some objects absorb it, raising its temperature to varying degrees. The relationship of light and color appears through the following sections (AbdelMagid, 2004):

1- The color has a warm appearance and it is reddish white and it is preferred to be used in homes.

2- A medium-hot color, which is normal white, and is used in most workplaces.

3- The color has a cool appearance, which is bluish white, and it is recommended to use it in works that require a high degree of luminance.

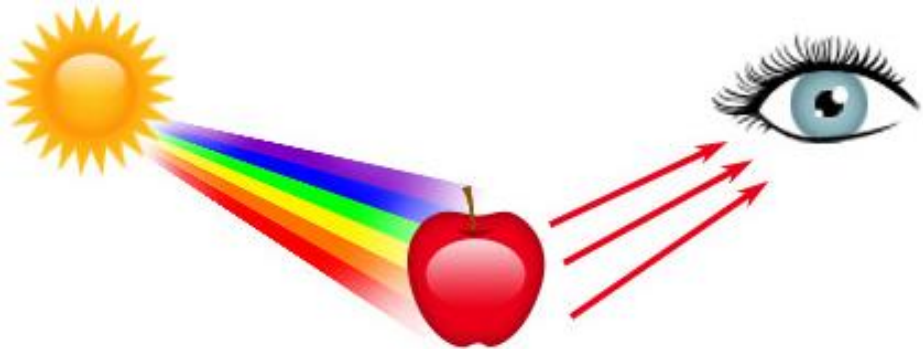


Figure 21: Color and Light (URL 20)

Then it is necessary to know the color temperature, which is intended to express the color of the light produced by the light source in comparison with the color produced by a black body. When its temperature rises, invisible radiative heat emits from it, and with the increase in temperature, the body begins to glow with a faint red color than bright red and then passes through a group of colors until white and then blue

light radiates, and any source of light is color that matches the color of the black body radiating at a certain temperature, so it is characterized That degree. The color temperature feature expresses the color of the light from the lamp, while the color display feature expresses the extent to which the colors are shown under the lamplight.

2.3 Color and Culture

There is a common denominator in the meanings of colors for people in different world cultures, they meet and differ in agreement on colors, their meanings and their connotations, and there is agreement and disagreement on the personal level of individuals for the same matter in colors, which a person may see in a color that he may not see another, and generally there remains a certain emotional response to color for many or some cultural groups (Al-Neaimy, 2006).

Figure 22: Color and Culture in Interior Design (URL 21)

- **Meaning of Color**

There are also colors that everyone agrees in their meaning and connotations, there are colors or one color that may have different and contradictory meanings and thus affect the social culture in a specific social environment, for example, white in the

West represents purity, and in India or some countries of Asia, a symbol of mourning (Rainwater, 1962; Al-Neaimy, 2006).

On the individual level, one can see yellow as the meaning of drought, while some may see it as a symbol of joy and pleasure. The cultural reality also proved that Western societies, on wedding occasions, wear the white color, which symbolizes purity, while the red color in India symbolizes these characteristics.

Changes took place in the connotations of colors according to the cultural development in the world and the communication and difference of social cultures. However, this development kept much of the commonalities of the traditional culture of some colors (Rainwater, 1996).

In general, the green color remained a representation of fertility and growth, and warm colors like red had negative meanings, and cold colors suggested positive meanings (Wright, 2008; Rainwater, 1992).

Table 4: Color Indications of Different Countries of the World (Posnock, 2009)

Color	Western Europe & USA	China	Japan	India	Middle East
Red	Danger, anger, stop	Joy, festive occasions, luck	anger, danger	purity	Danger, evil
Yellow	Caution, cowardice, joy, happiness	Honor, royalty	Grace, nobility, childish, gaiety	-	Happiness, prosperity
Blue	Masculinity, calm, authority	Strength, power, immortality	Villainy	-	protective
Black	Death, evil	Evil	Evil	-	Mystery, evil
Green	Sexual arousal, safe, sour, go	Youth, growth	Future, youth, energy	-	Fertility, strength
White	Purity, virtue	Mourning, humility	Death, mourning	-	Purity, mourning

Contemporary technologies have had a great impact on cultural interaction between peoples, and Internet technology has made cultures more rapprochement, and designers in the West have become influential in other peoples, so the blue color, for example, is considered a global agreement that it symbolizes safety and reassurance for its positive connotations in general. Traffic signs are the same symbols of their color and meanings at the global level, and this is one of the commonalities between different cultures globally in the meanings of colors and their connotations (Heschong, 2003).

If the flags of the countries are looked at, see that each country used certain colors and that each color has its own and specific symbols that express national pride, even at the level of the flags and slogans of sports clubs that arouse the feeling of their fans, the meanings of pride. In addition, there are colors that may indicate symbolism and connotations that are not common in the colors of its flags, such as the green and gold colors that Australia is characterized by, for example in the Olympic Games, knowing that they are not present in its flag (Heschong, 2003).

In cases where the color is alone, it has its own significance and importance, and also until that color is mixed with another color, the red color has a negative meaning and a symbolism of danger.

When combined with white, it symbolizes Christmas, and when it is combined with pink, for example, it becomes meaningful, referring to Valentine's Day (Bellizzi, 1992; Heschong, 2003).

2.4 Color in the Interior Space

Color is one of the most important elements of interior design, and colors can affect emotional changes. This is due to its strong influence on the user's emotion of the place as if it can give a place a feeling of warmth or cheerfulness. Calm colors, for example, in the bedrooms, help to rest and relax, and from here the designer must move away from random selections in colors because it is considered as one of the most important reasons for design weakness, and the designer in interior architecture must be aware of the color wheel, It is an effective way to help the process of harmonizing colors (Steadman & Bellizzi, 2006).

Figure 23: Color in Interior Architecture (URL 22)

The correct use of colors in interior architecture increases focus, activity, and the ability to learn, understand, and remember by 55% to 78%. In addition to the fact that color in interior architecture is an important component of its influence on the perception and mind, it also makes a person feel the beauty of the interior design and the integration of its performative, functional, and expressive elements and colors in interior architecture play a vital role in the beauty of the interior space of floors,

ceilings, and walls, and also occupy an important place in all aspects of activities in public and private life (Mahjoub, 2008).

It is worth noting that the best choice of colors in a scientific way and prior planning is one of the most important pillars of a successful design in interior architecture (Hill, 2006; Bellizzi, 1992).

2.4.1 Psychological Effects of Color on Humans

When scientists classified the colors into hot and cold, this classification came due to their psychological effects on human nature (Frank, 2006).

Sources of warm colors, which are the sun and fire, evoke a sense of heat and warmth, such as red, yellow and orange, and cold sources of colors, which are the sky, water, and plants, evoke a sense of coldness, chills, and comfort. Like blue and green, among the clear psychological effects of cold colors such as light blue, which gives a feeling of the widening of the internal space than its normal size, while the warm colors give a feeling of the smallness of the internal space between the seeker and the surfaces (Frank, 2006; Neaimy, 2006).

People spend a lot of time indoors, whether inside the house or at work, as studies have shown that people spend 87% of their lives indoors. The interior space positively affects the mood of the seeker, and places where the lighting and colors are uncomfortable negatively affect the beholder and here lies the importance of interior design even if some of the specialists consider it a secondary matter, the interior designer has the ability to change important elements such as daylighting and artificial lighting or colors or materials (Souza, 2020).

Color, ceiling surfaces, wall, and floor patterns influence our perception of space and our perception of room dimensions, proportion, and size. Furthermore, when certain colors are used, space can appear to be longer, shorter, wider, or narrower (Ching, 2018).

To enlarge the space: The use of light colors is one of the things that create spaciousness in the interior environment, which reflects light and makes the place appear larger to the eye (Stott, 2006; Souza, 2020).

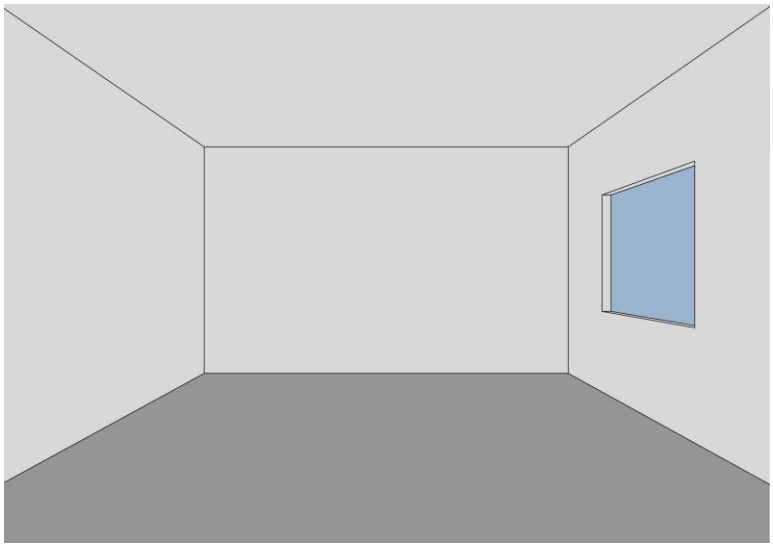


Figure 24: Example of Enlarging the Space (URL 23)

Figure 25: Example Two of Enlarging the Space (URL 24)

Narrowing the space: when we want to make space appear narrower or smaller, the designer uses dark colors on the walls and ceiling, as they absorb light (Souza, 2020).

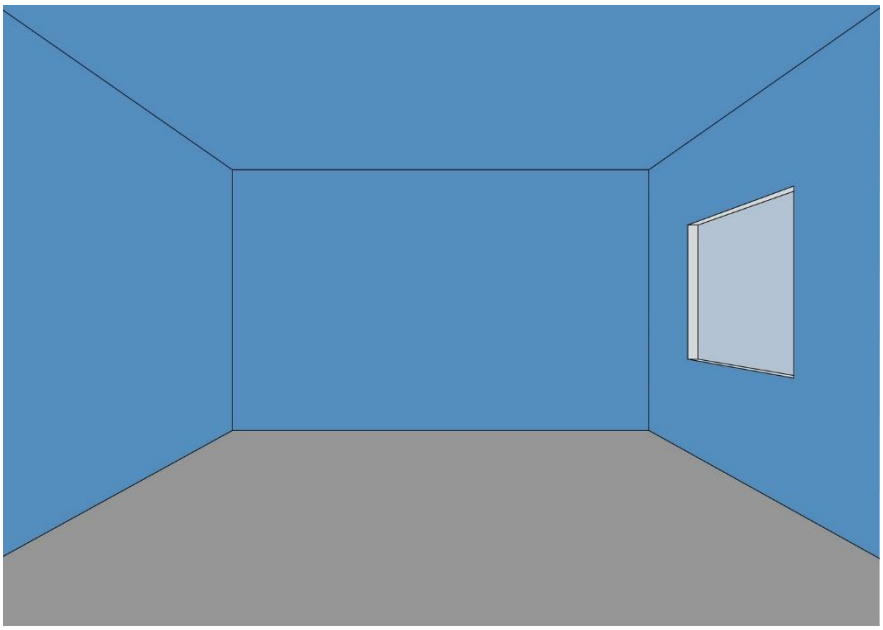


Figure 26: Example of Narrowing the Space (URL 25)

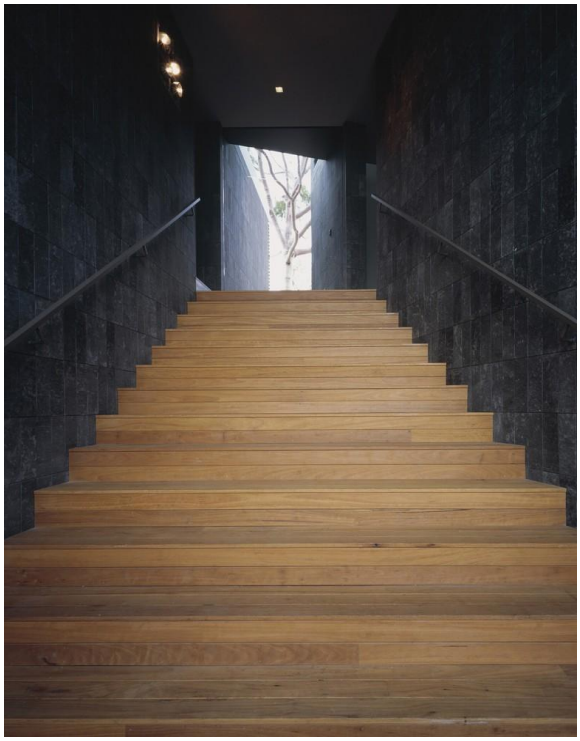


Figure 27: Example Two of Narrowing the Space (URL 26)

Lowering the ceiling: lowering the ceiling sometimes makes the space more interesting and a more welcoming place, and this is done by making the ceiling color darker than the color of the walls (Souza, 2020).

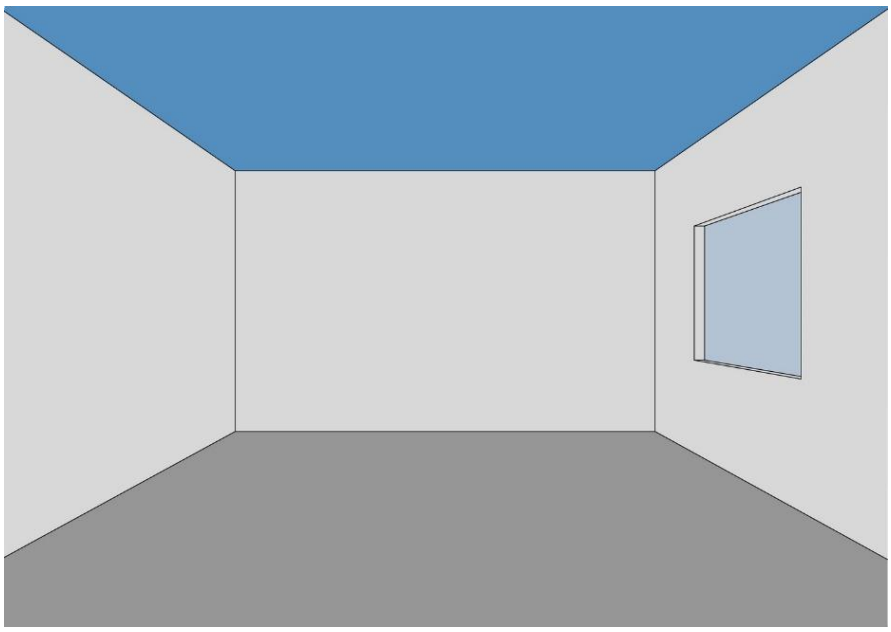


Figure 28: Example of Lowering the Ceiling (URL 27)

Figure 29: Example Two of Lowering the Ceiling (URL 28)

Design strategies to raise the height of the ceiling: In some spaces where the ceiling is low, it gives a feeling that the space is closed and gloomy and may also lead to a feeling of claustrophobia, then the designer can make the ceiling appear higher by making the ceiling color lighter than the color of the walls (Souza, 2020).

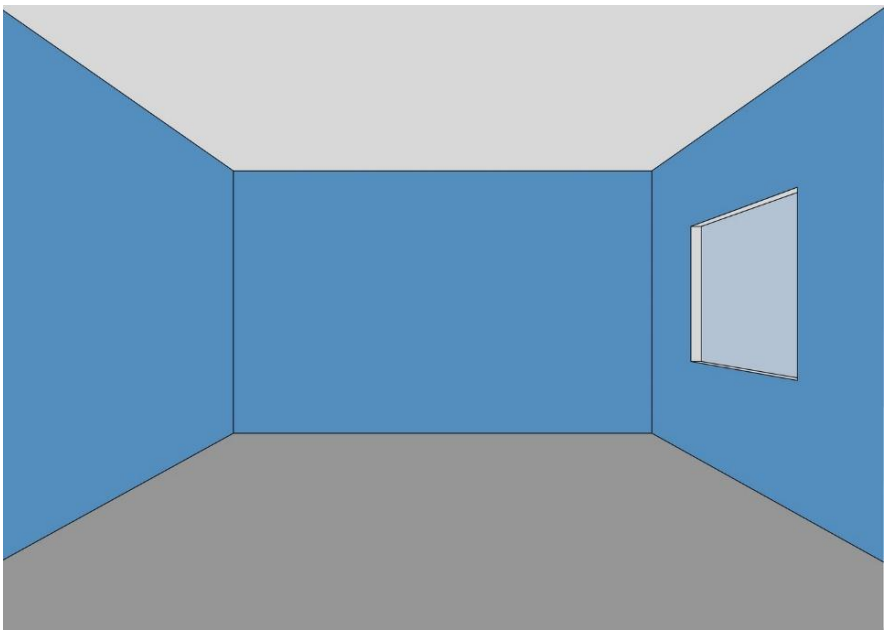


Figure 30: Design Strategies to Raise the Height of the Ceiling, E.G.1 (URL 29)

Figure 31: Design Strategies to Raise the Height of the Ceiling, E.G.2 (URL 30)

Expanding the space: in this case, the ceiling and the back wall are made in a darker color than the side walls, giving the viewer a feeling that the place seems wider (Souza, 2020).

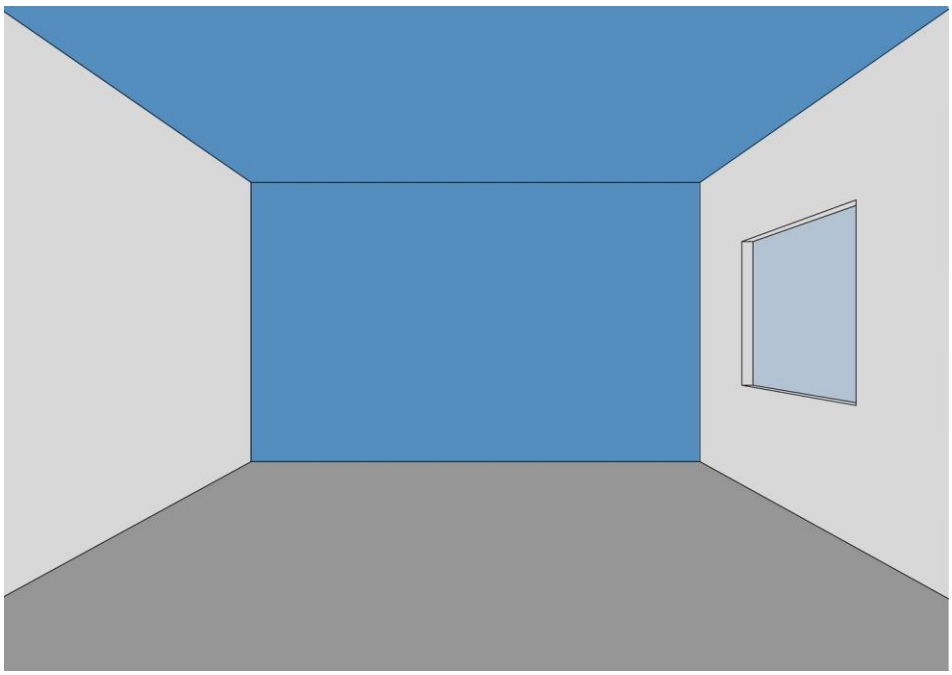


Figure 32: Design Strategies to Expand the Space, E.G.1 (URL 31)

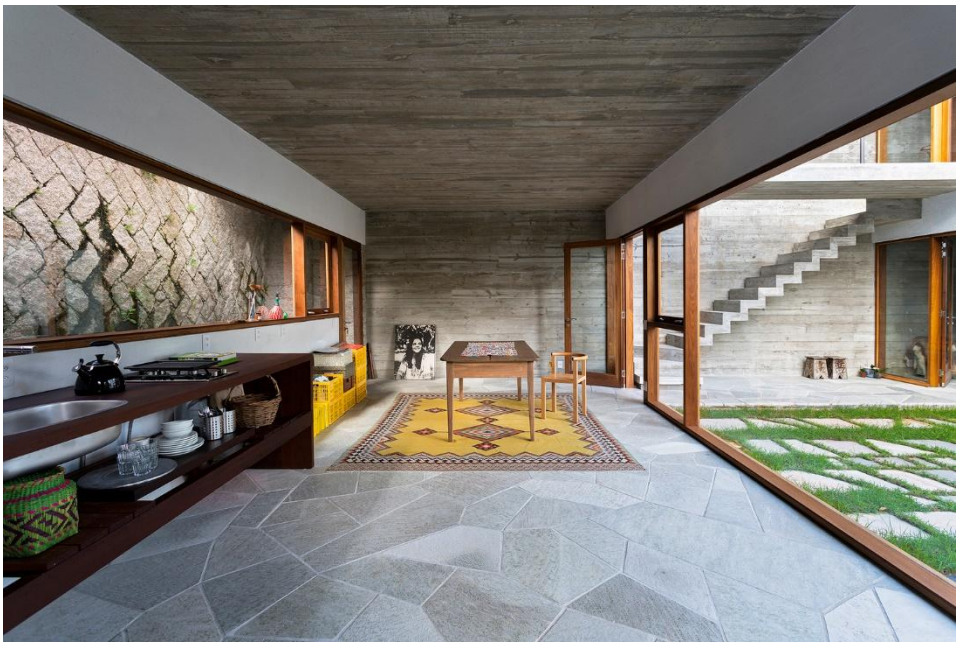


Figure 33: Design Strategies to Expand the Space, E.G.2 (URL 32)

Narrowing the space: in this case, the ceiling and the back wall are made in a lighter color than the side walls, which gives the viewer the feeling that the place seems narrower (Souza, 2020).

