THE ROLE OF NIGHT LIGHTING TO EXPOSE THE ARCHITECTURAL AESTHETICS OF BUILDING FORMS

A THESIS SUBMITTED TO THE INSTITUTE OF GRADUATE STUDIES OF NEAR EAST UNIVERSITY

By
MOHAMMED MUSTAFA HASAN

In Partial Fulfilment of the Requirements for the Degree of Master of Science in Architecture

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Approval of Director of Institute of Graduate Studies

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We certify that this thesis is satisfactory for the award of the degree of Master of Science in Architecture

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

The study examines the role of night lighting in highlighting the aesthetics of the architectural form of buildings with an aim of understanding the external night lighting of different spaces. Such follows compelling evidence showing that lighting continues to play a key role in the definition and formation of architecture, and visual perception of architectural composition like architectural form, and night lighting. Four international cases studies comprising of theEmirates Palace Hotel, The Building Flame Towers, National Center for the Performing Arts, Palestinian Pension Authority, and two local case studies drawn from in Erbil,Jalil Khayat Mosque and Erbil Rotana Hotel were used for fulfilling the intended study aims. Comparative examinations of these cases studies were conducted so as to establish both similarities and differences regarding the role of night lighting to expose the architectural aesthetics of building forms. The study findings showed that shape, color, texture, finishing materials, and construction system lighting elements significantly influence a building's architectural identity. It was also discovered that night lighting distinguishes the building from the rest of the adjacent buildings, which encourages architectural exclusivity and creativity in the design of the buildings. It was concluded that it is important to highlight public buildings at night by lighting to protect the building at night, identifying the place, determine the elements of its facades.

Keywords:Architectural aesthetics; building form; night lighting; industrial lighting; natural lighting.

ÖZET

Çalışma, farklı binaların dış gece aydınlatmasını anlamak amacıyla binaların mimari formunun estetiğini vurgulamada gece aydınlatmasının rolünü incelemektedir. Bu, aydınlatmanın mimarinin tanımlanmasında ve oluşumunda ve mimari form ile gece aydınlatması gibi mimari kompozisyonun görsel algısında kilit bir rol oynamaya devam ettiğini gösteren zorlayıcı kanıtları takip eder. Emirates Palace Hotel, Building Flame Towers, Ulusal Gösteri Sanatları Merkezi ve Filistin Emeklilik Kurumu'ndan oluşan dört uluslararası vaka çalışmasının yanında, Erbil Jalil Khayat Camii ve Erbil Rotana Otel'den alınan iki yerel vaka çalışması, çalışmanın amaçlarının yerine getirilmesi için kullanıldı.

Bu olguların karşılaştırmalı incelemeleri, bina formlarının mimari estetiğini ortaya çıkarmak için gece aydınlatmasının rolüne ilişkin hem benzerlikleri hem de farklılıkları belirlemek amacıyla yapılmıştır. Çalışma bulguları, şekil, renk, doku, kaplama malzemeleri ve inşaat sistemi aydınlatma elemanlarının bir binanın mimari kimliğini önemli ölçüde etkilediğini göstermiştir. Ayrıca, gece aydınlatmasının binayı bitişik binaların geri kalanından ayırdığı ve bu da binaların tasarımında mimari münhasırlığı ve yaratıcılığı teşvik ettiği keşfedildi. Geceleri binayı korumak, yeri belirlemek, cephelerinin unsurlarını belirlemek için geceleri kamu binalarını aydınlatarak öne çıkarmanın önemli olduğu sonucuna varılmıştır.

Anahtar Kelimeler:Mimari estetik; bina formu; gece aydınlatması; endüstriyel aydınlatma; doğal aydınlatma.

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LIST OF ABBREVIATIONS

APA: Aesthetically Pleasing Appearance

BFT: Building Flame Towers

EPH: Emirates Palace Hotel

KG:.....Kilogram

KM:…….Kilometer

LED:..... Light Emitting Diode

M:…….……...Meter

m2:……..Square Meter

NCPA: National Center Performing Arts

NL: Night Lighting

NLD: Night Light Design

PB: Public Buildings

PBE: Public Buildings Erbil

PPA: Palestinian Pension Authority

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Lighting is an essential element in the process of visual perception of everything that surrounds us, especially architecture, with which light plays a vital role in its functional and aesthetic perception, which helps to achieve visual pleasure on the one hand and social interaction on the other hand, as lighting helps to use the space functionally and enjoy an Aesthetically Pleasing Appearance (APA). The appropriate atmosphere to express the design, and achieve a visual extension to link the architectural void with the urban surroundings, the process of marriage between lighting and architecture helps in creating psychological comfort for the user and causes a state of harmony between the building and the surrounding environment, so the lighting design process was related to the first stages of producing the architectural space where the design is Each of them is synchronized with the other to achieve the highest level of functionality and comfort for the users of the space, and the research deals with the study of Night Lighting (NL) and its role in showing the architectural form of buildings, and the formation of the night scene, which in turn contributes to achieving social affinity, and highlighting the beauty of the architectural form in order to achieve the architectural identity of the buildings, through Using the descriptive and analytical approach and adopting the method of analysis for some regional and global models and other local models To conclude from them with the results and recommendations, the most important of which is to emphasize the role of night lighting in highlighting the architectural landscape that is absent from the architectural features (Akl, 2011).

Since prehistoric times, the human need has emerged to fill the lack of natural lighting with artificial lighting, so he took advantage of fires, torches, candles, saddles, lamps, etc. Lighting techniques have developed with the development of the human ability to control the fire, and they have reached to sources of light with great effectiveness and

returns, and to find appropriate means to control them, so placing the candle on a candleholder to increase its light and add beauty to its light with its glass decorations, and install a lamp or oil lamp with a number of the reflectors help to focus the light, and he used an adjustable cotton wick in it, and he made the lamp outlets that allow the passage of a stream of air that provides it with the most amount of oxygen needed for combustion, and installed a cylindrical bottle (crystal) that increases the focus of lighting, and after discovering the oil, it was replaced with oil kerosene (kerosene) and paraffin oil to improve the quality of combustion, and all this led to easy-to-manufacture, low-cost, safe and reliable lamps, so the use of candles, even if they remained for decoration, became invalid. In the United States and Canada, then the gas extracted from coal that was used in lighting a street in London in 1820, then acetylene gas, and this was accompanied by the manufacture of special devices to burn these gases and benefit from Its light culminated in the burning of the (Welsbach shirt) in 1880, which is composed of a fine cylindrical or spherical net of woven cotton and cesium, and when this shirt is used in the lighting device (lux) the materials that have been treated with it burn out and the shirt remains fragile and quickly damaged, but it gives a very white, slanting light Slightly green due to thorium salts, and increased orientation with increasing gas pressure at the inlet (Flynn, 2003).

Light and lighting have received great attention since ancient times, as legendary stories about the sun were woven into ancient civilizations and were sanctified until they became worshiped in some ancient religions because of the light and warmth they send, and light is no longer the simple element that the eye only needs in perceiving the visual components of life, Rather, it exceeds that much, because without light there is no life. Solar photovoltaic energy provides us with the thermal energy needed by creatures on earth, and the absence of light means not knowing time and lack of food and air, because plants depend on light to grow and create oxygen, and to pull carbon dioxide from the air. Therefore, it was necessary to study light, its properties and nature, and to learn more about its behavior, in order to know its use in the correct way that achieves the desired benefit and in the best way (Gordon, 2003).

1.2 Research Problem

Public buildings (PB) of all kinds, service, cultural and sovereign, represent distinctive and important architectural features for all, as they are the focus of public attention, and are frequented by most segments of society, and most buildings are invisible at night due to the absence and work of the night lighting component in these buildings, and here the research problem lies in the omission of the night lighting component and its role In highlighting the beauty of the architectural form in buildings, and accordingly, the research problem can be formulated in the form of a research question as follows: How can the value of the night lighting component be used to highlight the aesthetics of the architectural form of buildings and embody these buildings as prominent architectural landmarks within their urban surroundings?

1.3 Importance of theStudy

How we can benefit from this study in developing the design process, and producing creative spaces in the formation that meet the standards of taste and beauty and please the viewers day and night, and from the above, the importance of the study can be summarized through the following points:

1) Night lighting helps in preserving the architectural character and identity of public and private buildings, as each building maintains and shows its own character, identity and feature that distinguishes it from other neighboring buildings.
2) Encouraging creativity in architectural design and studying masses, shadows and shadows where the building is visible at night and day.
3) Night lighting works to achieve social interaction between humans and the built environment at night.

1.4 Aim and Objectives of the Study

Theaimof the study is to explain the role of night lighting in highlighting the aesthetics of the architectural form of buildings. The objectives are:

1) Learn about the external night lighting of different spaces.
2) A study of applied examples of global and regional buildings in which night lighting was an important factor.
3) Concluding findings and recommendations for specialists to produce an architecture that keeps pace with the spirit of the times and opens new horizons for study and research.

CHAPTER 2

THE ROLE OF LIGHTING IN ARCHITECTURE

There are several previous studies that examine lighting related and each of these studies offers distinct explanations. However, such explanations are vital for constructing essential arguments related to this study.

Mahdi (2008) conducted a study entitled Night Lighting in Architecture. The study talked about the optical design process, its importance, objectives and different stages and its analysis through studying some projects. The research concluded with adopting a philosophy of light design that works to support the main idea of the project and focus on the main element of the project by highlighting it with lighting, in addition to paying attention to the surrounding and complementary areas of the project to benefit from in enhancing the display of the aesthetic aspects of the project.