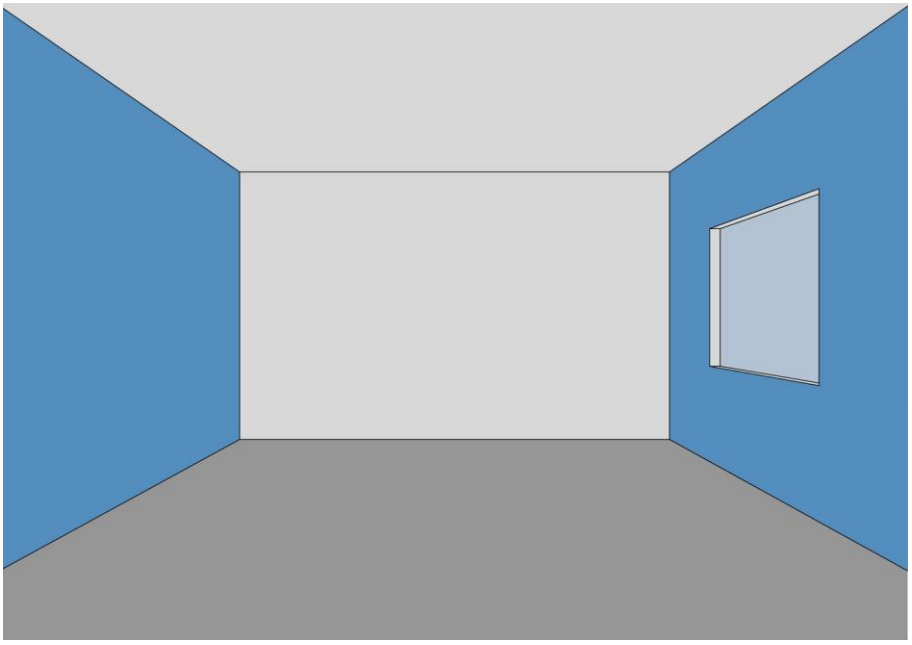


Figure 34: Design Strategies to Narrow the Space, E.G.1 (URL 33)

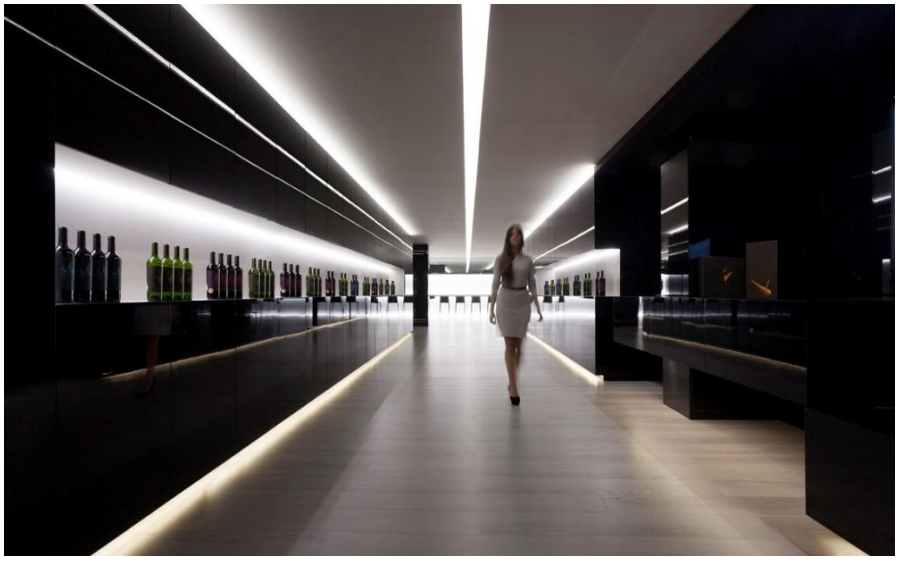


Figure 35: Design Strategies to Narrow the Space, E.G.2 (URL 34)

Shortening the space: in the event that the space is large, the back wall is painted in a darker color than the rest of the walls, which gives the viewer a feeling that the space appears to be narrower (Souza, 2020).

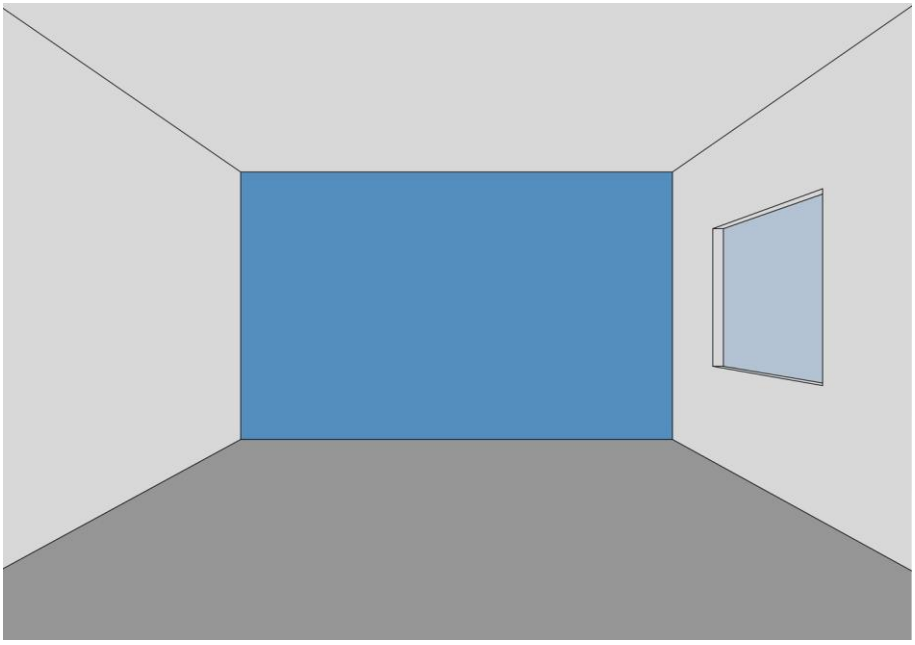


Figure 36: Example of Shortening the Space (URL 35)

Figure 37: Example Two of Shortening the Space (URL 36)

Shortening the walls: when you paint the bottom of the wall a darker color than the top of the walls, this gives the viewer a feeling that the walls are getting shorter (Souza, 2020).

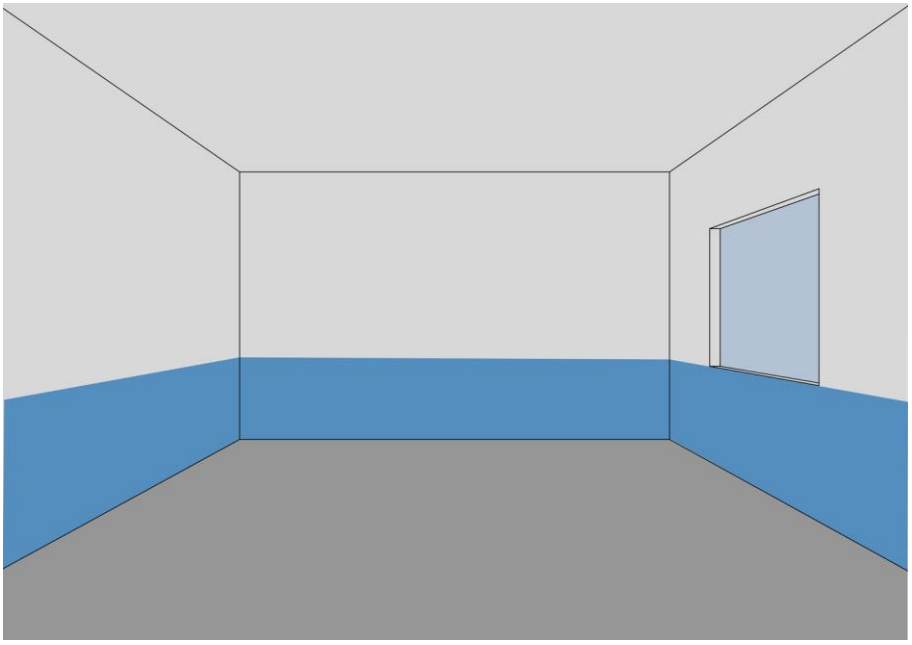


Figure 38: Example of Shortening the Walls (URL 37)

Figure 39: Example Two of Shortening the Walls (URL 38)

There are few exceptions for some, the colors has two types of effects:

1- Direct psychological effects: These are what appear in human behavior, such as fun, sadness, lightness, or heaviness.

2- Indirect psychological effects: which are variable according to the nature of people and their moods.

Just as colors have positive psychological effects, there are also negative psychological effects, which are shown in the following table 5 (Mohsen 2012):

Table 5: Positive and Negative Psychological and Physiological Effects of Color (Mohsen 2012; Marberry, 1995)

Color	Positive psychological effect	Negative psychological effect
Yellow- Primary color	Optimism, confidence, self-esteem, emotional strength, irrational strength, and creativity	Fear, emotional vulnerability, depression, and anxiety.
Orange Secondary color	Comfort, food, warmth, safety, emotion, fun	Denial, frustration, and immaturity
Red Primary color	Physical courage, strength, warmth, energy and survival, control, motivation, excitement	Challenge, aggression, visual impact, and stress
Violet Secondary color	Spiritual awareness, inclusion, vision, authenticity, truth, quality	Oneness, decay, oppression and inferiority
Green Secondary color	Harmony, balance, love, comfort, reassurance, environmental awareness, peace	Boredom, stagnation, emotional coldness and weakness
Blue Primary color	Communication, trust, competence, serenity, logic, calm and contemplation	Coldness, introversion, lack of emotion, unfriendly treatment.
Peach Tertiary color	Reassurance, care, warmth, femininity and love	Prevention, emotional phobia and physical restlessness
Gray Non-color	Psychological neutrality,	Distrust, sadness, depression, lethargy, and lack of energy
Black Non-color	Sophistication, security, safety, emotional safety, competence	Persecution, coldness, danger, and heaviness
White Non-color	Cleanliness, clarity, purity, simplicity, efficiency	Coldness and unfriendliness
Brown Natural-color	Seriousness, warmth, nature, confidence and support	Lack of fun, heaviness, and lack of sophistication

The importance of the psychological effects of colors appears through the many scientific and study studies conducted in many universities and study centers, as it has shown that colors are an energy and each color has a different energy, and as any energy around us affects us with an emotional effect if we know how to use it (William, 2000).

Many studies have shown the success of colors in the positive psychological effect in some of the specialized sciences, including in the health field. The scientist Ibn Sina 1037 AD - 1990 AD considered that color has great importance in the process of diagnosis and treatment or to alleviate the symptoms of diseases and confirmed this in his book ‘The Law in Medicine’.

In a study conducted in 1982 AD at the University Of San Diego College Of Medicine, 60 middle-aged women with rheumatoid arthritis were exposed to a blue color for 15 minutes and experienced significant improvement in alleviating the severity of pain (Steadman, 2008; Stott, 2006).

Another study conducted in 1990 showed that red light was shed on the eyes of a group of patients suffering from migraines, 93% of them partially recovered, and doctors attributed the reason for this to that the red color increases arterial blood pressure and widens blood vessels (Lahla, 2005).

2.4.2 Colors in the Workplaces

The concept of color was preceded by a reference to define the concept of color, which is intended as a physical phenomenon resulting from the analysis of white color, which is the dye used to produce colors, and the color appears according to its absorption of light, so the waves reflected from a surface on the eye through white

rays that represent the color of that surface. The color we distinguish by the fall of sun rays or light rays on an object, this body absorbs some of the rays and reflects others on the retina, which makes see and distinguish the colors. Here it should be noted that there is a strong link between rays and colors, without light, we could not distinguish the colors (Hameed, 2009).

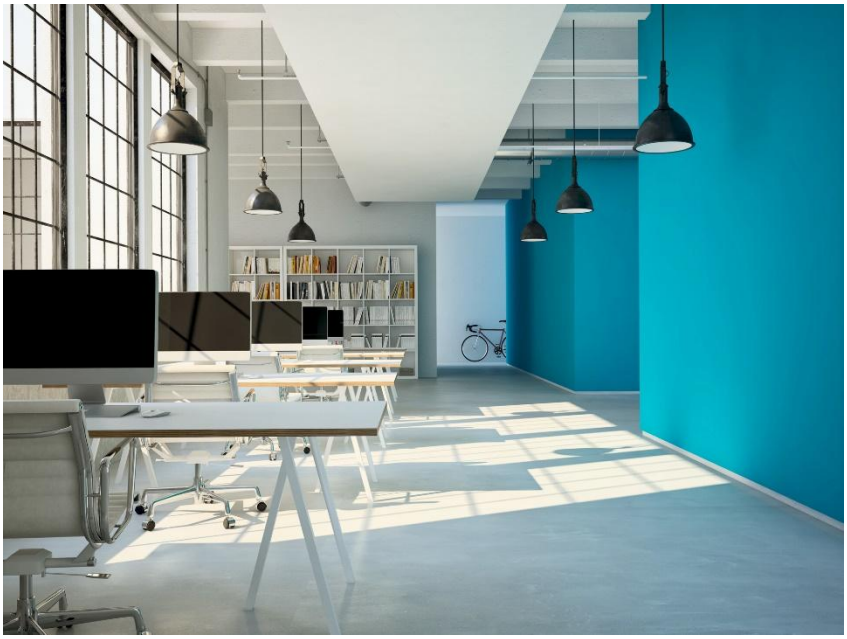


Figure 40: Colors in the Office Work Environment (URL 39)

Colors are very important in the visual image of the workplace, as it is not possible to imagine a workplace devoid of colors that make it a catalyst for performance and from here the designer must organize and employ colors to serve the goals of the environment (Fielding, 2006).

Studies have proven that colored lights affect the emotion center through the visual system in the brain. Therefore, the researcher emphasizes the appropriate choice of colors and their ability to motivate and be active in the work environment, especially

in offices, and the nature of each office and the specialized work in it (Hameed, 2009; John, 2018).

It has become evident that the appropriate colors in the offices have a great impact on the productivity of the employees, their acceptance of work and the alleviation of their pressures, and the designer should do this important anchor when choosing colors according to the nature of the offices and their goals.

The interior designer Edina Vaslchenko assures that the appropriate colors for the goals of the offices and the nature of their work are not reflected only on the employees, but on the clients and auditors alike. It is associated with calm, mental purity and creative thinking, and some colors in nature such as yellow and orange associated with nature make a person more clear when making a decision, but they are not suitable for small offices (Hameed, 2009).

Figure 41: Colors in Offices (URL 40)

The offices and the nature of work are important in determining the appropriate color. An employee whose work nature requires concentration and high calm prefers the blue color, but if the nature of work requires movement continuously, it is better to choose one of the hot group colors (Leadon, 2015; Flynn, 2018).

And because the nature of the work of university faculty members is based on disseminating knowledge, science, and scientific study and the relationship between teachers with each other, teachers and students, the researcher thinks that matching white and blue with the colors contained in the university and college logo are the most appropriate for their offices.

Chapter 3

LIGHTING IN INTERIOR DESIGN

Light is no less important in human life than some other necessities for the continuation of life. Plants that are considered one of the sources of living cannot grow without light, just as objects cannot be seen and colors are distinguished from other than light, and light is the only natural means of determining time.

If it were not for light, life would be disrupted, as it is the means that makes plants a factory of oxygen, which is one of the important necessities of life.

Many contemporary technological applications have evolved through the control of light properties such as lasers, fiber-optic communication systems, and radiography.

One of the benefits of light is that vitamin D is synthesized in the skin through light reactions upon exposure to sunlight.

Light also plays a very important role as one of the factors affecting the perception of designs. With light, the aesthetics of things appear in terms of brightness and shades.

- **Definition of Lighting**

The light is that ray that reveals the hidden forms of shapes and clears their details, so the eye becomes aware of them (Skym, 1878). Light is energy, emits evenly in all paths (Ching, 2018).

The light is radiation consisting of a group of electromagnetic waves of different lengths that are reflected on the surfaces on which they fall, so they are seen with the eye and thus perceived (the role of lighting in the perception of the color characteristics of designs in the internal environment), and the light is a group of electromagnetic radiation visible to the human eye has wavelengths and is responsible for the sense of sight and perception of things, and it may be daylighting or artificial (Mahhke, 2006; Darasbe, 2019).

Figure 42: Lighting in Interior Architecture (URL 41)

3.1 Design Standards for Lighting

There is a set of criteria when designing based on (Zelanski, 2003; Lochner, 2018)

1- Make use of daylighting as much as possible.

2- Determine the function of the light.

3- Darkness is as important as light.

4- Lighting the things and places.

5- High quality in geometry.

When designing, the designer should avoid making the following points:

1- Shadows and shadows direction.

2- Illumination color and chromatic performance.

3- Balanced lighting.

4- The level of illumination.

5- Reduce glare (Gliem, 2003; Pohl, 2003).

3.2 Factors Affecting Lighting Design

As for the factors affecting lighting design, the most prominent are:

1- Spatial factors: This factor has a great impact, which is the necessity of complementarity between architectural and interior design and lighting in a compatible system, with setting priorities in the design of interior lighting for spaces, as determining the influencing physical aspects of the architectural form with brightness would achieve design idealism, provided that it serves the philosophy of the project and expresses Correctly reporting it, and lighting the place is said to be half its décor (Fisher, 2020; Hakimi, 2003).

2- Aesthetic factors: It is one of the factors that designers focus on because of their importance, because the main goal of the design is related to the aesthetic aspects and functional values.

The aesthetic factors in lighting express the degree of creativity of the project, and others considered it the most important source of architectural creation, and the interaction between man and place was achieved (Veitch 2006; Fielding, 2006).