Mahdi and Mahdi (2009) examined the Night Light Design (NLD), an auxiliary factor for architectural creativity. The research problem is the absence of a clear development of the nocturnal light design process to achieve the state of architectural creativity of the structure. On the role of the nocturnal light design process in achieving architectural creativity, the importance of light design and the factors that affect the design process have been studied, and the study concluded that the nocturnal light design process works to give the facility a distinct and different look from the rest of the buildings to achieve the state of architectural creativity, as the study confirmed To pay attention to both internal and external spaces to achieve an integrated system to form the overall landscape to reach the state of architectural creativity.

El-Erian (2007) used modern techniques for external lighting to study public urban spaces in Cairo, Egypt. The researcher posed a question: How does the appearance of a

vacuum change at night and what are the factors responsible for its change, The study aimed to shed light on the field of lighting design, to study the possibilities of industrial lighting, and how to exploit these capabilities in lighting urban spaces at night, while studying the profession of lighting and light design and its properties, and its effects on bodies and people. The study also examined the techniques of industrial lighting. Among the variables it isconsidered responsible for changing the appearance of the elements of the space at night are;the direction of the light, the location of the lighting structure in relation to the angle of view, the quality of the light, the intensity of the lighting and the color of the light.

El-Muslimy (2000) analyzed the Role of lighting in highlighting the functional and aesthetic values of interior design in Egypt. The thesis addressed the role of lighting in showing the functional and aesthetic values of interior design, through research in The nature of light and the different effects of light on humans and bodies also dealt with the sources of natural and industrial lighting, in addition to the role of functional lighting in interior design and how to show it to formwork, texture and color, and the interaction of lighting with internal spaces. The study also included the interaction of lighting with design determinants of ceilings, walls and floors, and an applied study the results of the research by applying lighting methods to an office reception room.

2.1Light and Illumination

Light and lighting have received great attention since ancient times, as mythical stories about the sun were woven into ancient civilizations and were sanctified until they became deities in some ancient religions because of what they send from light and dash, and light is no longer the simple element that the eye needs only in the perception of the visual components of life, rather, it exceeds that much, because without light there is no life, the solar photovoltaic energy provides us with the thermal energy that the creatures need on earth, and the absence of light means not knowing the time and the lack of food and air, because plants depend on light to grow and create oxygen, and to pull carbon

dioxide from the air, so it was a study of its properties and nature and getting to know more about its behavior in order to know its use in the correct way that achieves the desired benefit and in the best way (Kane, 2011).

Light is defined as that visible radiation from the group of the electromagnetic spectrum and arises in a wave movement that varies in frequency and wavelengths between 400 angstroms. This gives us the sense of the violet color to the light radiation with a frequency of 760 units of angstroms, which gives us the ration in red, and between these two values The wavelengths of colored light waves are gradient (Karlen, 2004).

Light is a form of radiant energy that contains X-rays and radio waves and others, and it is a form of energy as it is transmitted through radiation, and according to the belief now prevailing. It is electromagnetic energy, and it penetrates the ether in the form of radiation waves at a speed of up to 186,300 miles per second. The light arises from the vibrations of the source molecules without the movement of the source itself, either by heat or electric current as noted by Figure 2.1.The higher the temperature or the intensity of the current, the greater the movement of the particles until it produces light radiation.

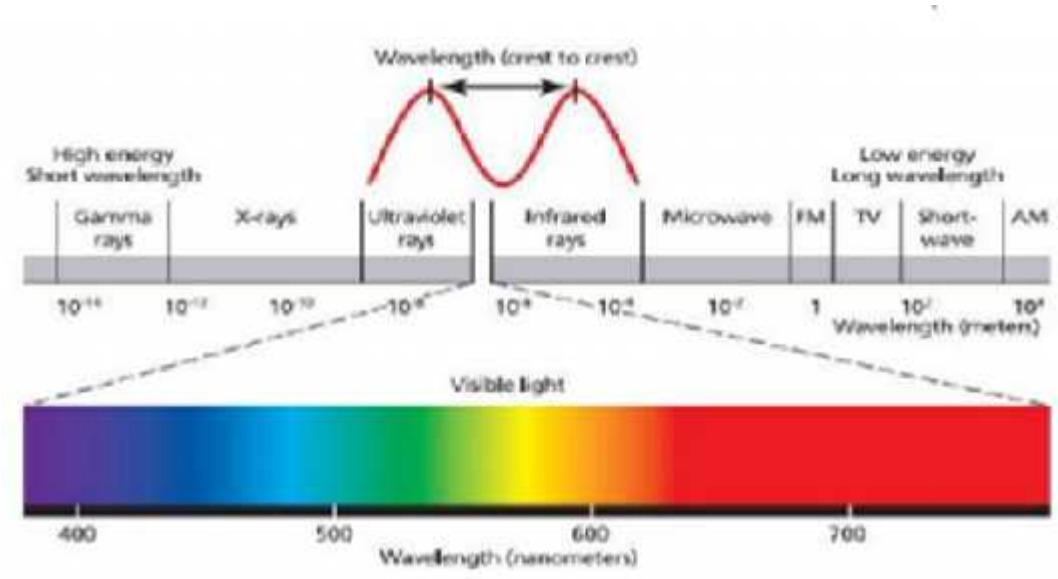

Figure 2. 1: The magnetic spectrum (Tabal, 2012)

- *Eye and vision*:There is a spherical eye in the shape of a camera-like lens, at the top of which is the pupil of the eye, which widens and narrows according to the light of the visible body, and is controlled by the iris and the lens works to focus the light reflected on the retina, where the optical nerves that convert the visual image into electrical impulses to the brain and there is the process of analysis Signaling and storing it, the central part of the eye near the fovea contains millions of light-sensitive cells, including cone-shaped cells (cones) responsible for seeing and distinguishing fine details and distinguishing colours as shown by Figure 2.2. Its sensitivity to light is about 1/10000 relative to the sensitivity of cone cells, and therefore it is responsible for night vision. However, it does not distinguish details and has no sensitivity to color, and it is slower than cone cells to receive and distinguish light (Khodadad, 2004).

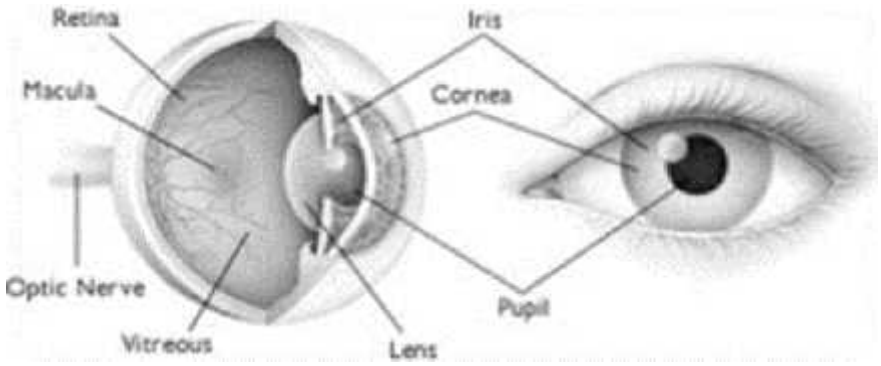

Figure 2.2: The parts of the eye and the camera (Tabal, 2012).

- *Light and vision*:In order to achieve the process of vision, the presence of light, the element, the receiver (the eye), and the analyzer (the brain), where the light rays reflected or transmitted from the element on which the light falls, excites and stimulates the electrochemical receptors in the eye, which in turn are sent signals to the brain where the sense of vision causes through the cooperation of the brain and eye to convert the radiated energy into a sense of vision (Tabal, 2012).

There are three factors that affect the vision of objects, which are the visible body, the lighting condition, the sight or the person, and these factors can be summarized as follows:

1) *Visible decisiveness (objective)*:It depends on the size or area of the visible object, the illumination of the body, the contrast in the luminance between the body and the surrounding medium, the duration of the vision, the type of the body, the movement of the body or its stillness, the type of the surrounding medium, and the required accuracy.
2) *Lighting conditions*: Depends on the level of lighting, glare (dazzling), and colors.
3) *The looker or the human*: It depends on the eye conditions, the level of adaptation, and the degree of stress, the reaction, and the psychological state(Navara, 2007).

Meanwhile, people have differed since ancient times in determining the nature of light and there are many theories that determine the nature of light. For the state of vision, and this is inferred by the following:

1) If light is prevented from reaching the eye, the visible object will be blocked and cut off the vision.
2) Man does not see in complete darkness.
3) The rays are running in straight lines.
4) Light sources are divided into two types, natural and industrial(Cinzano, 2011).

On the other hand, considerations must be given towards examining properties of light. Michel (1996) contends that when a ray of light falls on the surface of what happens to it, one of the following three possibilities:

1) *Absorption*: Light can be absorbed by the surface, and often converted into heat, and the percentage of light absorbed by the surface depends on both the angle of incidence and the spectrum.

2) *Reflection*:It is the bounce of radiation by the surface of any change in the frequency of the waves. When the light is reflected, we find that a proportion of it has been lost by the surface absorption of it, and the reflected light is the relationship between the illumination and the reflecting surface.
3) *Refraction*:When light falls on a surface of a certain thickness and permeable to the other intent, we find that there is a change in the direction of the ray coming out of it, and the reason for this is the difference in the speed of light in this material from its speed in the air. These ideas can be illustrtated by Figure 2.3.