3- Visual environment factors: The visual and appropriate aspects of the visual environment are a process of coupling between lighting and balance in achieving common goals to reach a comfortable state that achieves harmony between all conditions affecting the building, whether it is architectural treatments or interior designs, and the visual aspects include the following:

A- The location of these installations and their relationship with the architectural elements and the rest of the structural systems included in the design.

B - Technical formation and consistency of the used optical installations.

C- Shapes and sizes of light installations used (Park, 2003; Fielding, 2007).

3.3 Lighting in the Workplace

The lighting in the work workplace is a basic condition in the design because light has a very effective effect on performance, production, employee comfort, health, and functional efficiency, and the intensity of lighting in the work environment varies according to the nature of the work and the type of activity, and here the designer must take into account the distribution of lighting. Because that is the fit for the performance, that is why proper light distribution increases aesthetics and functionality (Kamal, 2007; Mills, 2016).

The designer should also work as much as possible that the lighting in the work environment, especially the offices, should be very close to daylighting. With a focus on work in the office that requires directed light, because poor lighting creates depression, poor production, and a tendency to laziness, and many countries have enacted legal legislations that require the employer to contain the work environment on homogeneous and widespread lighting to avoid shade and be free from sparkle and luster direct and mirrored. And that the lighting units are cleaned continuously from dust and plankton. This is to protect the worker from work injuries and accidents, and it is stipulated that the lighting units give off light close to nature and avoid surfaces that reflect light (Fisher, 2020; Hakimi, 2003).

Studies have shown that poor amount lighting causes headaches, congestion around the cornea, and eye inflammation, so the designer must do his best to find suitable lighting close to daylighting and move away in design from shiny and reflective surfaces in the work environment and in offices.

With the contemporary development in the lighting industry, the researcher sees the use of white LED lights in offices and the work environment, due to their proximity to daylighting, in addition to being free from glare and heat, providing aesthetic form factor, lowering electricity consumption and operating costs for maintenance.

The Philips lighting company made a scientific study on office work and came up with three results:

1- This type of lighting improves business facilitation processes.

2- Reducing energy costs to up to 80% (Philips, Egypt & Cairo, 2019).

3.3.1 Psychological Effects of Light on Humans

There is no doubt that light has clear effects on the human being from a physiological standpoint, as appropriate lighting facilitates vision, reduces eye fatigue, and feels comfortable, and improper lighting quickly leads to fatigue, boredom, and stress (Flynn, John & Taha, 1988).

The amount of suitable lighting is determined by a set of factors:

1- Work environment.

2- The type of work or activity performed by the person.

3- The type of people who do the work ‘young or old’.

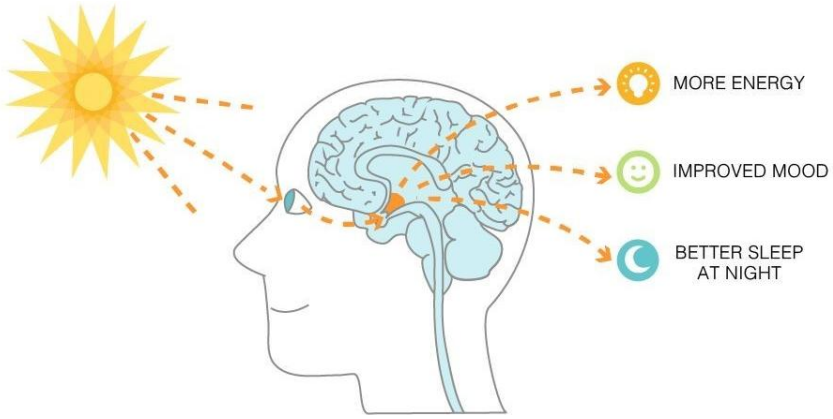


Figure 43: Psychological Effects of Light on Humans (URL 42)

For example, the intensity of the light that the surgeon needs in the operating room must be high, and the level of light needed by the average worker is very less than that, so what the surgeon needs exceed 10,000 LX, while the average worker does not need more than 75 LX to perform his functional tasks (Muhammad, 2007).

The intensity of the illumination is associated with the physiological effect of light, depending on the degree of accuracy required by the work. And the designer must take into account these measurements when distributing lighting in different places. Because proper lighting reduces work obstacles, almost everyone agrees on the design that the state of the visual environment in which a person works has a clear effect on his health. Because improper lighting may cause a person to exert more mental effort, as in the case of working the adaptive muscles in the eye during light. Because it is certain that the mental effort is greater when the lighting is not appropriate, and from the harmful effects of the light that the weak light distracts attention, in addition to the heat emitted from the strong lighting source has a harmful effect on human health (Frank, 2010; Küller, 2006).

The prominent physiological effects of light on humans can be summarized as follows (Russ, 1992; Steffy, 2002):

1- Visual acuity: It is the ability of the eye to discern details, and visual acuity in a person is measured by the open circuit method when a person is asked to sit 6 meters away from an open circuit board, then the number of the direction of the circular aperture is among the four possibilities that are possible for it. The visual acuity depends on the following factors:

A- Intensity of illumination: the intensity of illumination reduces visual acuity.

B- Contrast: between the visible object and the existing surface, both in color and lighting.

C- The stratigraphic composition of the light: where the visual acuity is strengthened by the use of monochromatic light in illumination.

2- Adaptation of the eye: God created the eye with a system to adjust the aperture and direct the image to the retina, and the vision in the eye depends on the amount of light falling on the visible object, there is a direct incidence between the clarity of the image and the fall of light on objects, the visual vision depends on the optical resolution, which is the ability to distinguish The subtle details if the eye took the necessary time. Adaptation, which is the ability to adjust the eyes to different levels of light by changing the size of the lens of the eye, when going out from a very bright place to another less lit, it takes 20-30 seconds for normal vision, and in return when leaving a dark place to the bright sun, the eye is Adapt in less time (Sabry, 1996).

3- Perception speed: the eye needs a certain time to fully understand the response to a vision, and this period of time depends on the state of the eye in

terms of its safety or fatigue, and it represents the speed of perception that if the eye is looking at a white plate, for example, with homogeneous lighting and then put a black spot on it, then the eye perceives After a time, its duration shortens, the more intense the lighting increases (Hammouda, 1998).

4- Glare: It has already been indicated that dazzling eyesight occurs if one of the points of the beauty of vision is brighter than what is around it.

5- Eye sensitivity to colors: It is known that the effect of different colors on the eye is not equal, as there is some sensitivity for each color, so this sensitivity is not equal for everyone.

6- The effect of aging on the functions of the eye: as its efficiency decreases with the passage of time, a person over the age of 60 needs 15 times the lighting of what a 10-year-old child needs to obtain the same level of vision and the same degree of comfort and visual effectiveness (Philips, 2008).

7- The speed of approval: This refers to the changes that occur when suddenly switching to different levels of light intensity ‘from a sunny place to a dark place and vice versa’.

Among the apparent physiological effects of light on a person is what Dr. Al-Mansouri indicated that the eye nerves are severely affected or weak in lighting, as the dim lighting may cause headaches, lack of activity, and the desire to sleep. The white light is the best in the workplace for the comfort of workers and that night work may lead to a disturbance in the sleep cycle, High rates of fatigue, stress, and performance errors (Vision, 2015).

3.3.2 Daylighting and Artificial Lighting in Offices

It is necessary to differentiate between daylighting and artificial lighting. Daylighting is used exclusively for what is natural and the main source is the sun. As for artificial lighting, it is like electricity, and daylighting is not dispensed within any field, due to the inefficiency of daylighting access to all internal work environments and office sites. And because windows constitute the important entrance to light, it must be wide, directed, and thoughtful, and to improve work activity, balance and integration must be made between artificial lighting and daylighting, noting that some countries, such as the United States of America, do not prefer daylighting and rely on artificial lighting by closing curtains in the daytime (Flynn, John, & others, 1992).

Figure 44: Day Lighting and Artificial Lighting in Offices (URL 43)

- **Daylighting in Offices**

The daylighting in the place is of utmost importance, as it makes the user psychologically accept the space and feel the colors, details of the furniture and the shape due to the daylighting. He feels warm and energized to do his work with clarity, performance and high productivity.

Figure 45: Daylighting in Offices (URL 44)

Some of the benefits of daylighting in offices include the following:

1- Psychological comfort in using the office and a sense of time and the external environment through windows (Mohammed, 2014).

2- The physiological effect of daylight on humans, as daylight helps the bodies produce vitamin D, which is important for human health. It also increases the activity of white blood cells, which strengthens the immune system and weakens bacterial activity (Mohammed, 2014).

3- Increased secretions of some hormones in the body those are particularly sensitive to sunlight.

4- Feeling warm in cold days.

5- Increasing the effectiveness of work, giving and production due to the comfort, activity and stimulation of production that they demonstrate (Gordon, 2003).

- **Artificial Lighting in Offices**

It is known that daylighting is lacking after sunset, and some places do not reach daylight, which calls for the use of artificial lighting, in addition to some modern

designs of buildings that dispense with windows and are provided with artificial lighting and air conditioning in an integrated design that gives an atmosphere of a natural feeling of the climate and the satisfaction of the soul and the body.

Figure 46: Artificial Lighting in Offices (URL 45)

And because artificial lighting became part of the appropriate design to add pleasure and aesthetics to the place, some conditions had to be met (Lechner & Flynn, 1974):

1- The lighting units should give the amount of light suitable for the practical activity in the place.

2- Avoid shadows resulting from poor lighting distribution.

3- Avoid direct light falling into the eyes and prevent annoying shine on surfaces.

4- The lighting should be homogeneous, meaning that it has an equal spread throughout the place.

5- Choosing the right spectrum for vision with light stability.

6- Taking into account the economic cost and energy consumption expenditures.

7- Observance of work conditions for long-term vision comfort and effective vision.

3.3.3 Lighting Design Standards in Workplace

When talking about standards for lighting design for offices, one must be aware of a set of standards and apply them professionally, as there are mistakes that must be avoided and not made (Philips, 2008). .

Standards for lighting design in office interior spaces (Jonathan & Poore, 2004):

1- Modify the position of the means to block the windows light or the stability of the movement of curtains to control brightness and lighting levels.

2- The use of indirect lighting to avoid the formation of shadows.

3- The use of surfaces that are not bright and neutral colors absorbent on walls and furniture.

4- The use of adjustable light stands in order to increase the level of lighting if necessary.

5- Lighting focus according to the activity performed in the given space.

6- Using the smart lighting control system until the appropriate lighting scene is controlled according to use.

7- Use quality lamps that show colors well and stay away from lamps that have a color display rate of less than 80%.

8- Refer to the competent authority responsible for public health and safety to find out the permissible levels of lighting, the ability of the eye to distinguish and the pattern of work, and the following table shows the levels of lighting permitted in major countries and the International Commission on Illumination.

Table 6: Offices Brightness Levels Determined by Lux through Different Countries

Brightness levels determined by Lux (LX)					
Origin	Germany	France	Britain	Russia	International Commission on Illumination
office	500-250	320	500	300	500

The definition of LX is the unit of luminescent value in the SI system of Si s, and it is equal to one lumen per square meter ‘Baroudi’.

International centers conducted studies to reach the best types of lighting in offices, and the results of these studies were very close, and the researcher presents one of these studies and its accuracy, which is the German study conducted by the German Center for Lighting Applications (DIAL) and the study was in 1999, and the study was based on assigning 20 cases of lighting within the following factors:

1- Brightness of light: The best type gives the best feeling of the place.

2- Increased activity: the most common type that helps people feel energetic.

3- Psychological comfort: the most psychologically comfortable type of office user.

4- Luminous Attraction: The most attractive species.

The results were as follows:

1- The best case of lighting brightness is the lighting of the walls with focused lighting on the table in general when there is lighting on the walls where the place appears to be brighter, because 80% of the visual field is located on the vertical surface.

As for the colors, the best was light blue, followed by light green, and the worst was bright red, followed by dark orange.

2- As for the best cases of increased activity, studies have confirmed that focused lighting has a major role in increasing activity, which is the case of direct lighting with wall lighting with focused lighting on the walls and the table.

3- The results of the psychological state of the office user came, as studies also confirmed that focused lighting has a very important role in increasing the positive psychological state, with the same results as the colors, which are light blue, followed by light green.

4- As for the results of the attractiveness of lighting, it was that focused lighting always raises the percentage of gravity in the place, especially in the case of direct lighting with focused lighting on the walls and the table.

In this requirement, the researcher confirms what was previously referred to from the Phillips study using LED lighting, as the correlation between the results of the study achieves the ideal goals of the design in lighting offices and interior spaces (Lam, 1992).

Chapter 4

INTERIOR DESIGN OF WORKPLACES

This chapter focuses on workplaces, and important factors affecting their interior design, especially focusing on color and lighting, including furniture and space quality in general. Different types of workplaces will be discussed and some well-known offices will be analyzed to set the criteria for the analysis of the main case studies of the study.

4.1 Workplace Types and Definitions

- **Workplace**

When the studies that define the workplace are tracked, almost all of them are characterized as being ‘The place where the employer and the employee agree to perform the work’ or ‘the place where the worker works’.

Figure 47: Workplace (URL 46)

The workplace is described as the space in which a person works, whether as an employer or employee, and ‘the spatial space in which the employee carries out his practical activities with comfort and privacy that serve both the work (Leadon, 2015).

The workplace must also include all the needs that enable the user to carry out their practical activities, thus achieving the achievement and safety of the worker or employee together (Giang & Nguyen, 2015).

The workplace is in a continuous state of development according to the changes that occur in the user’s needs and on the work that take place in this space, as the development of the institution and its success and its employees, is related to the development of the workplace itself and the way it is designed and constructive. It affects the psychology of the individual and thus affects his performance in a way that may be positive or negative depending on the quality of the internal environment of the workplace (Becker, 2017; Nguyen, 2004).

- **Office Space**

It is not possible to carry out work that includes special techniques in a regular space, and therefore any work must be from a place with a specific design to practice work tasks, job duties and various activities that the employee needs to perform well.

Figure 48: Office Space ‘Claremont McKenna College’ (URL 47)

The office environment is characterized by special specifications and a necessary need to complete the work, such as the correct distribution of appropriate lighting and studied colors in terms of their impact on the user himself, which is reflected in his performance. Office spaces vary according to the nature of the job (Klein, 1982; Poore, 2004).

Also, the office space for work has a role in determining the extent of the employee’s belonging to the company, as the employee loves, accepts and belongs more to the place where he feels comfortable and appreciated, as the studied office space, which receives special attention in terms of design, reflects the extent of the company’s interest and appreciation for the employee who operate this office and thus it be affected by the employee's affiliation with the company (Poore & Kamal, 2007).

Accordingly, the office should be a specially designed space in which the employee performs the duties of his job and at the same time supports his well-being (Kamal, 1992).

- **University Academic Personnel Offices**

It is a special space on the university campus that the academic personnel uses to follow up their daily activities related to their academic work, whether in the training process or scientific study.

Through the definition, the importance of the requirements that must be met in terms of the internal design of the university office and the standards that must be observed to make it meet the needs of the faculty member appears easily and simple (Nguyen, 2017; Obeidat, 2017).

As for the suitability of the office for university work, the spaces necessary for the activities of the teacher must be taken into account, as well as the appropriate daylighting and artificial lighting, as well as the colors that bring comfort and the appropriate atmosphere for the performance of work and production on the campus, as these characteristics are considered catalysts for work and achievement (Mahnke & Galasiu, 2006).

4.1.1 Plan Types

- **Workplace Layout**

Workplace layout affects how employees perform their tasks and is an important factor for it as well. Before planning an office, office planning goals should be defined, how much users need to interact with each other and with clients within it, as well as access to support functions should be determined (Yildirim, 2007).

An office layout, also known as an office space planner, is "the orderly organization of office equipment, machinery, and furniture to provide a working space that is spacious, efficient, and productive for the office staff."

- **The Importance of Workplace Planning**

There are many aspects that must be taken into consideration during the process of designing a plan or making a thoughtful layout of the workplace. There is a set of criteria and objectives that help build this integrated planning. However, the first and most important objective remains how simplified work will be done, in line with employee satisfaction (Yildirim, 2007; Galasiu, 2006).

The main objectives of designing a successful office floor plan are as follows:

1- Working on the appropriate and effective use of the given space of the available floor.

2- Ensure a stable workflow and an effective design style to increase production.

3- Design a healthy environment that makes employees feel safe and comfortable in the workplace.

4- Distribution of space to facilitate communication between different departments and work on linking them to each other as needed.

5- Paying attention to providing privacy for employees working on secret projects.

6- Providing a work space free from disturbance by isolating the office floor from external disturbances and sounds.

7- Allocating areas for future expansion of the space.

- **Types of Office Layouts**

The modern trend of dedicated workplaces is moving away from the cubicle system of cubicles. So that there are many types of office layouts to develop different and

renewable work styles according to the needs of the company. Here we consider some examples of the diverse office layouts (Sailer & McCulloh, 2012):

1- Traditional office layout

The traditional office consists of planning individual offices "compact" that is, they are permanent or semi-permanent layouts. This style of office planning includes a group of several closed offices, in addition to meeting spaces, and a more open reception area in order to allocate it to receive clients (Sailer & McCulloh, 2012).

2- Cubicle office layout

Office cubicle is a design type of open office design plan where it consists by creating work spaces by using partition walls to form a box or "closet" on 3 sides. This style of cost-effective workspace is larger and more space efficient compared to built-in desks. It is used with private offices and with built-in meeting rooms for senior staff (Sailer & McCulloh, 2012).

3- Low partition office layout

The more recent version is the design of the low partition office, which is from the office of the cabin, where its design is with more light and interaction between workers by making the height of the dividing walls around the workspaces lower. And in terms of the rest of the parts, it is like the layout of the office cabin, so that it includes built-in offices and meeting rooms if more privacy is needed (Sailer & McCulloh, 2012).

4- Team-based office planning

The latest type of planning is the team-based office layout where workers are grouped by team. And for each team, according to the type of work that needs to be accomplished, there is a difference in the size and space allocated to the

office. In this type, the team workspace includes a collaboration space and individual workstations. This type helps reduce the need for meeting rooms (Sailer & McCulloh, 2012).

5- Open-Plan Office Layout

In this type, instead of creating and defining work areas using furniture, dividing walls are removed completely. Lounge chairs and tables are used to create informal meeting and collaboration areas. Desks may be lined up side by side or they can be replaced with multi-person work tables called 'benches' to create 'banks'. The attractiveness of this type of office is that it can expand and contract, meaning that it is very flexible and easy to reconfigure (Sailer & McCulloh, 2012).

6- Hybrid office layout

A mixed office is one of the most modern types of offices. Because it combines the elements of all the previously mentioned office styles based on the company and its needs. Where creating your office layout is as if you have a menu from which to choose what you want, from which you can choose different "environments" based on the needs of your company. This is made possible and easier than ever before with our innovative new office systems (Sailer & McCulloh, 2012).

7- Co-Working Office Layout

One of the great workplace innovations of this century is co-working desks. It allows you to access all the features of a modern office without having to create it yourself. Instead, simply log in and find a workstation or lounge space and pay a monthly fee to become a member. The co-working office

design will provide a range of work spaces from meeting rooms to private offices to open lounge areas (Sailer & McCulloh, 2012).

8- Layout of the home office

The most popular offices at the present are the home offices more than ever before because they made it possible to work from home during the pandemic. Planning the home office in order to be an effective and productive place requires careful study to get the work done, as in the external offices, and its efficiency (Sailer & McCulloh, 2012).

4.1.2 Furniture Ergonomics Proportions

The science of ergonomics is one of the branches of modern science, which is concerned with the healthy and safe interaction between the human element and the other elements of a system in the work environment through proper design of their environments, the evaluation and analysis of various work activities and functions, and the study of the work environment with the aim of making the system comfortable and safe for the human being and consistent with his needs, capabilities and physical characteristics (Gilbert, 1994; Wiley, 2012).

One of the main goals of ergonomics is to prevent accidents and diseases caused by work. There are many diseases due to work that are included in injuries caused by repetitive and continuous movements, the work of ergonomics addresses these problems with the proper design of the workplace and the placement of tools and means of operating machines, for example, within reach without having to turn the body or bend or extend the body and arm to pick up something a little far from reach, as well as the proper design of offices and seats to suit all sizes and lengths of people (Miller, 1994).

It is also concerned with increasing the worker's efficiency and productivity, such as placing the most frequently used parts or tools close to him, while arranging the work system so that it provides comfort, ease and smoothness during work, so the result is a quick rate of work with less effort without accidents.

The application of ergonomics in the interior design of offices and the distribution of elements and components allows, for example, the availability of a comfortable and safe environment and furniture for the user, so that his work can be completed quickly with less effort and more safely.

It must also be taken into account the appropriate heights of office furniture such as the chair, desk, table, and sofa, in accordance with the length and size of the human element that works on it:

1- The back of the chair should support the lumbar vertebrae.

2- The height of the chair is subject to change in the sitting position.

3- The chair base has five legs to provide maximum stability.

4- Position the calculator user's elbows at a 90-degree angle, allowing the forearms to balance with floor (Gilbert & Miller, 1994).

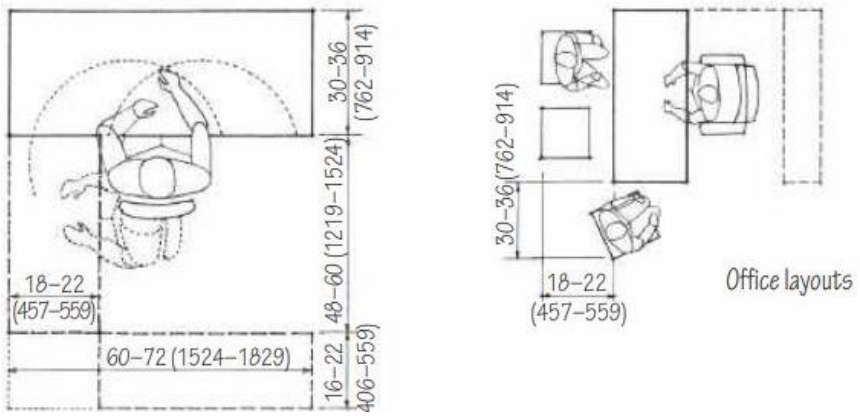


Figure 49: Computer-Based Work Environment Vocabulary (Wiley, 2012)

Rules related to the sitting position of an office user, these rules include a set of instructions, other guidelines for office users include (Gilbert & Miller, 1994):

1 - Adjust the lighting in the workplace to a level that secures comfort.

2 - Turn the angle of the screen to avoid glare or light reflections.

3 - The safe and comfortable distance between the user and the screen should be between 15-40 inches.

4 - The center of the calculator screen should be 10-25 degrees below eye level.

5 - It is assumed that the tools used by the user to enter data should be at a level screen height and beside it.

6- Taking regular breaks and not staying in a sitting position for a long period of time.

7- Doing exercises to overcome body muscle tension, especially after sitting for several hours.

4.1.3 Heights and Window Types in Relation to Lighting

The first type of window is an opening in the sidewalls that opens the way for sunlight to enter during the day and for air to enter the building. The windows inside buildings are generally classified into two types, the first type is centered on the facades of the building and the second type is located on the upper surface of the building and is called the skylights. The amount of daylight entering the building from the windows depends on the height of the ceiling (Mohammed, 2014).

Windows, doors, and skylights are essential parts of buildings. It performs many important functions, the first of which is the entry of daylight into the building. Natural daylighting is one of the main sustainable ways to achieve visual comfort, green buildings, and establish energy efficiency. It has also been identified as the

main source of light entry for color rendering as seen as the light source that is in harmony with the human visual response (Roche, 2000).

The amount of natural daylight entering the building mainly enters the interior of the building through these windows and thus creates a distinctive interior environment, and in addition provides a pleasant visual pathway into the existing interior environment (Cheung, 2008). Window openings have two main functions simultaneously, they are:

The first is that it allows the outside light to enter the building and thus creates an indoor environment and a pleasant indoor atmosphere, the second function is that it allows the users of the place to stay in visual contact with the world and the external environment (Muneer, 2004).

Daylighting opening types can be divided into three categories (Mohammed, 2014):

1- Side lighting.

2- Roof and top lighting (horizontal).

3- Horizontal lights (illuminator).

1- Side lighting is used as the first way for daylight to enter the interior of buildings. The side lighting can also serve to create visual access to the outdoor areas and create an atmosphere of ventilation. The direction of the sun changes to different places of the buildings and therefore receives varying amounts of natural light during the times of the day, so the external elements and the aperture gauges are two elements of great importance to provide daylight and solve the problem of rays and excessive heat, which are negative features if they are not studied properly correct.

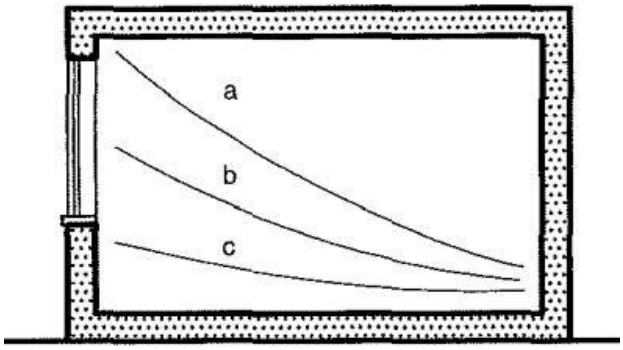


Figure 50: Side Lighting (Wiley, 2012)

2- Roof and top lighting (horizontal) this type of opening is located in the roof line from the top, and therefore is an essential part of the roof of the building. In this method, light penetrates from deeper areas and thus shines deeper, and sometimes it is used when the side illumination is disproportionate.

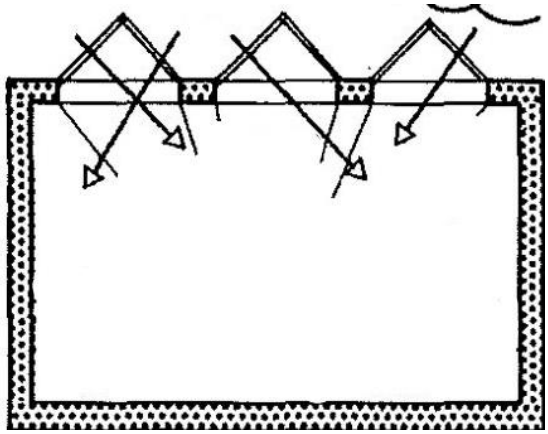


Figure 51: Roof and Top Lighting (Wiley, 2012)

3- Horizontal lights ‘illuminator’ this type of lighting is a one-of-a-kind lighting inside the interior spaces. Thus, it opens the way for sunlight to cross into the ceiling light as well, despite the fact that it is necessary to stay away from sunlight at times.

The illuminator is one of the types of horizontal lighting. Heat gain is a problem in places and areas with high temperatures. The use of transparent glass is a kind consistent with the type of the upper window in order to mitigate and avoid the problem of glare, as its function is more service than aesthetic in terms of the external view.

For a window to meet all the internal demands, certain basic exterior requirements must be addressed. The place where the window would be located and the size of the window are a vital and important feature of designing for daylight. Therefore, since the design of a window plays a major role in determining the daylight quality in the interior space, attention needs to be given to it (Connor, 1997).

When designing for daylighting the depth of the interior space should be in accordance with daylighting zone. 1.5 of the room‘s depth multiplied by the head height of the window will produce adequate illumination enough balance for the distribution of light. An office space with a head room height of about 3 meters can 35 conveniently light up an interior space of about 4.5 meters from the window. A building width of approximately 12 meters allows all offices to have access to daylight (Smith, 2005; Mohammed, 2014).

The higher the window head height, the deeper the penetration of daylighting. Ordinarily the daylighted zone is 1.5 times more than the head height of the window. By utilizing high reflective light shelves this area can be broadened up to approximately 2.5 times more than window head height. With adequate window and proper ceiling height the daylighted zone is 4.6 meter from the window (Smith, 2005; Mohammed, 2014).

In cases which the height of windows is increased, adapting to the daylight by controlling glare and heat gain becomes more difficult. This is due to the fact that the requirements for shading devices and double and triple glazing areas are increased.

- **Window Area to Floor Area Ratio**

The ratio of window area to the floor area has been widely cited in several architectural references. Scientifically, although specifying an exact ratio for all the places in the world is not acceptable, by relying on different accomplished study work it can be estimated. To illustrate this matter better, Neufert (2000) argues that appropriate ratio between window area to the floor area should be 10 to 12.5% while Gutherie (2005) claims that 10 to 25% ratio is acceptable to achieve daylighting requirements. Some of them propound this controversial matter along with other effective factors such as depth of the room or function of the place. Smith cited proper ratio of window area to the room area as 20%, since the maximum ratio of room depth to the height of the ceiling is 1.5 times higher. Robson stated that the 36 ratio of window area to the floor area must be 20% to have appropriate existence of daylighting in classroom (Smith, 2005).

- **Window Area to Wall Area Ratio**

The other significant criterion to have acceptable sufficient daylighting in an indoor space is the ratio of the window area to the wall area. WWR along with visible transmittance (VT) provide effective aperture (EF) as a considerable factor to choose appropriate WWR. For instance in Figure 2-29, 3 different window areas with different VTs have been depicted showing same EF (Mohammed, 2014).

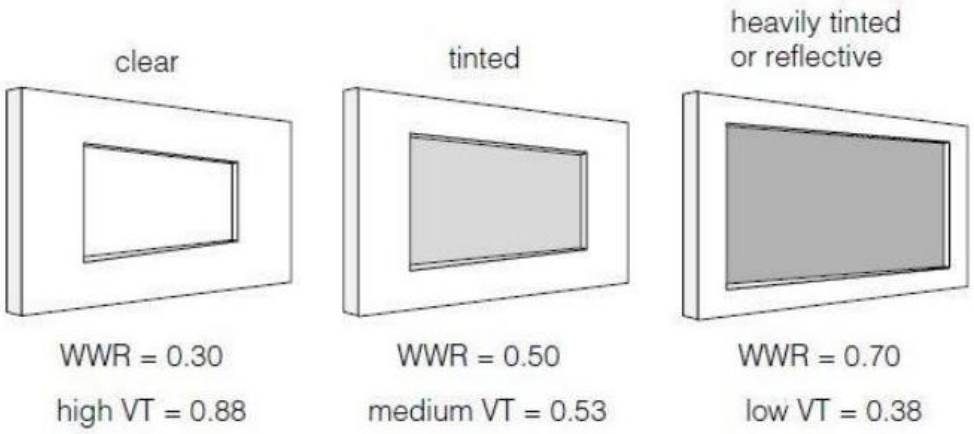


Figure 52: Window to Wall Ratio (Wiley, 2012)

4.2 Successful Examples

As for the global models, there are a number of case studies from different office buildings in the world, and they were specifically selected for the following reasons:

1- Modern and contemporary buildings, in accordance with the main case-studies of this study.

2- Diversity of services provided in each office building.

3- The presence of a special character and a different interior design for each building.

4- Its presence in important locations in the world.

5- The different sizes and areas of each building.

6- Focusing on color and lighting because it differs between one building and the other.

- **Successful Examples - Case Studies**

In choosing some international study cases, studying them in all their details, reviewing the lighting system and the color system used in them, analyzing them, and deducing the main colors used in each case.

4.2.1 Google Office

Table 7: Information about the Google Corporation 'Googleplex'

The name of company	Location	Established	Building area
Google Corporation 'Googleplex'	United States	9/4/1998	3,100,000 square feet, '290,000 m2'

Figure 53: Outside Shot of Googleplex Company 1 (URL 48)

Services Provided - Building Activity: An American public company specialized in the field of advertising related to Internet search services and sending emails through Gmail.

Classification of building offices: general commercial service company offices.

Encouraging creativity and working time: Google used a wonderful method to motivate its people, as all engineers of a company are encouraged to spend 20% of their working time on projects that interest them.

Project location: the company's headquarters in the United States in the state of California.

Figure 54: Googleplex Company Location (URL 49)

Description of offices from the inside: the secret of the success of this company is the concern for the well-being and comfort of its employees, Google provides amenities and benefits for its employees, which makes workers in most other companies with what they are in, Google's basic rule is "be yourself", Google allows you to make your office as you want To feel like you are in your own room, which makes them do a great job and try to make things easier for the users and this makes it necessary for them to feel comfortable and stable in order to be productive. Because this environment is directly reflected on the efficiency of the job performance of the employees in the company and thus increase its revenues, profits and customer satisfaction with it.

When choosing the administration at Google’s headquarters, where everything was taken into accounts, such as the height of the ceilings, the design of work offices, places to eat dinner, and meeting rooms, the organizers insisted that it be unconventional and unconstrained for employees, taking into account that the design of the company is full of spirit and life, in order to make A community that helps to

innovate and generate ideas, even the dining areas are designed for the team to be close to each other and get to know each other more, not only that but the colors used in the company's paint are made of certain materials that are comfortable for the nerves, the design of the place internally is based on social interaction between employees and break Routine in corporate offices.

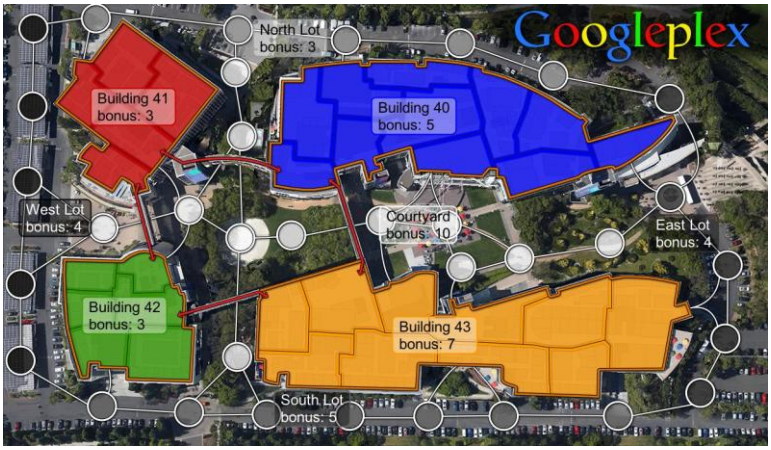


Figure 55: Top View of Company Googleplex (URL 50)

Figure 56: First and Second Plan of Company Googleplex (URL 51)

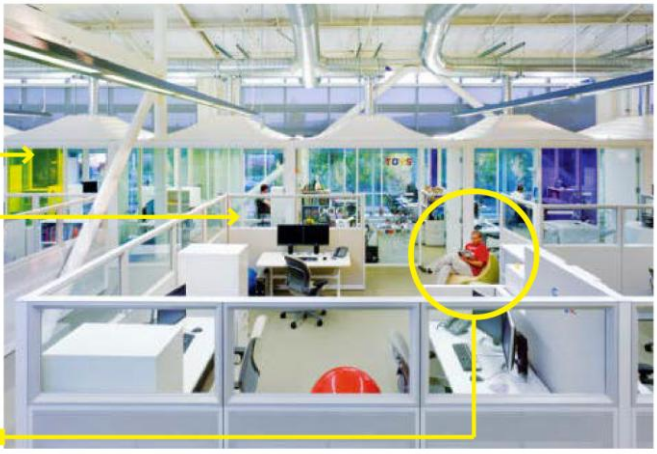
Figure 57: Workplace Types of Company Googleplex (URL 52)

- **Offices Types of Company Googleplex**

Types of Offices: (approximate)

- 40 Open - (40%)
- 60 Enclosed - (52%)
- 15 Meeting Rooms (13%)

The enclosed and open offices are share with 2 or four individuals. This workspace design promotes high collaborative work based on team.



Huddle Room

Open Office

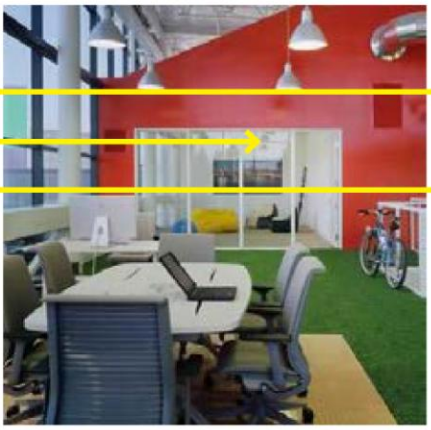
The open offices are within proximity to hunddle rooms to facilitate employees to move from individual work to team work.

Within the open space area , the employees also have the choice to a open private corner .for quick rejuvenation

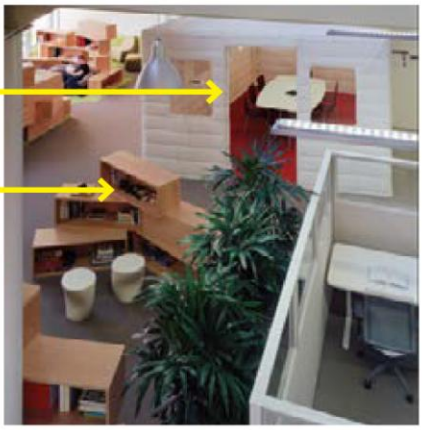
Shielded

Enclosed

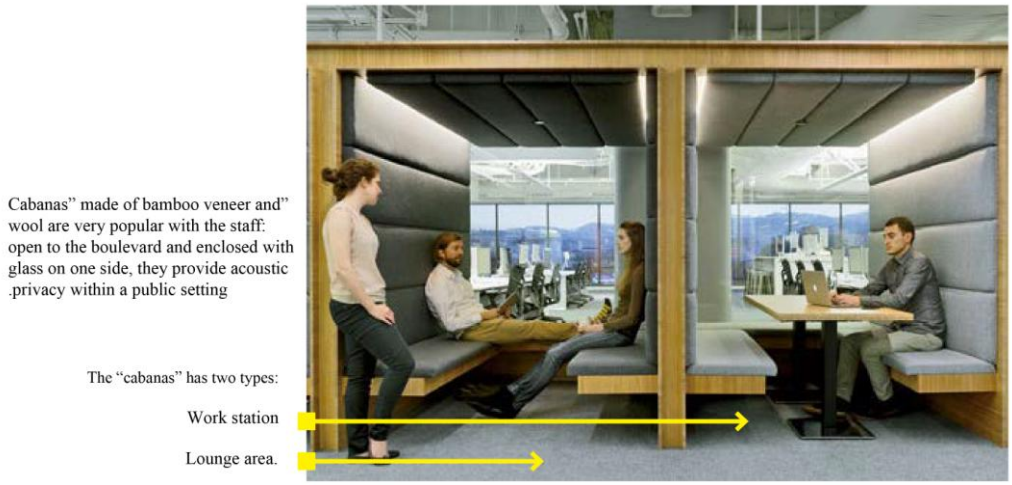
Open



Distributed Model



Zone Model



- **Various Systems for Lighting**

Figure 58: Various Systems for Lighting the Company Googleplex 1 (URL 53)

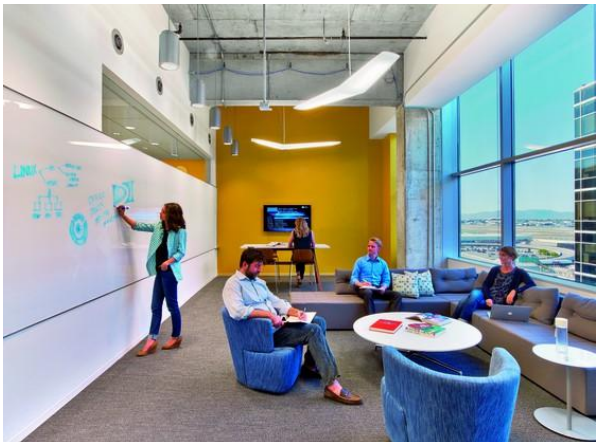


Figure 59: Various Systems for Lighting the Company Googleplex 2 (URL 54)

Figure 60: Various Systems for Lighting the Company Googleplex 3 (URL 55)

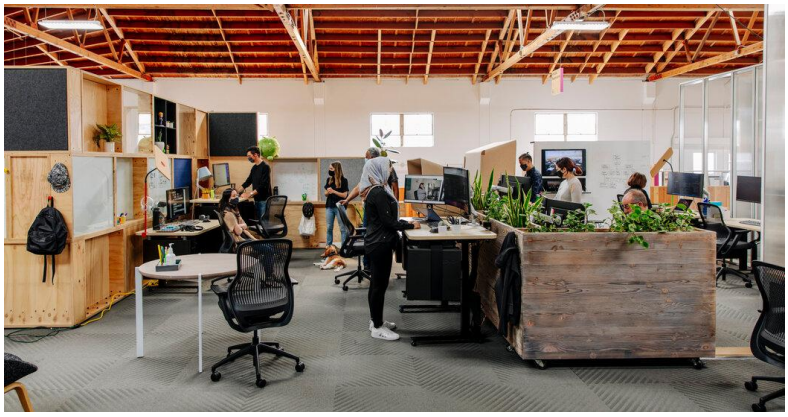


Figure 61: Various Systems for Lighting the Company Googleplex 4 (URL 56)

As shown, lighting has relied on both daylighting and artificial lighting together during daytime working hours. Openings, windows, and large spaces are spread over large areas of walls that allow the maximum amount of sunlight to penetrate, in addition to reflecting the views of the building's exterior green spaces within the void and giving that by supplying the outside sight, As for the artificial lighting units, it is clear that they differ from one room to another. The approved units differ to give diversity in the lighting methods that suit the design of each space. Artificial lighting was of three main types, namely general, focused and decorative, and all of them worked together in an integrated manner with daylighting.