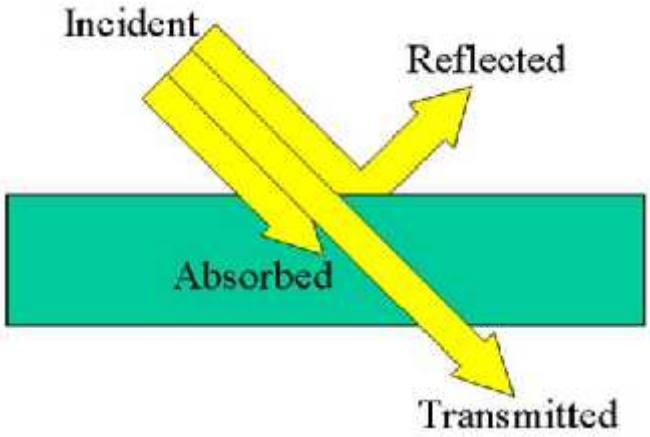

Figure 2.3: Properties of light when it collides with an object (Michel, 1996).

A study by Rich (2004) demonstratses that both the adbsorption, transmission and reflection processes are influenced by the type of m,aterials involved. The materials can be divided according to the behavior of light with it into (Rich, 2004).

- Transparent materials: Allow most of the light to pass through, except for a small amount, which varies according to type and thickness. Objects can be seen through them, such as flat glass and plastic.
- Translucent materials: Transmit light but scatter it in different directions, and things such as frosted glass and plastic cannot be seen through them.
- Opaque materials: Completely block the light from penetration and cannot absorb or reflect it, and these surfaces can be shiny or rough like metals.

*Light and colour***:**The issue of determining the colors of objects or the colors of light from colored lamps is a complex issue, as it is not only a physical issue, but rather depends on the vitality and psyche of the person watching. In addition to the light spectrum reflected from surfaces as soon as the viewer sees them, the color of the light source depends on the components of the light spectrum reflected from the surfaces as soon as the viewer sees it, and the color of the light source depends on the components of the light spectrum of the light emitted by it, and the color appearance of the light reflected from the surfaces and is determined by two components characteristics. The light spectrum of light through which it shines, and the properties of the light spectrum reflected from the objects, the colored body appears colored after the wavelength of the light falling on it is reflected, for example if there is a red body, it may appear red if the light falling on it contains red radiation enough to make it reflect its color, in addition to that, it can appear dark when the light source does not contain red radiation, and when the horse statue is illuminated with wavelengths of light that contain all but therefore, all the colors of the horse will be seen in its natural colors, but if the statue is illuminated by a light with a light wave that contains only yellow and green colors, then we will see only the yellow and green colors of the statue (Kocifaj, 2013).

1) *Mixing colours*:When a beam of light is mixed, the result is often a bright color more than the individual colors, and if the real colors are mixed. The result is white light, and this is known as the additive colors, so the three primary colors of light are red, green and blue, which are called primary colours (Figure 2.4). Mixing these colors produces all colors (Philips, 2008).

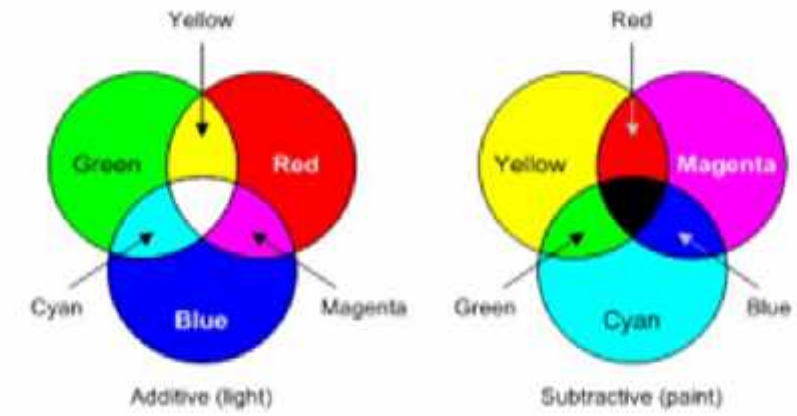

Figure 2.4: Mixing colour (Zelinsky, 2006).

2) *Colour performance*:The color performance is considered an important aspect of industrial lighting (Philips, 2008) because it affects how the furniture and various decorative materials appear, as well as the viewer's look in general, and the color performance is a term used to describe the ability of artificial light to present the true color of objects as seen in their natural form in light. The sun, which has a color performance value equal to 100, therefore, it is necessary to pay attention to the color performance when designing different spaces, especially those in which the color has an important effect (Kerbiriou, 2015).Various objects of some industrial objects perform differently when subjected to light. For example, Figure 2.5 shows that there are differences in the colour performance of incadescent halogen, low pressure sodium and metal halide.

incadescent/halogen low pressure sodium metal halide

Figure 2.5: The color performance of some industrial light sources (Thanaphanit, 2010)

In order to classify the lighting sources according to the color performance specifications, a color rendering index was made, which provides a Color Rendering Index (CRI) scale of 50-100%.Table 2.1 shows the meaning of these values.