- **Diversity in the Colors**

Figure 62: Diversity in the Colors Used in Googleplex 1 (URL 57)

Figure 63: Diversity in the Colors Used in Googleplex 2 (URL 58)

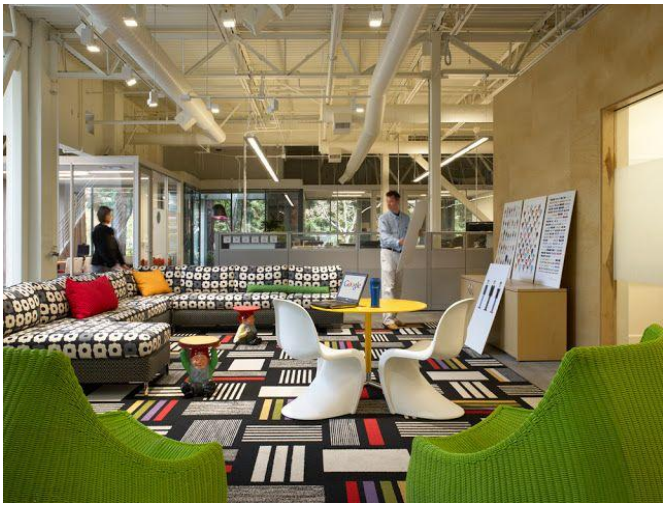


Figure 64: Diversity in the Colors Used in Googleplex 3 (URL 59)

Figure 65: Diversity in the Colors Used in Googleplex 4 (URL 60)

As can be seen from Figures 62, 63, 64 and 65, there is clear diversity in the colors used in the interior spaces of the building. The neutral colors were not relied on only as is common, because they bring routine in the hearts of the employees, and therefore the atmosphere that they added was the various colors on the general character of the spaces, which is a literal translation of the company's logo And the colors used include warm and cold colors in a smart combination between them, mainly focusing on primary colors in addition to secondary colors.

4.2.2 LinkedIn Office

Table 8: Information about the LinkedIn Corporation

The name of company	Location	Established	Interior Designer
LinkedIn Corporation	United States	12 / 2002, the actual operation began on 5/5/2003	Rapt Studio

Figure 66: Outside Shot of LinkedIn Company (URL 61)

Services Provided - Building Activity: It is a website and classified as a social networking site. The site is used as a professional network, allowing members to search for companies that are interested in jobs and want to work in them. When the member writes the name of the company in the search box, he can view and read data and statistics about the company, in addition to many ways to benefit from the site by employing information technologies that show statistics. Which includes the ratio of female employees to male employees in the company, and a description of the company's main location and locations of its offices.

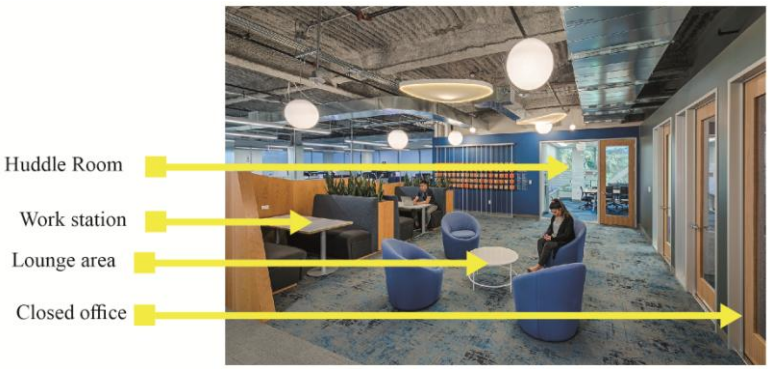
Classification of building offices: general commercial service company offices.

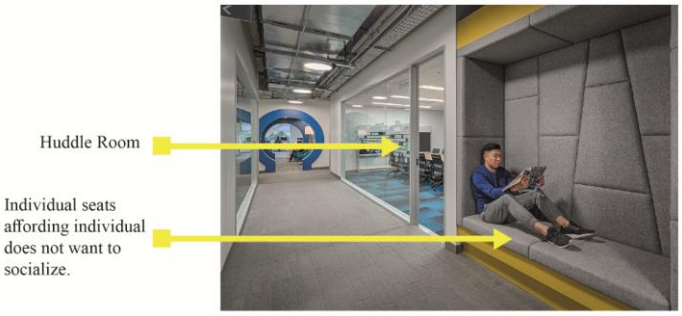
Project location: The company's headquarters is in the United States in California.

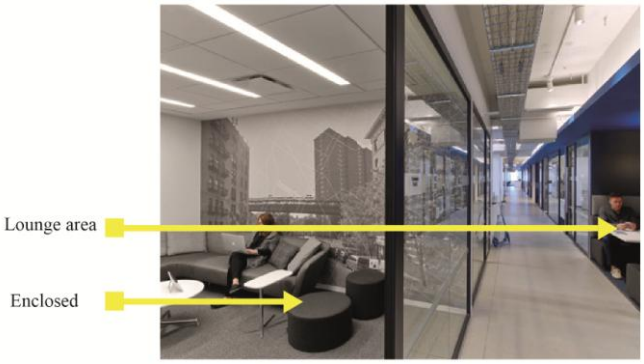
Figure 67: LinkedIn Company Location (URL 62)

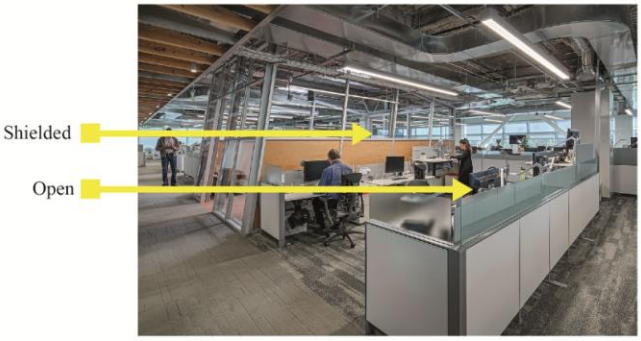
Description of the offices from the inside: The building consists of 5 floors, each floor was designed internally with a different idea, in order to give a different character on each floor, which works to break the routine and stagnation in the place, while maintaining the simplicity of the design while creating inspiring and attractive visual aspects, at the same time maintaining on the general character.

- **Offices types of Company LinkedIn**









- **Various Systems for Lighting**

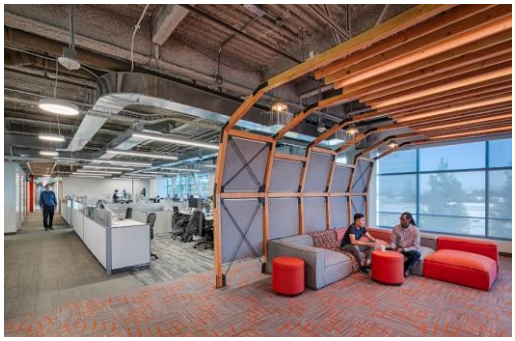


Figure 68: Various Systems for Lighting the Company LinkedIn 1 (URL 63)

Figure 69: Various Systems for Lighting the Company LinkedIn 2 (URL 64)

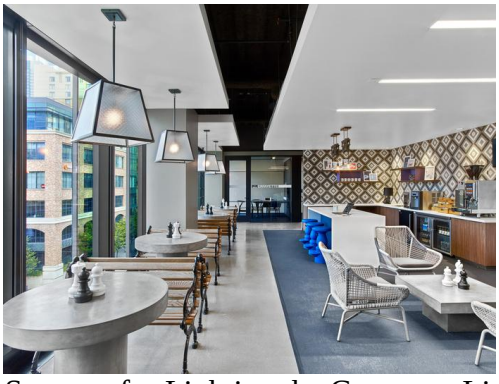


Figure 70: Various Systems for Lighting the Company LinkedIn 3 (URL 65)

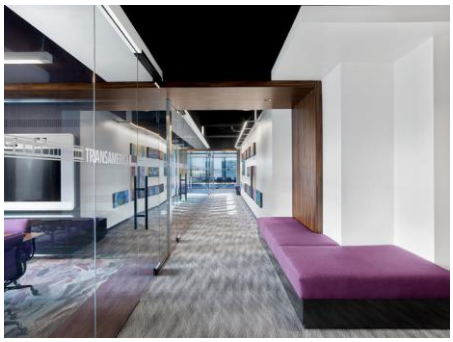


Figure 71: Various Systems for Lighting the Company LinkedIn 4 (URL 66)

With regard to the lighting in the interior spaces of the building, it is clear from the pictures that the same approach was used in the design of the interior lighting for Google headquarters, considering that the designing company is the same company. The combination of daylighting and artificial lighting was successful, in addition to an appropriate brightness on the spaces during daytime working hours. The sun's rays penetrate inside through the large glass openings in the walls, as well as skylights systems that take their space in the ceiling, and as for the lighting units, it appears from the pictures the great diversity in their shapes, sizes, places, and colors, including general lighting units, including those installed on the walls of the decorative lighting units, as well as the units Directed on specific areas and areas to benefit from focused lighting.

- **Diversity in the Colors**

Figure 72: Diversity in the Colors Used in LinkedIn 1 (URL 67)

Figure 73: Diversity in the Colors Used in LinkedIn 2 (URL 68)

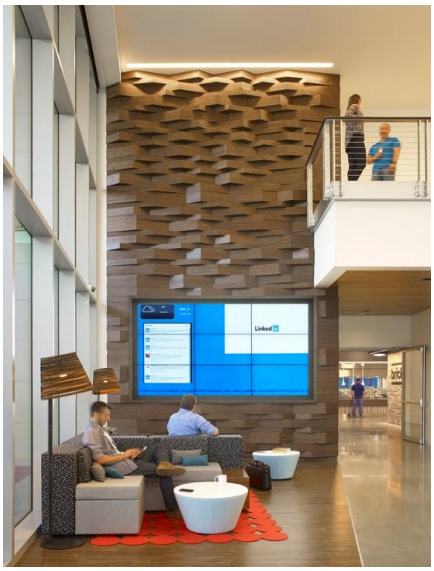


Figure 74: Diversity in the Colors Used in LinkedIn 3 (URL 69)

Figure 75: Diversity in the Colors Used in LinkedIn 4 (URL 70)

As shown, the colors that have been adopted in the interior coatings of the spaces, as they are also based on a smart combination of warm and cold tones, but the difference here is focused on the shades of gray color, which is one of the most widely used color shades in most of the spaces with black and white, and a warm color is added to it Or take action, while at Google headquarters it is rare to use gray in the interior and the focus was on combining cold and warm colors in contrasting shades.

4.3 Case Studies of University Academic Staff Offices from Around the World

As for the university academic offices, they are a number of case studies from different academic offices in the world, and they were specifically selected for the following reasons:

1- Modern and contemporary buildings, not old.

3- The presence of a special character and a different interior design for each university.

4- Its presence in important locations in the world.

5- The different sizes and areas of each office.

6- Focusing on light and color because it differs between one university and the other.

4.3.1 Selected Case Studies from the World

4.3.2 Brown University

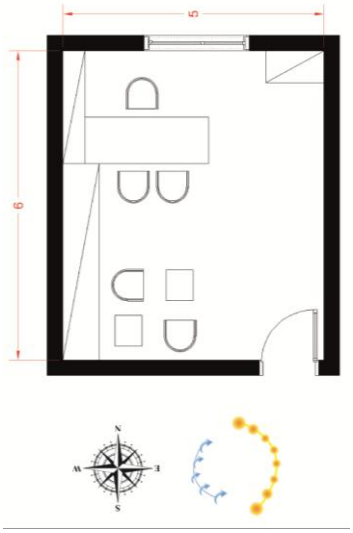
Figure 76: Brown University (URL 71)

Table 9: Information about Brown University

The name of university	Location	Established	Area
Brown University	Providence, Rhode Island	1764	143 acres

Table 10: Office type of Brown University

<table>
<tr><th>Interior Environment</th><th colspan="3">1. Brief Description about Case Study</th></tr>
<tr><td rowspan="11"> 
Office in Brown University (URL 72)

 
Plan of Offices in Brown University (Author, 2021)

Layout and furniture arrangement
Floor area = 30 m2</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td colspan="2">Day lighting</td><td>Artificial Lighting</td></tr>
<tr><td colspan="2">Oriental lighting in the diffuse during daytime working hours</td><td>Central lighting in the space and functional lighting at the desk</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties White Color</td><td>Spreading</td><td>50%</td></tr>
<tr><td>Value</td><td>Light shade / Lightness</td></tr>
<tr><td>Chroma</td><td>High degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Clear</td></tr>
</table>

In this office, the interior design was analyzed in terms of color and lighting, and the design was well thought out in terms of using daylighting well, as the lighting entered the office in a large way to cover the main workspace and the user's office

sufficiently during the day, and in addition to that, the distribution of industrial lighting was concentrated at the work area. In a way and spread in the rest of the space.

The predominant color on the office was pure white, but in a consistent way with the rest of the colors in a way that made the office bright and with positive energy.

4.3.3 College of Marin

Figure 77: College of Marin 1 (URL 73)

Table 11: Information about College of Marin

The name of university	Location	Established	Area
College of Marin	California	2015	27 acres

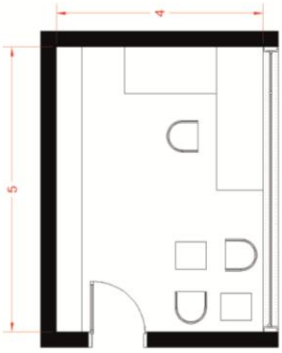
In this office, the interior design was analyzed in terms of color and lighting, and the design was based mainly on daylighting through the large window that covers the part where the work space is concentrated, and therefore this is reflected in the

energy of the place positively. As for the industrial lighting, it was distributed centrally in the center of the desk to illuminate the entirety.

The colors varied between white and light beige in harmony, with the use of dark black, which worked to create a balance between the colors in the office.

Table 12: Office Type 1 of College of Marin

<table>
<tr><th>Interior Environment</th><th colspan="3">1. Brief Description about Case Study</th></tr>
<tr><td rowspan="9"> 
Office 1 in College of Marin (URL 74)

 
Plan of Offices 1 in College of Marin (Author, 2021)

Layout and furniture arrangement
Floor area = 20 m2</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Day lighting enters from the right side completely, illuminating all the space</td><td colspan="2">Central lighting in the space and functional lighting at the desk</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties White Color</td><td>Spreading</td><td>40%</td></tr>
<tr><td>Value</td><td>Light shade / Lightness</td></tr>
<tr><td>Chroma</td><td>High degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Clear</td></tr>
</table>

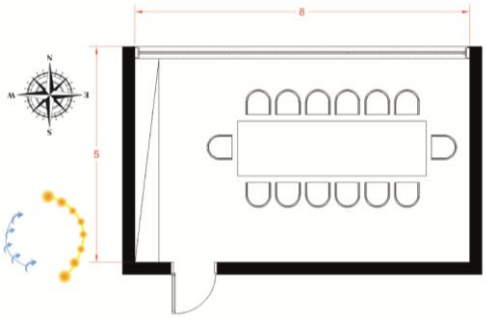
The interior design was analyzed in terms of color and lighting in the following meeting room, and the design was similar to the design of the previous work office in

terms of lighting, as it was based mainly on daylighting through the large window that covers the wall opposite the workspace, and therefore this is reflected in The energy of the place was positive in terms of the widespread of daylight that stimulates performance, and as for the industrial lighting, it was distributed centrally in the center of the office, in addition to its distribution on the corners of the space and its edges to light it up completely.

The colors varied between white and light gray in an integrated manner, which worked to create harmony between the colors in the office.

Table 13: Office Type 2 of College of Marin

<table>
<tr><td>Interior Environment</td><td colspan="3">1. Brief Description about Case Study</td></tr>
<tr><td rowspan="11"> 
Office 2 in College of Marin (URL 75)

 
Plan of Offices 2 in College of Marin (Author, 2021)

Layout and furniture arrangement
Floor area = 40 m2</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Day lighting enters from the left side completely, illuminating all the space</td><td colspan="2">Central lighting in a longitudinal manner, proportional to the internal distribution of the space</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties Gray Color</td><td>Spreading</td><td>50%</td></tr>
<tr><td>Value</td><td>Dark shade / darkness</td></tr>
<tr><td>Chroma</td><td>Medium degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Cold Color/ Short Wavelength</td></tr>
</table>

4.3.4 The University of British Columbia

Figure 78: British Columbia (URL 76)

Table 14: Information about British Columbia

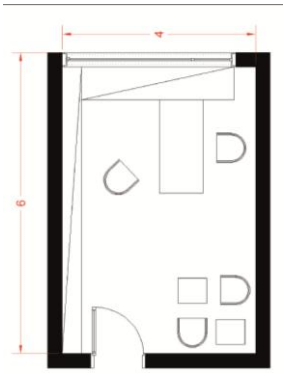
The name of university	Location	Established	Area
The University of British Columbia	Canada	1908	400 acres

The interior design was analyzed in terms of color and lighting, in terms of daytime lighting, the office was lit through a large window the size of the wall from the front facade of the office so that the spread of lighting was equal in the office between the workspace and the rest of the space, as well as for industrial lighting, it was an average centrality of the office and not directly on the workspace, but diffuse.

The colors varied between white and light beige in an integrated manner with the use of black, which created a balance between the colors in the office.

Table 15: Office Type 1 of British Columbia

<table>
<tr><td>Interior Environment</td><td colspan="3">1. Brief Description about Case Study</td></tr>
<tr><td rowspan="11"> 
Office in British Columbia (URL 77)

 
Plan of Offices in British Columbia (Author, 2021)

Layout and furniture arrangement
Floor area = 24 m2</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Appropriate for space</td><td colspan="2">Central Lighting</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties Beige</td><td>Spreading</td><td>70%</td></tr>
<tr><td>Value</td><td>Light shade / Lightness</td></tr>
<tr><td>Chroma</td><td>Medium degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Warm Color / Long Wavelength</td></tr>
</table>

Chapter 5

CASE STUDIES - SELECTED ACADEMIC WORKPLACES OF JORDAN

5.1 Methodology of Selection and Analysis of Case Studies

This chapter describes the methodology used by the researcher in the study identifying the population, sample, tool, and sources for obtaining data for the study, and then the statistical methods used in order to analyze the results. Where the descriptive and analytical approach was used, which is based on determining the characteristics of the apparent sample, describing its nature and the quality of the relationship between its variables, causes, and trends, and recognizing its reality on the ground through conducting the field study and through a questionnaire survey in order to answer the study questions. In order to reach the results and submit the recommendations reached by the study.

This study focuses on interior design related problems in the academic-staff offices of design-related faculties of Jordan; especially in relation to color and lighting. The study targets the academic staff working at the design-related departments of universities so that the users are somehow informed of the elements of color and lighting in the design of the interior spaces.

Table 16: Information about the Studied Universities

Name of university	Yarmouk University	The University of Jordan	University of Petra
Logo			
Location of university	Irbid city in the north of Jordan	Amman city in the middle of Jordan	Amman city in the middle of Jordan
State / Private	State	State	Private
Founded	1976	1962	1991
Number of faculties	15	20	8
Design related departments in the faculty	Department of architecture Department of design Interior design Graphic Design Industrial Design Fashion Design	Department of architecture Department of interior architecture	Department of architecture Department of interior architecture
Total number of faculty members	928	1,637	193
Number of students	45,196	54,236	8,028

Figure 79: Map of Jordan – Showing the Locations of the Case Studies (URL 78)

- **Case Studies**

5.1.1 Yarmouk University Offices Analyzing

Figure 80: Yarmouk University (Author, 2021)

Figure 81: Faculty of Architecture in Yarmouk University (Author, 2021)

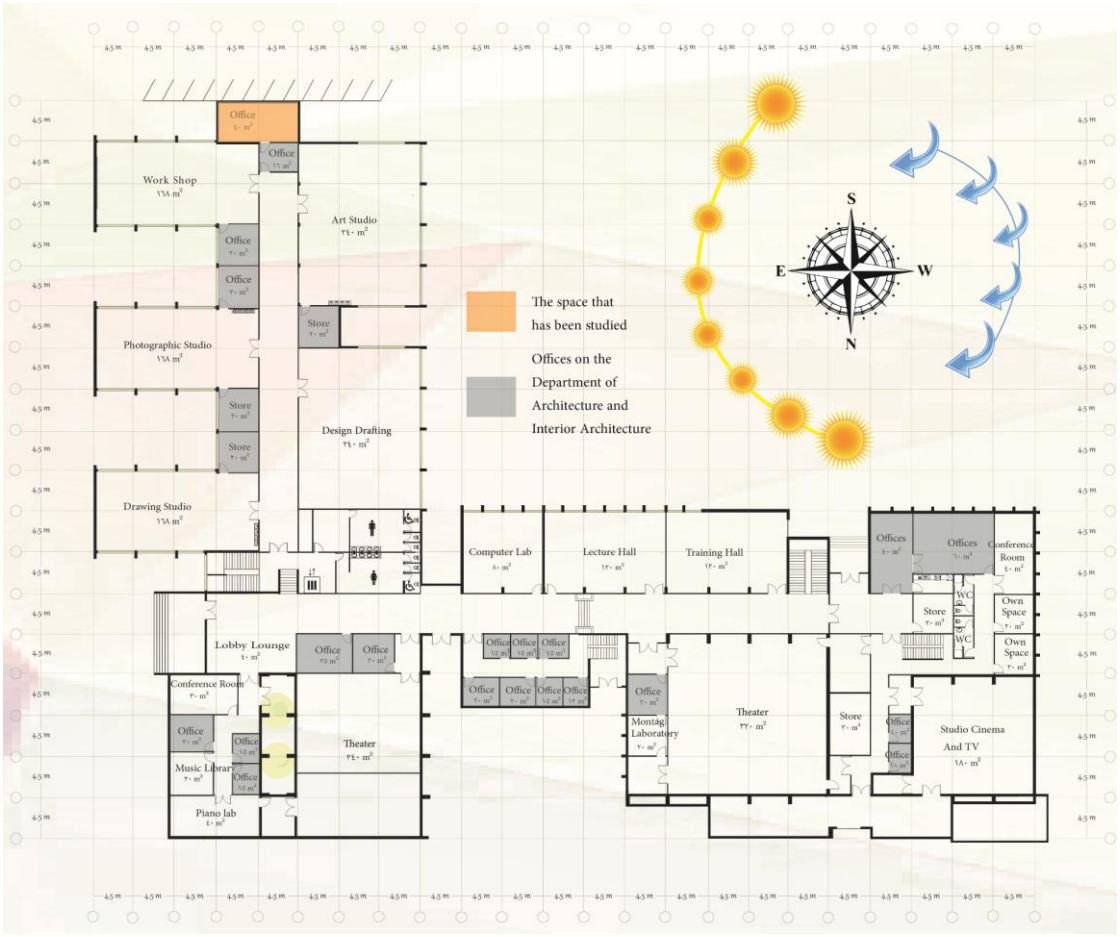
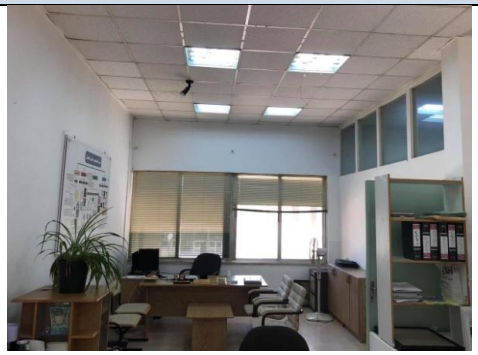
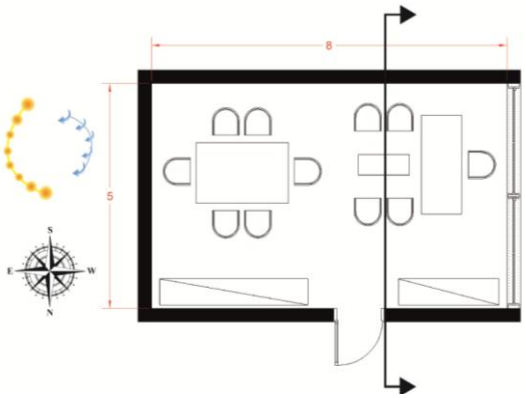
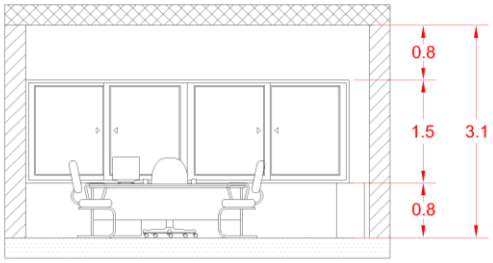


Figure 76: Plan of Faculty of Architecture in Yarmouk University (Yarmouk University Archive)

Table 17: Office Type of Yarmouk University

<table>
<tr><th>Interior Environment</th><th colspan="3">1. Brief Description about Case Study</th></tr>
<tr><td rowspan="11"> 
Yarmouk University Offices Analyzing (Author, 2021)
 
Plan of Offices (Author, 2021)

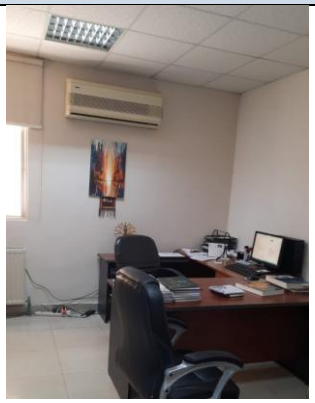
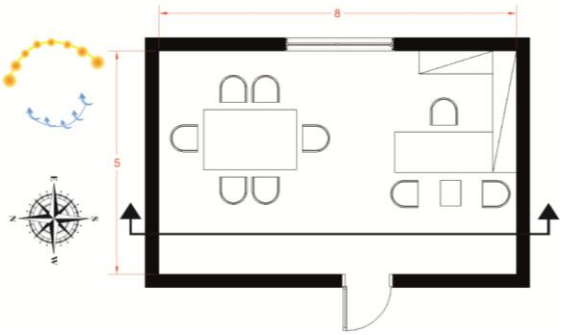
Layout and furniture arrangement
Floor area = 30 m2 / Length = 8 Width = 5
 
Section of Offices (Author, 2021)
Height = 3.1 meters
Height of window = 1.5 meters
Height of window from floor = 0.8 meters</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Day lighting is appropriate for space and focused on the desk</td><td colspan="2">Artificial lighting is spread according to the interior design</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties White Color</td><td>Spreading</td><td>60%</td></tr>
<tr><td>Value</td><td>Light shade / Lightness</td></tr>
<tr><td>Chroma</td><td>High degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Clear</td></tr>
</table>

5.1.2 University of Petra Offices Analyzing

Figure 82: University of Petra (Author, 2021)

Figure 83: Faculty of Architecture and Design in University of Petra (Author, 2021)

Table 18: Office Type 1 of University of Petra

<table>
<tr><th>Interior Environment</th><th colspan="3">1. Brief Description about Case Study</th></tr>
<tr><td rowspan="11"> 
University of Petra Offices Analyzing 1 (Author, 2021)
 
Plan of Offices 1 (Author, 2021)

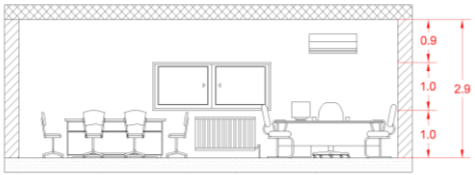
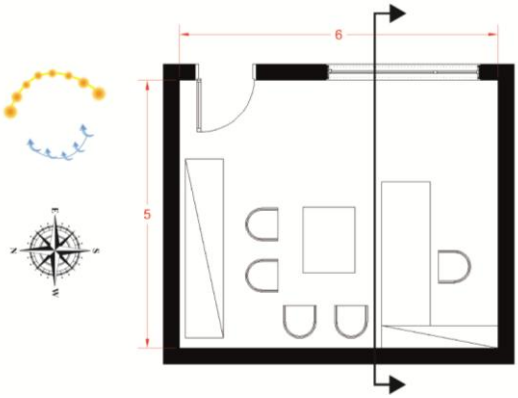
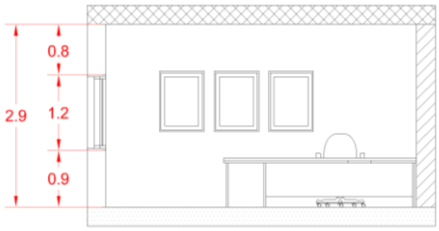
Layout and furniture arrangement
Floor area = 40 m2
 
Section of Offices (Author, 2021)
Height = 2.9 meters
Height of window = 1.0 meters
Height of window from floor = 1.0 meters</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Day lighting is central, on average, with little scattering</td><td colspan="2">Artificial lighting is decentralized, in the middle of the space and few</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties Beige Color</td><td>Spreading</td><td>%80</td></tr>
<tr><td>Value</td><td>Light shade / Lightness</td></tr>
<tr><td>Chroma</td><td>Medium degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Warm Color / Long Wavelength</td></tr>
</table>

Table 19: Office Type 2 of University of Petra

<table>
<tr><th>Interior Environment</th><th colspan="3">1. Brief Description about Case Study</th></tr>
<tr><td rowspan="11"> 
University of Petra Offices Analyzing 2 (Author, 2021)
 
Plan of Offices 2 (Author, 2021)

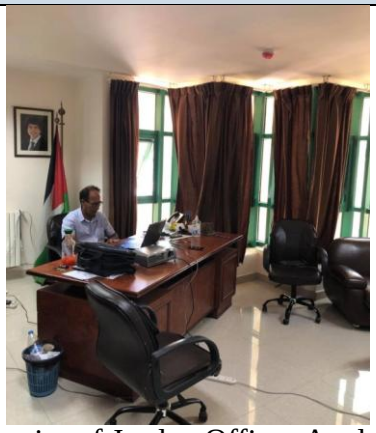
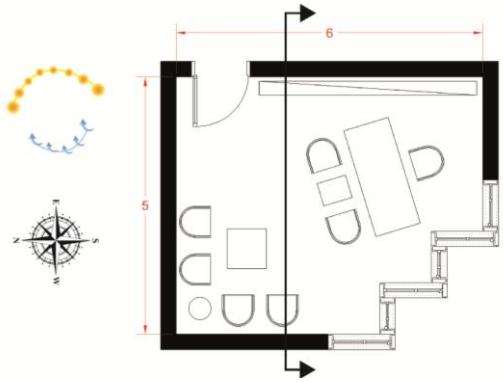
Layout and furniture arrangement
Floor area = 30 m2
 
Section of Offices (Author, 2021)
Height = 2.9 meters
Height of window = 1.2 meters
Height of window from floor = 0.9 meters</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Day lighting is diffused from the left</td><td colspan="2">Artificial lighting is functional at the office only, not enough</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties Blue Color</td><td>Spreading</td><td>25%</td></tr>
<tr><td>Value</td><td>Dark shade / darkness</td></tr>
<tr><td>Chroma</td><td>Medium degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Cold Color/ Short Wavelength</td></tr>
</table>

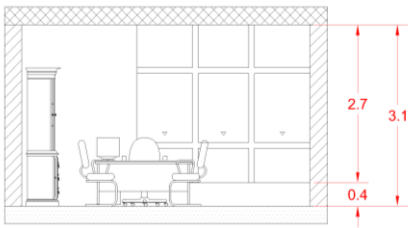
5.1.3 University of Jordan Offices Analyzing

Figure 84: University of Jordan (Author, 2021)

Figure 85: Faculty of Architecture in University of Jordan (Author, 2021)

Table 20: Office Type of University of Jordan

<table>
<tr><td>Interior Environment</td><td colspan="3">1. Brief Description about Case Study</td></tr>
<tr><td rowspan="11"> 
University of Jordan Offices Analyzing (Author, 2021)
 
Plan of Offices 2 in University of Jordan (Author, 2021)

Layout and furniture arrangement
Floor area = 27 m2
 
Section of Offices (Author, 2021)
Height = 3.1 meters
Height of window = 2.7 meters
Height of window from floor = 0.4 meters</td><td colspan="3">2. The Light Characteristics</td></tr>
<tr><td colspan="3">Selected Light types</td></tr>
<tr><td>Day lighting</td><td colspan="2">Artificial Lighting</td></tr>
<tr><td>Day lighting is wide diffusion and range, curtains are used to control the daylighting</td><td colspan="2">Artificial Lighting is randomly distributed on the sides, not in accordance with the furniture</td></tr>
<tr><td colspan="3">3. The Color Characteristics</td></tr>
<tr><td colspan="3">Selected Color Indicators</td></tr>
<tr><td rowspan="4">Visual Properties Beige Color</td><td>Spreading</td><td>%80</td></tr>
<tr><td>Value</td><td>Light shade / Lightness</td></tr>
<tr><td>Chroma</td><td>Medium degree of purity</td></tr>
<tr><td>Color Qualities</td><td>Warm Color / Long Wavelength</td></tr>
</table>

5.2 Study Population and Sample

- **Study Population:**

The study Population is faculty members in the Faculties of Architecture at Yarmouk University with 39 members, The University of Jordan with 34 members, University of Petra with 27 members, the total are 100 members, sample number is 80 people.

- **Study Sample:**

The total number there is 100 instructors and according to the source on methodology (Educational and psychological measurement). The study sample consists of 80 Faculty members in the Faculties of Design. 80 is a fit number (Krejcie & Morgan, 1970). Determining sample size for study activities. Educational and psychological measurement. Consequently, 80 questionnaires were analyzed to fulfill the study (Krejcie & Morgan, 1970).

5.2.1 Data Collection Sources

The researcher relies on two groups of sources: Secondary sources and Primary sources:

- **Secondary Sources:** The researcher relies on secondary sources to collect data on books, documents, previous studies, electronic articles, master's theses, and Ph.D. theses related to the effect of color and lighting on the academic performance of employees in the workplace. All of these studies were placed on the Precedent Studies focusing on color and lighting concerning office interiors.
- **Primary Sources:** The study relied on the questionnaire as a primary source for collecting its data. The researcher visited the places where some of the questionnaires were distributed, but not all of them due to Covid-19. The researcher visited some offices from all 3 universities,

but not all the offices due to pandemics. The researcher knows some people in the places which visited. Therefore, the researcher took some pictures of the places could reach.

5.2.2 Study Tool

The researcher developed the study tool ‘questionnaire’ after reviewing the literature review stage of previous studies on the subject of the study for which the questionnaire was designed and related to the subject of the study ‘the impact of color and lighting on the performance of employees: academic workplace’. The questionnaire was sent online due to the epidemiological conditions (Covid-19) that Jordan is going through, therefore a questionnaire was designed, and then sent to the study sample members by Email to answer it, and therefore the researcher collected the data. The researcher has definitely visited this place and generally has access, however, due to the Covid-19 pandemic, online has been chosen as a means to reach out to the users. I visited in the past, especially Yarmouk University. I know it well because I was a student there. The response of the study sample individuals, through the link that is created directly, and exported to an excel sheet, and then using this data for the purpose of analysis by entering it into the SPSS program to conduct the necessary statistical tests for the purpose of this study. At first, the researcher sent the questionnaire to 80 people, but not everyone responded, 65% responded and 35% did not respond, and because my study requires 80 people to answer, I sent it again to others in order to complete the required number of 80 individuals.

Also, some members of the study sample have knowledge of the researcher, because they are members of the faculty and who were associated with the researcher during his university studies. The researcher had personal contacts from the employees of

those universities, which facilitated the conduct of the survey, and thus he knew some of the people there.

The researcher developed the study tool 'the questionnaire' after reviewing a number of previous studies related to the subject of the study for which the questionnaire was designed and related to the subject of the study ‘the impact of color and lighting on the performance of employees: academic workplace’.

Table 21: Study Tool ‘Questionnaire’

The study tool ‘questionnaire’		
Part	Type	Number of questions
First Part	Personal information	5 questions
Second Part	Lighting	5 questions
Third Part	Color	5 questions
Fourth Part	Internal environment quality	5 questions
Fifth Part	Furniture	5 questions
Sixth Part	Outside view	5 questions

To answer the paragraphs of the questionnaire, the researcher determined the Likert scale consisting of five points, and by giving the standard weight of the sample trends as follows:

- **The Standard Weight of the Ladder of the Study Sample Responses According to the Likert Five-Scale**

Table 22: The Likert Five-Scale

Answer	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Standard weight	1	2	3	4	5

To determine the level of approval and compare it with the arithmetic means, to answer the study questions, the researcher identified three levels ‘high, medium, low’ based on the following equation:

Duration = ‘upper limit of degree - minimum grade’ / number of levels.