Table 2. 1: The degrees of colour performance and their different rates

N	Average color performance	Degree of color performance
1	100-90%	Excellent color performance
2	90-80%	Good color performance
3	80-60%	Medium color performance
4	Less than 60%	The color performance is poor

3) *Colour temperature*:Colour temperature is a term sometimes used to express the color of light produced by a light source compared to the color produced by a black body, which when its temperature rises initially emits from it invisible radiant heat and with the increase in temperature, the body begins to glow with a faint red color, then a color Bright red, then passes through a group of colors until it emits a white light then a blue light(Richardson, 2006).Table 2.2 shows the relationship between the color of an object and its temperature which is measured by kelvin.

Table 2.2: The relationship between body color and body temperature (Richardson, 2006).

N	Body Color	Temprature (K)
1	Red	900-800
2	Yellow	3000
3	White	5000
4	Pale Blue	8000-10,000
5	Bright Sky Blue	60,000-100,000

Any source of light whose color matches the color of a black body radiating at a certain temperature can be characterized by this degree, and sources that have a spectral distribution of energy similar to the spectral distribution of a black body radiating at a certain temperature Natural sources of light and the following table shows the color

temperature for different lighting sources.Different highlight sources have different colur temperatures, and this can be illustrated using Table 2.3.

Table 2.3: Different colour temperatures for different light sources (Richardson, 2006)

EXAMPLES OF DIFFERENT COLOR TEMPERATURES	
Type of Light	**Colour Temperatures (K)**
Candles	1900 – 2500
Tungsten filament lamps	2700 – 3200
Fluorescent lamps	2700 – 6500
High-pressure sodium (SON)	2000 – 2500
Metal halide	3000 – 5600
High-pressure mercury	3400 – 4000
Moonlight	4100
Sunlight	5000 – 5800
Daylight (sun + clear sky)	5800 – 6500
Overcast sky	6000 – 6900

4) *Shadow shape and siz*e:Shadow is one of the most important difficulties encountered by the wave theory in interpreting light, as it occurs when an object blocks light rays while they pass in straight lines. Shadow when it is combined with light works together to embody objects and facilitate the process of visual perception and the artistic representation of objects. That falls under the light and the shadows (Beier, 2006).There are three factors that influence the shape and size of a shadow and they are:
   - The effect of the distance between the source and the illuminated object while keeping the angle of incidence constant. The greater the distance between the body and the source, the larger the size of the shadow and it appeared smooth, and the smaller the distance, the smaller the size of the shadow and it appeared sharp.
   - The relative position of objects and the effect of the angle of incidence, the angle of incidence of light rays to the source has a direct effect on the shape

and size of the shadow, so the size and shape of the shadow changes in two ways (Duffy, 2015).Fixing the location of the light source and changing the lighted object in relation to the background, and this method by which various shades are obtained.Fixing the position of the lighted object while changing the location of the light source, and this method gives various shapes of shadows.The shape of the surface that receives the light, and it means the type of surface on which the shadow falls, is it flat, convex, or bumpy. Each has its effect on the size of the shadow, as concave surfaces cause the shadows to shorten, while the convex surfaces cause the shadows to lengthen.

Meanwhile, the directions of light play the main role in the formation of the lighting works, whether the light falls on the design or emitted from it, and the following is a presentation of the types of lighting according to the direction of the light (Branch, 2004).

1) *Front lighting*: It has a weak ability to detect objects or materials used in the exterior cladding, as the shadows disappear behind the bodies, and as a result, the objects appear flat and flat.
2) *Side lighting*:Good for displaying objects and cladding materials, and gives a feeling of protruding shape and a sense of three dimensions, shadows are prominent and attractive and as a result, the contrast is high.
3) *Backlight*:The contrast is very high, but if the light source is at a small oblique angle, the objects appear bright and some details are clear in them.
4) *Overhead lighting*: It is considered an unusual condition, although it is present in sunlight, and dim light in this case is an effective way to display objects, while strong light can express ambiguity as it conceals most things.
5) *Lower lighting*: It is a rare type of lighting and the shade in this case is reversed, and can be used to create a creative effect.
6) *Lighting*:Lighting is the real mix between art and technology, and it is art before it is a science, and a science does not mean anything without art. Geometric

feelings, because of its magical ability to directly or indirectly affect both humans, matter and space simultaneously, and lighting does not enable calculating the number of lamps, but rather how and where to place these lamps as good lighting is to put the appropriate light in the place Al-Sahih (Tabal, 2012). The study will address the issue of lighting and light design in some detail during the third semester (Parker, 2014).

2.2A Brief History of Lighting

The human need has emerged since prehistoric times to fill the lack of natural lighting with artificial lighting, so he took advantage of fires, torches, candles, saddles, lamps and others, and the purpose of using artificial lights from the beginning was to provide the possibility of seeing in the dark on the one hand, and to achieve visual effects according to the human need on the other hand. Lighting techniques developed with the development of the human ability to control fire, and his access to sources of light with great effectiveness and return, and to find appropriate means to control them, so placing the candle on a candleholder to increase its light and add beauty to its light with its glass decorations, and install a number of reflectors for the lamp or oil lamp (Hanifin, 2015). It helps to focus the light, and he used an adjustable cotton wick in it, and he made the lamp outlets that allow a stream of air to pass through, providing him with the most amount of oxygen needed for combustion and he installed a cylindrical glass (crystal) that increases the focus of the lighting, and after discovering the oil he replaced kerosene oil (kerosene) and paraffin oil to improve the quality of combustion, and all this led to easy-to-manufacture lamps that are affordable, reliable and safe.

Although it remained for decoration, the beginning of the nineteenth century witnessed a great development in industrial lighting techniques when the use of natural gas in the United States and Canada, then the gas extracted from coal that was used in lighting a London street in 1820, then acetylene gas, and this was accompanied by the manufacture of special devices To burn these gases and benefit from their light, all of them culminated in the burning of (Welsbach's shirt) in 1880, which consists of a fine

cylindrical or spherical mesh of knitted cotton and cesium, and when this shirt is used in the lighting device (lux) the materials that have been treated with it burn out and the shirt remains fragile and rapidly perishable. It gives off a very white light slightly greenish due to thorium salts, and its orientation increases with the increase in gas pressure at the inlet (Buchanan, 1993).

With the many disadvantages of the aforementioned lighting means, all or some of them have been used to this day in various parts of the world for one reason or another, but the discovery of electricity in the mid-nineteenth century brought about a global revolution in lighting technologies that had the best effect on changing human life (Buchanan, 2006).

Electricity was used in lighting in the beginning with an electric arc between two carbon electrodes, and this type was developed to be used in street lighting in major cities, giving a bright light close to natural light, but the invention of the light bulb with an incandescent wire in 1878 was the first scientific step in lighting with electricity, and because of the importance of this lamp, a lot of controversy arose about who first came up with its innovation, and the French, Russians, British and Americans claim that it was attributed to them, and the truth is that the first credit for making the incandescent light bulb emptied from the air and using it commercially belongs to Thomas Edison in the United States of America.Because his work was part of an integrated electrical lighting project that included generating, transmitting and distributing energy, and his company set up a historical show in 1879 for electric lighting, the first of its kind in the world, and since then light bulbs have occupied their important place in industrial investment and senior physicists and producers have worked to improve their types.

The next step in industrial electrification was the innovation of gas-discharge tubes, which is that Lighting tubes that operate with the principle of electric arc inside a vacuum tube that contains a small amount of vapor of an element such as neon (red light) or mercury vapor (blue and white light) (Coleman, 2015). These tubes have been popularly used in household lighting, factories and facades decoration since the thirties. From the twentieth century until after its improvement, it became one of the best

practical means in indoor lighting, which is known today as a gaseous scintillation lamp or fluorescent lamp. Many improvements occurred during the second half of the nineteenth century to these gas discharge tubes, so he invented a high-pressure mercury vapor discharge lamp and a discharge lamp. The high-pressure studio was also used in street lighting, stone building facades and monuments, as well as in devices that need intense lighting, and one of the last achievements in this regard was the xenon discharge lamp (inert xenon gas) with high energy and light similar to almost sunlight, then (electric light bulb) that makes walls and ceilings look like self-lighting, which may become the main lighting medium in the future (Duffy, 2014).

In sum, lighting science today has what kinds of knowledge can meet all public and private lighting needs according to their purpose: for interior lighting in homes and factories or street and buildings lighting, or decorating facades and advertisements, or for use in lighthouses and in illuminating skylights, or for lighting large areas. Immersive lighting (Baker, 2015).

2.3Types of Lighting

Natural lighting exists in two distinct forms and these are;

1) *Natural lighting*: Natural lighting comes from natural sources and its main source is the sun and it is the most suitable for humans, but it changes and varies according to time, season, location, distance from the equator, weather conditions, direct contact with natural lighting and the feeling of sunlight has a psychological effect that broadcasts activity and vitality in In addition to the appearance of the building and the surrounding space under the good lighting of sunlight, which gives a sense of clarity and a comprehensive view of the place and the building, we used that the combination of light and shade and their

compatibility with the building with its units and openings strengthens the factors of unity and homogeneity, and natural lighting affects the design of the openings of buildings from one region to another according to the strength Sunlight and temperatures (Molenaar, 2003).

2) *Industrial lighting*:It is used as an alternative to natural lighting in two cases, the first when natural lighting is insufficient, and the second when it is dark. To multiply colors and provide freedom for the designer to choose colors that are compatible with the design idea and the extent of its harmony with the building and its compatibility with the activity taking place in it, and industrial lighting helps to focus on building elements such as architectural details and finishing materials with the ability to overlook defects if any, as well as shining lighting on the building Turning it into an attractive and unique element without other surrounding buildings, and natural lighting is distinguished from industrial lighting that it is more economical, better for distinguishing colors, and its sources do not require maintenance, and it is better in terms of health and psychological (DeCoursey, 1986).