(5-1) /3=4/3=1.33 levels are as follows:

1- Low approval score (1- 2.34)

2- Medium approval score (2.34 - 3.68).

3- High degree of approval (3.68-5).

5.2.3 A Scale for Determining the Level of Suitability for the Arithmetic Mean

Table 23: Level of Suitability

Mean	Rating
1-less than 2.34	Low
2.34 - less than 3.68	Medium
3.68-5	High

5.2.4 Reliability Analysis

To demonstrate the consistency of the study tool, the researcher used the Cronbach's Alpha coefficient of reliability, Cronbach’s alpha tests to see if multiple-question Likert scale surveys are reliable. These questions measure latent variables hidden or unobservable variables like a person’s conscientiousness, neurosis, or openness. These are very difficult to measure in real life. Cronbach’s alpha tells you how closely related a set of test items are as a group. Altman (1991), the strength of agreement for the Kappa statistic that considers the ratio if the alpha Cronbach coefficient exceeds a value 0.60 is appropriate and gives the study tool sufficient

reliability to represent the study tool. Coefficient test, Cronbach's alpha test is used for the stability axis to ensure that it gives the same result as it does every time the test and re-measurement are performed, indicating that the level of internal consistency is completely identical (Ahmed, 2018).

The internal consistency of the questionnaire paragraphs was verified as being the most used measure by researchers to achieve this purpose (Morera & Stokes, 2016) (McNeish, 2018).

5.2.5 Cronbach's Alpha Parameters for Search Variables

Table 24: Cronbach's Alpha

		Cronbach's Alpha
Workplace environment	Lighting	0.64
	Color	0.65
	Internal environment quality	0.63
	Furniture	074
	Outside view	0.84
	Total coefficient	0.80

The results appeared according to Table 24, where the Cronbach's coefficient showed the dimensions and paragraphs of all the variables and the effect of organizing the internal space in a appropriate percentage as it exceeded 0.60. The total value of Cronbach's alpha coefficient for all variables was equal to 0.80, which is a high percentage according to (Gliem & Gliem, 2003), and therefore we find that the study tool has stability and can achieve the goals for which it was set.

5.2.6 Statistical Treatment Used

To achieve the objectives of the study, answer its questions and test its hypotheses - the Statistical Package for Social and Economic Sciences (SPSS) program was used

by analyzing the descriptive demographic characteristics of the study sample, in addition to using a number of statistical data to test its hypotheses as follows:

1- Cronbach factor alpha test to ensure the stability of the study instrument;

To demonstrate the consistency of the study tool, Cronbach’s alpha tests to see if multiple-question Likert scale surveys are reliable. These questions measure latent variables—hidden or unobservable variables like a person’s conscientiousness, neurosis, or openness. These are very difficult to measure in real life. Cronbach’s alpha tells you how closely related a set of test items are as a group.

To demonstrate the consistency of the study tool, Cronbach's alpha test to see if multi-question Likert scale surveys are reliable. These questions measure latent variables - hidden or unobservable variables such as a person's awareness, neurosis, or openness. It is difficult to measure in real life. Cronbach's Alpha tells you how closely a set of test items relate as a set (Altman, 1991). And the strength of agreement for the kappa statistic, which is considered the ratio if Cronbach's alpha coefficient exceeds 0.60 is appropriate and gives the study tool sufficient reliability to represent the study tool, and if it comes 0.60 - 0.90 it is considered a appropriate ratio and gives appropriate stability and reliability according to Rodriguez and Maeda (2006). The Cronbach's alpha test to check the internal consistency of questionnaire items is the most widely used measure by researchers for this purpose (Moreira & Stokes, 2016; McNeish, 2018).

Cronbach's alpha test for stability axis is used to ensure that it gives the same result as it does each time the test and re-measurement are performed, indicating that the level of internal consistency is exactly the same (Ahmed, 2018).

2- Frequencies and percentages for analyzing the demographic characteristics of the study sample are calculated;

Through the frequencies and percentages that contribute to describing the demographic characteristics of the study sample, which gives the researcher an idea about the nature of the study community and its sample, and contributes to the researcher's understanding of the characteristics of the sample in that the study sample can answer questions and paragraphs of the study tool in order to analyze it and the ability to generalize the results to the study community.

Standard deviation was calculated in order to measure the dispersion of the answers of the study sample members around the questions, and their spread around the arithmetic mean, which based on the standard deviation values shows the extent to which the study sample members agree to answer the questions asked.

3- The arithmetic mean and random deviation is calculated to answer the study questions;

By calculating the arithmetic averages, the level of concordance (low - medium - high) can be determined, and therefore the study questions that measure the importance of the axis or variable can be answered by calculating the weighted general arithmetic mean of the questions of the axis or variable and determining its level of importance.

4- Testing the normal distribution of the study data using (Kolmogorov-Smirnov) test;

In order to verify the absence of any statistical problems in the study data that may be negatively reflected in testing the study's hypotheses, such as not adopting the

normal distribution of the data, which could lead to the inability to explain or predict the situation.

5- One-sample test (T-test) to test the study hypotheses;

In order to test the hypotheses of the study at the level of statistical significance ($\alpha \leq 0.05$), as the value of (T) if it is statistically significant at the level ($Sig \leq 0.05$), we accept the main hypothesis, and if the level of significance is ($Sig > 0.05$), we reject the main hypothesis and accept the null hypothesis.

By calculating the arithmetic mean (mean value): we can determine the level of agreement (importance) (low - medium - high), and thus the study questions that measure the importance of the axis or variable can be answered by calculating the weighted general arithmetic mean of the variable questions and the determination of the level of importance.

By calculating the standard deviation: it can measure the dispersion of the answers of the sample members and determine the extent of agreement between them on the level of agreement 'importance' and the extent of the difference in it. As the value of the standard deviation decreases and approaches the correct one, the standard deviation indicates a weak dispersion, that is, the members of the sample agree with a large percentage on the answer to a particular question.

5.3 Descriptive Analysis for Demographic Characteristics

The outputs of the study data analysis through the (SPSS) program and the researcher presents these outputs and explains their results in order to answer the study questions.

5.3.1 Frequencies and Percentages for Analyzing the Demographic

Descriptive analysis highlights the demographic characteristics of the study sample: Frequencies and percentages for analyzing the demographic characteristics of the study sample.

Table 25: The Results of personal information of the study sample

		Repetition	Percentage
Gender	Male	42	52.5%
	Female	38	47.5%
	Total	80	100%
Age	From 18 - 25	0	0%
	From 26 - 30	20	25%
	From 31 – 40	17	21.2%
	From 40 – 45	43	53.8%
	Total	80	100%
Educational attainment	Assistant	1	1.3%
	Masters	21	26.3%
	PhD	58	72.4%
	Total	80	100%
Social status	Single	11	13.7%
	Married	63	78.8%
	Divorced	6	7.5%
	Total	80	100%
Scientific experience	5 years or less	6	7.5%
	5-9 years	20	25%
	10 years	14	17.5%
	11 – 20 years	16	20%
	20 or more	24	30%
	Total	80	100%

The ratio of the number of males and females is close and that the percentage of males is higher than that of females by 5%, as the percentage of males is 52.5% while the percentage of females is 47.5% of the study sample.

In addition, the percentage of the study sample is higher than the age of 31 years is 75%, and those who are 30 years old or younger are 25%, and this gives that the sample members are of old ages and have stability and experience.

It was also found that the percentage of the sample members with a higher academic degree, MA and Ph.D., is 98.7% from Faculty members in the Faculties of Architecture at Yarmouk University, The University of Jordan, University of Petra. Therefore, most of the sample members possess a higher degree of academic achievement and this is what gives the study reliability and strength.

It was also found that most of the study sample are married and have social stability, with a percentage 78.8%.

The majority of the sample members are those with more than 10 years of experience 67.5%, and thus they are able to answer accurately the questions and paragraphs of the study tool, which gives the study strength and accuracy in answering the hypotheses and questions of the study.

5.3.2 Descriptive Statistics of the Variables

The researcher calculated a number of statistical measures such as 'mean, standard deviation, and rank and acceptance level' in order to measure the response of the study sample members and their agreement on the level of importance of the variables or their differences. It also gives the order of the variables and their questions according to the level of importance by comparing the arithmetic mean for each of them. The standard deviation also gives a measure of dispersion about the agreement or difference between the answers of the study sample members.

- **Issues Related to Lighting**

To determine the level of importance of the lighting, variable in detail. Table 26 shows the mean results of the variable questions in addition to the standard deviation values and the level of their order of importance, and the level of importance of

lighting in the workplace. To find out the level of importance of work environment variables in:

Table 26: Descriptive Statistics of the Lighting Variable

No	Item	Rank	MEAN	SD	Disagree ASSESMENT
1	Daylighting is an order that reflects the employee's comfort in the workplace	1	4.71	0455	HIGH
2	Daylighting is a positive impact on the psyche of the individual in the workplace	3	4.34	0.635	HIGH
3	When the lighting is sufficient, it have a positive impact on the employee	5	4.13	0.802	HIGH
4	Appropriate guidance for windows according to the construction site has a positive impact on the employee	2	4.68	0.497	HIGH
5	Taking into account the type and intensity of lighting has an impact on employee productivity	4	4.13	0.753	HIGH
Lighting		4.31			HIGH

Through the results presented in Table 26, it was found that the arithmetic averages of the lighting variable questions ranged between 4.13 - 4.71 with high degrees of approval and evaluation for all the paragraphs, as the study sample members believed that lighting is important in enhancing the concept of the performance of workers within the organization, and what enhances that. The weighted general arithmetic mean for this dimension equals 4.31 with a high rating. Question 1 came first, which states that “Daylighting that reflects the employee's comfort in the workplace” while question 4 came in the second place. Which states that “Appropriate guidance for windows visible in the close surroundings site has a positive impact on the employee “Question 2 Came in the third place, which stated that “Daylighting has a positive

impact on the psyche of the individual in the workplace" and all the paragraphs came with a high degree of approval, while question 3 came in the last position, which states "When the lighting is sufficient, it have a positive impact on the employee" with a high degree, with a consensus on the level of importance as shown in the values of the criterion, the deviation that does not exceed the value of 1 This indicates the presence of weak dispersion in the responses of the study sample on the vertebrae of the axis related to illumination. Therefore, the agreement in the answers of the study sample individuals indicates that of lighting is of the high importance in the workplace on the performance of users.

- **Issues Related to the Color Variable**

To determine the level of importance of the color variable in detail. Table 27 shows the results of the mean of the variable questions in addition to the standard deviations values and the level of their order of importance, and the level of importance of color in the workplace.

Table 27: Descriptive statistics of the Color variable

No	Item	Rank	MEAN	SD	Disagree ASSESMENT
1	Choose colors thoughtfully is important and affects the workplace	1	4.69	0.493	HIGH
2	The wrong choice of colors may be affecting the work of employee negatively	3	4.42	0.897	HIGH
3	Choice of colors affects employee psychology	2	4.42	0.759	HIGH
4	Colors should be tested according to design studies, not the company logo colors	4	4.14	0.775	HIGH
5	Colors have effects and meanings regardless of aesthetic values	5	4.13	0.905	HIGH
Color		4.12			HIGH

Through the results presented in Table 27, it was found that the arithmetic averages of the questions related to the effects of color ranged between 4.13-4.69 with high degrees of approval, as the study sample individuals see that the colors are important and affect in the workplace. The work environment is important in enhancing the concept of employee performance within the organization. What reinforces this is that the weighted general arithmetic means for this dimension is equal to 4.21 with a high evaluation score as in questions 1. It came in the first place and reads “Color is important and affects the employee” while questions 3 came in second place, which states: “Choice of colors affects employee psychology". Questions 2 came in third place, and it reads: “The wrong choice of colors may be the cause of employees’ low motivation." And all the paragraphs came with a high degree of acceptance, while questions 5 Came last, which states that " Colors have connotations and meanings regardless of aesthetic choices” with a high degree as well, with a consensus on the

level of importance. It is also evident from the standard deviation values that do not exceed the value of 1, which indicates the weak dispersion in the answers. Accordingly, the study sample members unanimously agreed on the questions of the axis related to color in the workplace, and thus the great importance of color in the workplace on the performance of the staff.

- **Issues Related to Environmental Quality**

To determine the level of importance of the environmental quality variable for color and lighting in detail, the Table 28 shows the means values of the variable questions in addition to the standard deviations values and the level of their order of importance, and the level of importance of environmental quality variable for Color and light in the workplace.

Table 28: Descriptive Statistics of the Internal Environment Quality Variable

No	Item	Rank	MEAN	SD	Disagree ASSESMENT
1	The appropriate temperature has a positive effect on the employee	3	4.48	0.729	HIGH
2	Caring for the appropriate humidity in the workplace affects the employee's comfort	4	4.20	0.488	HIGH
3	Conditioning is important and has a positive impact on the employee	2	4.50	0.675	HIGH
4	Precise workplace hygiene improves employee psychology	1	4.53	0.595	HIGH
5	Use of right materials in the workplace increases the efficiency of the employee	5	4.03	0.779	HIGH
internal environment quality		4.34			HIGH

Through the results presented in Table 28, it was found that the arithmetic averages of the internal environment quality items ranged between 4.03 - 4.53 with high degrees of approval and evaluation for all items as seen by the study sample. Colors in the work environment are important in enhancing the concept of employee performance within the organization, and what reinforces this is that the overall weighted average for this dimension is 4.34 with a high evaluation score. Question 4 came in the first place which states: “Precise workplace hygiene improves employee psychology” while question 3 came in second place, which states that “Conditioning is important and has a positive impact on the employee”. Question 1 ranked in the third place which states:” Conditioning is important and has a positive impact on the employee”, and all paragraphs came with a high degree of approval, while question 5 came in last place, which states that "Use of right materials in the workplace increases the efficiency of the employee "Also of high rating, with agreement on the level of importance as indicated by the standard deviation values and the value does not exceed 1, which indicates a weak dispersion in the responses of the study sample individuals on the axis. Question related to the quality of the internal environment, and thus agreement regarding the answers of the study sample members the quality of the internal environment quality in the workplace has great importance for the performance of workers.

- **Issues Related to Orientation and Appropriate View**

To determine the level of importance of the outside view variable for color and lighting in detail, the Table 29 shows the means values of the variable questions in addition to the standard deviations values and the level of their order of importance, and the level of importance of outside view variable for Color and light in the workplace.

5.3.2 Descriptive Statistics of the Outside View Variable

Table 29: Descriptive statistics of the outside view variable

No	Item	Rank	MEAN	SD	Disagree ASSESMENT
1	Connection to the outside with a appropriate view increases the employee's performance and motivation	4	3.85	0.873	HIGH
2	A person should communicate/have eye contact with the outside - for example, through the window	5	3.72	1	HIGH
3	Outside view in the workplace influences the employee's motivation	3	3.88	0.753	HIGH
4	The location of the window openings must be taken into account when designing the working environment	1	4.39	0.771	HIGH
5	The density of plants affects the productivity and improvement of employee mood	2	4.04	0.719	HIGH
outside view		3.97			HIGH

Through the results presented in Table 29, it was found that the arithmetic averages of the outside view items ranged between 3.72-4.39 with high degrees of approval and evaluation for all the questions, as the study sample indicates. The outside view in the workplace is important in enhancing the concept of the performance of workers within the organization, and what reinforces this is that the weighted general average for this dimension is equivalent to 3.97 with a high evaluation score, as in question 4. It came first and stated: “The location of window openings must be taken into account when designing the work environment,” as it was mentioned in question 5 In the second place, which states that “The density of plants affects productivity

and improves employee's mood.” question 3 Came in third place, which reads: "The outside view in the workplace affects the employee's response better."With a high degree of acceptance, while question 2 came last, which states that “a person should communicate with the outside - for example, through the window” with a high degree of evaluation as well, with a consensus on the level of importance as it is. Indicated by the standard deviation values that do not exceed the value of 1, Which indicates a low dispersion in the answers of the study sample members to the questions related to the outside view, and thus the compatibility of the responses of the study sample members with the high importance of the outside view in the work environment on the performance of employees.

5.3.3 Normality Test of the Study Data

To ascertain the validity of the study hypotheses and the absence of statistical problems, such as the irregularity of the normal distribution, which leads to the inability to interpret or predict the situation. The normal distribution test is used to ensure that the sample is representative of the original population by following the normal distribution method. Therefore, the value of (Sig > 0.05) must be rejected in order to accept the null hypothesis that the data follow a normal distribution.

- **Tests of Normality (Kolmogorov-Smirnov[a])**

Table 30: Tests of Normality

Item	Statistic	df	Sig.
Lighting	0.73	80	0.200*
Color	0.064	80	0.200*
Internal environment quality	0.062	80	0.200*
Furniture	0.093	80	0.081*
Outside view	0.041	80	0.200*

It was found from Table 30 that shows the outputs of the results of the statistical analysis of the SPSS program, and by looking at the results at the level of significance ($\alpha \leq 0.05$)), the data show the level of statistical significance all distribution ratios for all answers are greater than ($0.05 < sig$)), which is the level adopted in the study the statistic is then processed, thus accepting the null hypothesis indicating the moderation of the distribution (the data follow a normal distribution). It was found from table 30 that shows the outputs of the results of the statistical analysis of the SPSS program, and by looking at the results at the level of significance ($\alpha \leq 0.05$)), the data appears to follow the normal distribution where the level of statistical significance for all the proportions of the normal distribution of all answers was greater than 0.05, which is the level Adopted in the statistical study and its treatment, thus accepting the null hypothesis indicating the moderation of the distribution 'data follow the normal distribution'.

5.3.4 Study hypotheses test

- **Descriptive Statistics and One-Sample Test**

One independent test was used to test the hypotheses of the study at the level of statistical significance ($\alpha \leq 0.05$), where the value of (T) if it was statistically significant at the level ($Sig \leq 0.05$), then we accept the main hypothesis, and if the level of statistical significance is ($Sig > 0.05$), we reject the main hypothesis and accept the null hypothesis, and the arithmetic mean values of the study variables were found in order to know the level of importance, in addition to the standard deviation values to find out the extent to which the study sample members agree on the level of importance or their differences.

Table 31: Descriptive Statistics and One-Sample Test

No	Item	Rank	MEAN	SD	Disagree ASSESMENT	T-test	df	Sig. (2-tailed)
1	Lighting	2	4.31	1.12	HIGH	34.19	79	0.000*
2	Color	3	4.12	1.06	HIGH	34.48	79	0.000*
3	Internal environmen t quality	1	4.34	0.969	HIGH	42.58	79	0.000*
4	Furniture	5	3.96	1.03	HIGH	34.64	79	0.000*
5	Outside view	4	3.97	0.993	HIGH	36.98	79	0.000*

Through the results presented in Table 31, it was found that the arithmetic averages of the axes ranged between (3.96 -4.34) with a high degree of approval. Through the results presented in Table 31, it was found that the arithmetic mean of the axes ranged between 3.96 -4.34 with a high degree of approval ‘the level of importance’ in enhancing the concept of employee performance within the organization, where the axes came according to the results presented in the table and in the third column ‘Rank’ arranged according to importance and impact on the performance of employees ‘internal environment quality - lighting - color – outside view – furniture’ according to the opinions of the study sample, meaning that the quality of the internal environment with attention to color and lighting ranked first in terms of its importance in order to enhance the performance of employees, While lighting separately ranked second in terms of its importance in enhancing the performance of employees, and color ranked third in terms of attention to color in the workplace in consolidating the performance of employees, and the outside view ranked fourth

after attention to lighting and color in enhancing employee performance, while attention to furniture came Taking into account the quality of lighting and colors, it is ranked last in terms of importance, which is positively reflected on the performance of employees in the workplace. There is a consensus on efficacy and a high level of significance for all variables, and a consensus on the level of significance as evidenced by standard deviation values that do not exceed the value 1. This indicates a weak dispersion in the answers of the study sample members to the study questions and their variables. Therefore, there is the great agreement in the answers of the study sample members on the high importance of all aspects and variables of the work environment 'internal environment quality - lighting - color - outside view – furniture' on the performance of workers in the workplace. Promoting the concept of employee performance within the organization, as the axes came in order of importance and impact on the performance of employees 'internal environment quality - lighting - color - Outside view – furniture' according to the opinions of the study sample. There is a consensus on the effectiveness and the level of high importance for all variables, and the existence of consensus on the level of importance as shown by the standard deviation values that do not exceed the value 1. This indicates that there is a weak dispersion in the responses of the study sample on the study axes and variables. Therefore, the agreement in the answers of the study sample individuals is the high importance of all aspects and variables of the work environment on the performance of employees.

Lighting has a high level of importance from the point of view of the study sample, because daylighting is a matter that effects the employee's comfort, and has a positive effect on the psyche of the individual, and appropriate orientation of

windows towards the appropriate view, taking into account the type and intensity of lighting, in addition to adequate lighting, it have a positive impact on the employee.

Colors have a high level of importance from the point of view of the study sample, because the colors are through consistency of colors, choosing colors, not choosing the wrong colors, testing colors according to design studies, not the colors of the company logo, and choosing colors that have goals and meanings regardless of aesthetic. It have a positive impact on the employee. Colors have a high degree of importance from the point of view of the study sample, as the level of their importance came through the value of their arithmetic mean with a high value and within a high level of importance, that is, the selection of colors on the walls, for example, and the consistency of colors that reflect the lighting in addition to the harmony of colors with the colors of the company logo gives It is aesthetically pleasing and gives a appropriate psychological impression to the employees and thus have a positive impact on the performance of the employees in the workplace.

- **Main Objective**

  As can be seen from the results presented in Table 31, all (T) values became a statistical function at the significance level ($\alpha \leq 0.05$), where all (SIG <= 0.00) came for all variables, which is (<= 0.05). Therefore, we reject the null hypothesis that claims that there is no statistically significant relationship at the level of significance ($\alpha \leq 0.05$), and accept the main hypothesis that shows that there is a significant effect between color and lighting on the performance of workers in the workplace.

- **To Verify the Sub-Hypotheses**:

  H01: There is a big impact between lighting and employee satisfaction in companies.

The value of (t = 34.19) and in terms of (0.0000 <= 0.05) is a statistically significant value, and therefore we reject the null hypothesis claiming that there is no influence relationship between lighting and employee performance in companies, and we accept the first sub-hypothesis that confirms the existence of a significant effect between illumination and performance of the company employees.

H02: There is a huge impact between color and employee performance in companies.

The value of (t = 34.48) is statistically significant (0.0000 <= 0.05), which is statistically significant, and therefore we reject the null hypothesis claiming that there is no influence relationship between colors and the performance of company employees, and we accept the second hypothesis that confirms the existence of a significant effect between colors and performance Company employees.

Chapter 6

CONCLUSION

In this chapter, the results of the study will be presented together with its comparison with the results of previous studies that were presented in the theoretical section.

6.1 Conclusion

Conducting a field study on a group of academic members of design-related faculties of universities and determining the effects on their behavior and comfort, by knowing the extent of employee satisfaction with their internal work environment and the components that make up them, knowing the impact of these elements on the job performance of individuals, and knowing the level of this satisfaction from the viewpoint of the sample members.

After the extensive study that was listed during the previous chapters, a review of the study that was completed regarding the effects of each and a list of some global models and some local case studies and comparison, the analysis of the opinions and comments collected.

Accordingly, the study confirmed that the design of the workplace is closely related to the employee's job satisfaction and that color and lighting coordination in the workplace is of a high level of importance for employees.

The study emphasizes that the design of the workplace according to the internal environment quality variables, including selection and organization of furniture, and outside view has a high level of importance for users.

The study confirmed that designing the workplace with special attention to the quality of lighting (both daylighting and artificial lighting) and color coordination can have a positive effect that is reflected in the employee's job satisfaction. The study confirmed that the design of the workplace by paying attention to lighting and color coordination is closely related to the employee's job satisfaction and that lighting and color coordination in the workplace is of great importance for employees. Where the value (T=34.19) of the variable of illumination came with a high value and statistical significance, and the value (T=34.48) of the color variable came with a high value and statistical significance.

The study confirmed that designing the workplace with special attention to the factors such as the quality of the internal environment, selection and organization of furniture, and outside view has a positive effect that reflects on the employee's job performance, Where the value of (T=42.58) for the internal environment quality variable came with a high value and statistical significance, the value (T=34.64) of the furniture variable came with a high value and statistical significance, and the value (T=36.98) of the ‘outside view’ variable came with a high value and statistical significance as well.

These results are consistent with the results of a study by El-Zeiny (2018), which showed that office design has a substantial impact on the employees’ job satisfaction. And agreement with the result of a study by Samani et al (2018), which showed that

underscore the value of attention to employees' opinions and concerns when designing their work environments. And agreement with the result of a study (Mendis, 2016), which indicates that there is a strong positive relationship between workplace design and job performance of operational level employees.

The study confirmed that the shape and design of the internal environment of the workplace is one of the most important things that connect users to the place and repeat it more than once.

The study confirmed that the process of choosing colors is a double-edged sword that must be balanced in space, regarding its value and weight.

The study confirmed that the process of choosing colors in their correct proportions within the academic offices is a major part of the success or failure factors of the project. Furthermore, the process of choosing the correct color can be considered as an inexpensive process that needs only prior study.

The study confirmed that there are many factors affecting the choice of color, the most important of which are the functional factor, the climate, the colors of the surrounding environment, the individual taste of the parties to the architectural work, the customs and traditions of the peoples, the region and the country, the profession, and work. It has been observed that technological development has a direct impact on the color selection process, whether in the design process through automatic color mixing with appropriate accuracy through the computer and according to certain numbers that determine each color.

The study confirmed that there are several factors that affect the process of choosing colors in academic offices, such as the size of the place, working hours, culture, and the segment targeted by the design.

The study confirmed that colors have a great impact on the human psyche, only feelings occur in them, some of which are comfortable and relax the soul, and others make them strike. The revealing colors evoke joy and are more dynamic than dark colors, which are considered more rigid, and colors according to their types have effects on the human being.

The study confirmed that daylighting provides psychological and health comfort to a person. Daylighting and artificial lighting can be combined in creative ways to accentuate the beauty of academic office interiors.

This study focuses on two main study questions:

- What are interior design related problems in the academic-staff offices of design-related faculties of Jordan; especially in relation to color and lighting?
- To what extent do the issues related to color and lighting affect the user satisfaction of university-academic staff in their workplaces?

Specially designed workspaces, paying significant attention to color and lighting, reflected on the job satisfaction of the staff, and the working conditions that are part of his surroundings have a direct correlation with the performance of employees.

Starting from the problem of study and the study questions developed, and through the theoretical and applied study using analysis tools in order to reach to highlight the relationship between lighting and color and work environment and the performance of employees in the institution, which were studied in several local models, the researcher reached:

- The sample members are fully aware of the surrounding work conditions.
- There is a co-relation between the working conditions and the special attention to color and lighting in the office environment.

It can be recommended to give attention to daylighting in the workplace in addition to artificial lighting so that the lighting in the place becomes sufficient because it improves performance inside the workplace.

It can be proposed that each interior space should contain an external light source from an external opening.

It can be recommended that close attention be paid to the quality of the internal environment, and the choice of comfortable furniture, and attention to the outside view in the workplace for better performance .

It can be recommended to the registration of researchers and those interested in further study and study to develop systems of taste and color in offices and to find deep solutions that contribute to the efficient advancement of the office work environment, raising the functional efficiency of employees and encouraging them to innovate.

It can be recommended to work on applying models for office color and lighting systems that contain an element of creativity to simulate different architectural models around the world.

It can be recommended the media focus and dissemination of architectural works for offices with a clear visual impact, increasing awareness and interest in lighting and color systems for offices and the work environment.

It can be recommended when designing lighting, a number of additional factors must be taken into account for the function, which is the psychological and physiological impact of it on the human being.

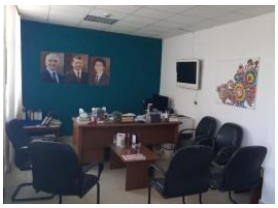
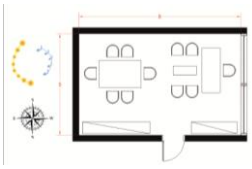
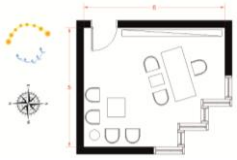
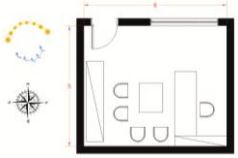
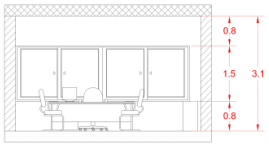
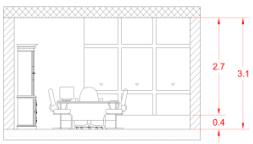
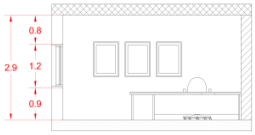
It can be recommended the designing office lighting distribution schemes, with certain international conditions and standards, as part of the engineering plans approved for public buildings by the Syndicate of Engineers and the competent authorities, and considering them as a condition for acceptance and approval.

It can be recommended to work on preparing a guide for designing office lighting models, by designers, containing the types of office lighting, modern used lamps, reflector, all technical and executive accessories, requirements, and standards to be followed when designing lighting, in addition to general and specific specifications. The same is true of colors in offices.

It can be recommended to use of modern technological development represented by advanced computer programs in the processes of mixing colors and determining the correct proportion of spaces.

- **Findings and Results for the Case Studies - Jordanian Universities**

Table 32: Office Type of University of Jordan

University	Yarmouk University	The University of Jordan	University of Petra
Photo			
Plan			
Ceiling & Window	The ceiling is 3.1 meters height with a window in 1.5 height and 5 meters width from the South.	The ceiling is 3.1 meters height with a window in 2.7 height and 4.5 meters diagonally located in the Southwest.	The ceiling is 2.9 meters height with a window in 1.2 height and 2.8 meters width located in the East.
Section			
Daylighting	The window direction and dimensions helps the day-lighting to enter the office wildly	The window is located diagonally in the southwest, which helps daylight to enter the office at most hours of the day and with a wide spread.	The window is located in the East that assures day- lighting spared from the very early morning hours enter the office.
Artificial lighting	Distributed on the edges of the middle area of the ceiling space in a way that makes it central	Distributed on both ends of the office space centrally	Focused lighting at the work area distributed on the sides.
View	Green space in the building.	A student walkway between the Faculty of Architecture and the corresponding faculties	Green outdoor space

- **Recommendations for Jordanian University**

Table 33: Office Type of University of Jordan

University	Yarmouk University	The University of Jordan	University of Petra
Plan	The office space was appropriate	The office space was appropriate	The office space was adequate and organized
Ceiling & Window	Appropriate height	Appropriate height	The height was a little low
Daylighting	Good use of daylight and it needs to be more controlled	Good use of daylight	Good use of daylight and it needs to be more controlled
Artificial lighting	Need to be increased, previous planning needed. was not spread wildly on the rest of the space.	Need to be increased Need to be more focused on work areas in the office with task lighting	Need to be increased It was focal on the work area, but was not spread enough on the rest of the space. previous planning needed.
View	Appropriate view	Green area could be increased.	Appropriate view

In the end, it can be said that there are many interior design related problems in the academic-staff offices of design-related faculties of Jordan; especially in relation to color and lighting, and it enabled the subject to see the relationship between working conditions and the satisfaction of the staff. Especially considering the COVID-19 pandemic period, the importance of individual workspaces has been increased enormously and considering academic staff of universities where they have been working through online teaching in the last almost two years, it should be emphasized how much more importance should be given in terms of study to the design of individual workplaces, which underlines the necessity behind this study.

6.2 Future Recommendations

By shedding light on the topic of interior design related problems in the academic-staff offices of design-related faculties of Jordan; especially in relation to color and lighting, the researcher found that this field has to be explored more as, following the questionnaire survey as well, there observed many problems related.

A field related to lighting and color, both includes countless parts and titles and has a great impact on the organization in general in terms of job satisfaction of users in particular. Throughout the study, the researcher tried as much as possible to link and highlight the mutual relationship between the two sides 'in terms of physical working conditions - lighting and color in addition to human resource performance.

Future work can include more study, regarding interior design related problems in the academic staff workspaces of Jordan, including other faculties and in addition to other factors such as material selections within the office spaces.

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APPENDICES

Appendix A: Questionnaire

Eastern Mediterranean University

Faculty of Architecture

Interior Architecture

Questionnaire

Mahmoud H. Almatarneh

18500748

Assoc. Prof. Dr. HACER BAŞARIR

2020

Investigation of Academic Workplaces of Jordan through Color and Lighting

Introduction: The following questionnaire is a helpful way to support my study, which is studying the topic of Color and lighting.

Color and lighting is an art and science of understanding people, and how to create functional space in companies through creative and technical solutions. It is also to improve the quality of life occupants and make it aesthetically attractive. Workplace interior organizing is a key factor in job satisfaction so it affects employee's work includes the simple size of the target group for professors in the College of Architecture and College of Design.

The aim of this study is to find out the impact of color and lighting on the performance of academic members of design related faculties in their offices. Conducting a field study on a group academic member of design related faculties of universities and determining the effects on their behavior and comfort.

Therefore, we kindly ask that you answer the following questions comfortably so that we can assist you in the future.

Definition: I am the student Mahmoud Hani Al-Matarneh from the Department of Interior Architecture at Eastern Mediterranean University and I am studying a master’s degree in the field of interior architecture, and I am doing this study in order to achieve the requirements of my thesis

Thanks: There is no doubt that your responses help the study be more accurate and well-informed. In this study, please fill out the questionnaire with full transparency and clarity, and you have the option to stop answering whenever you wish, knowing that the results of this questionnaire are very confidential, and thank you for your cooperation with us.

For more information, please contact the following e-mail:

Searcher's Email: Matarneh80@gmail.com

Professor's Email: hacer.basarir@emu.edu.tr

With all gratitude and appreciation

Researcher: Mahmoud Hani Al-Matarneh

Investigation of Academic Workplaces of Jordan through Color and Lighting

Note: Please put a X in the right place

First: personal information

- **Gender**

Male □ Female □

- **Age**

From 18 - 25 □ From 26 - 30 □ From 31 – 40 □

From 40 – 45 □

- **Educational attainment:**

Assistant □ Masters □ PhD □

- **Social status:**

Single □ (33) Married □ (47) Divorced □ Widowed □

- **Work experience**

5 years or less □ 5 years or more □ 10 years □

11 – 20 years □ 20 or more □

Table of Lighting

The Number	The Questions	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
1	Natural light an order that reflects the employee's comfort in the workplace					
2	Natural lighting is a positive impact on the psyche of the individual in the workplace					
3	When the lighting is sufficient, it will have a positive impact on the employee					
4	Good guidance for windows according to the construction site has a positive impact on the employee					
5	Taking into account the type and intensity of lighting has an impact on employee productivity					

Table o Color

The Number	The Questions	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
1	Color consistency Important and affects the workplace					
2	The wrong choice of colors may be the cause of employee laziness					
3	Choice of colors affects employee psychology					
4	Colors should be tested according to design studies, not the company logo colors					
5	Colors have goals and meanings regardless of aesthetic aesthetic					

Fourth: Internal Environment Quality

The Number	The Questions	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
1	The appropriate studied temperature has a positive effect on the employee					
2	Caring for the appropriate humidity in the workplace affects the employee's comfort					
3	Conditioning is important and has a positive impact on the employee					
4	Precise workplace hygiene improves employee psychology					
5	Use of right materials in the workplace increases the efficiency of the employee					

Fifth: Furniture

The Number	The Questions	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
1	The employee wants furniture that is out of the ordinary					
2	Comfortable furniture and choosing furniture with correct human dimensions clearly contributes to employee productivity					
3	The innovation component of furniture design is of great importance in breaking the employee's routine					
4	Innovation in furniture design is rare in our society					
5	Innovation in furniture design gives an incentive to the employee and increases productivity					

Sixth: Outside View

The Number	The Questions	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
1	The right outside view increases the employee's comfort by a very large percentage					
2	A person must communicate with the outside - for example, through the window					
3	Outside view in the workplace influences the employee's response better					
4	The location of the window openings must be taken into account when designing the working environment					
5	The density of plants affects the productivity and improvement of employee mood					

The questionnaire ended here

Other notes you want to add:

*

*

*

*

Appendix B: Application for Ethical Approval

Doğu Akdeniz Üniversitesi
"Erdem, Bilgi, Gelişim"

Eastern Mediterranean University
"Virtue, Knowledge, Advancement"

99628, Gazimağusa, KUZEY KIBRIS / Famagusta, North Cyprus, via Mersin-10 TURKEY
Tel: (+90) 392 630 1995
Faks/Fax: (+90) 392 630 2919
E-mail: bayek@emu.edu.tr

Etik Kurulu / *Ethics Committee*

Reference No: ETK00-2021-0028 19.01.2021

Subject: Your application for ethical approval.

Re: Mahmoud Almatemeh (18500748)

Faculty of Architecture

EMU's Scientific Research and Publication Ethics Board (BAYEK) has approved the decision of the Ethics Board of Architecture (date: 18.01.2021, issue: 2021/01) granting Mahmoud Almatemeh from the Faculty of Architecture to pursue with his MA thesis titled **"The impact of color and lighting on the performance of employees in the workplace"** supervised by Assoc. Prof. Dr. Hacer Başarır.

Best Regards

Prof. Dr. Yücel Vural

Chair, Board of Scientific Research and Publication Ethics - EMU

YV/şk.

www.emu.edu.tr

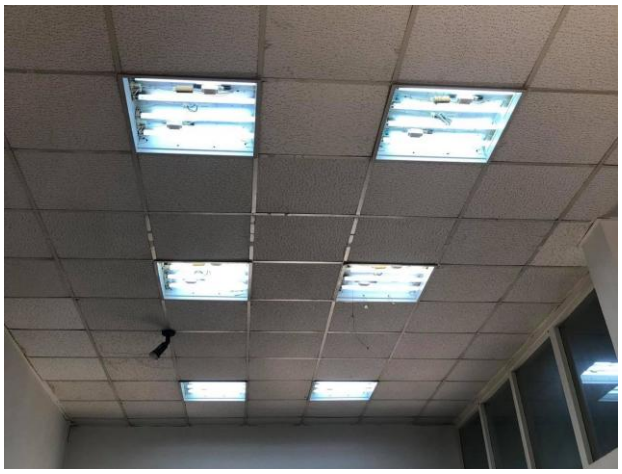
Figure 86: Application for ethical approval (Author, 2021)

Appendix C: Yarmouk University Offices Analyzing

Yarmouk University was visited on the 28 of March 2021. The researcher would like to acknowledge the head of the design department and all the professors who own this office, for their permission to take photographs in addition to their answers to the questionnaire survey.

Yarmouk University Offices (Author, 2021)

Yarmouk University Offices (Author, 2021)



Yarmouk University Offices (Author, 2021)

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