2.3.1The importance of lighting in architecture

Lighting serves important functions in architecture and its functions are influenced by the type of lighting under consideration. The importance of natural and industrial lighting can be summarized as follows:

1) *A service functi**on (visual)*:** We find it necessary to deal with the spaces and shapes in the lighting according to its type and intensity(Buchanan, 2006).
2) *Psychological function (sensory)*: that lighting creates a psychological balance and a sense of safety within different architectural spaces, especially natural lighting, because it adapts to the human eye(Buchanan, 2006).

3) *An (healthy) environmental function***:** It is recognized that the sun's rays, and thus (daylight), must reach vital architectural spaces such as the living room and bedrooms, as natural lighting works on a natural environmental cleansing of the air of these spaces (Buchanan, 2006).

The sun is the source of natural light, and the intensity of the lighting in a specific place and at a specific time depends on the angles of incidence of the sun's rays that change according to latitude, date and daylight hours, as well as the prevailing weather condition and the characteristics of the geographical location (Beier, 2006).Natural or daytime lighting provides visual and psychological comfort for humans, and is preferred over artificial lighting.

1) Its reflections are unobtrusive and provide reasonable shades.
2) It provides excellent lighting for vertical surfaces.
3) The natural light varies throughout the daylight hours, in line with the human eye.
4) The heat generated from its uses can be utilized according to the space and the orientation of the building.
5) Its quantity can be controlled with good direction and design by calculating the gap openings, the depth of the room dimensions, the interior and exterior finishing materials and the colors used.
6) An essential element in achieving energy conservation.
7) The best light source to achieve good color rendition.
8) Increase the sense of spaciousness and breadth in architectural spaces.
9) Natural light entering the space creates a dynamic characteristic and increases the beauty of the space.

It is represented in the lighting resulting from light bulbs of various types and shapes, its importance (Cinzano, 2011).

1) The need for industrial lighting is a necessity in the building during night hours.

2) The possibility of using it at different times according to the desire of the user of the space.
3) You can design and choose shapes and sizes of lighting sources according to the location and dimensions of the spaces.
4) The ability to choose the intensity of the light produced and the color used.
5) The most important feature is the possibility of placing the source of industrial lighting on all surfaces (floors - vertical surfaces - ceilings).
6) Certain visual characteristics can be created by choosing the lamp type and color.

2.3.2Light sources

Light bulbs of all kinds are the main source of industrial lighting, and those interested in the field of industrial lighting carry out studies and research to develop well-known lamps, and create other lamps that are more suitable to the needs of users in terms of efficiency, effectiveness and quality for the type of different uses, and the light bulb of any kind is nothing but a tool for energy conversion Electrical into light energy by passing an electric current through a medium that is solid (incandescent lamp) or liquid (carbon arc lamp) or gaseous (gas discharge lamp). This part is concerned with identifying the different types of lamps in the internal and external spaces and their uses, and the lamps can be classified as follows (Eisenbeis, 2006).

2.3.2.1Filament lamp

- *Incandescent lamp*: It is considered one of the oldest light bulbs, it was used instead of the old primitive lighting methods, it has different shapes and sizes, and its performance depends on the temperature of the wick. When the temperature increases, three important steps occur: The color of the light from the lamp becomes more inclined to white the lamp's life increases and decreases the lamp's life, and the lamp's life depends on the filament temperature. The higher its temperature, the lower the lamp's life due to the increase in the rate of

filament evaporation. The luminous power leads to a large rate in the replacement of lamps and thus to a significant increase in the price of lighting, and the incandescent lamp is characterized by being available in many and varied forms and has an easy and inexpensive dimming system, and it does not require auxiliary devices to operate it, and the luminous flux reaches its specified value immediately after its operation is appropriate. It is cheap, and is characterized by the color of its light and its high safety in transmitting colors, but what is wrong with it is that the higher the temperature of the filament, the higher the luminous efficiency and the shorter life of the lamps. The lamp life and its luminous efficacy are an optional issue. It emits high heat, the luminous efficacy is low, and the lamp life is short (Cinzano, 2011).

- *Tungsten lamp (halogen*): It is an incandescent lamp, but some modifications have been made to it by introducing quartz glass material and halogen gas, but it retained the characteristic of heat resulting from operation. The life of this lamp reaches twice the life of an ordinary incandescent lamp, approximately 2000 - 3500 hours and with higher efficiency.

The advantages of this lamp can be summarized as it has high luminous efficacy, longer life and smaller size compared to the ordinary incandescent lamp, as it is simple in operation and control, and is characterized by a white color and more balanced than an incandescent lamp, it has a very high color rendition higher than all other lamps compared With sunlight, its price is generally cheap compared to other lamps. But one of its disadvantages is that it is very sensitive to shocks during operation, so it is important to be careful when installing and it must be closed before moving it and waiting for it to cool down. It is used in the lighting of landscaping, shops and galleries, pictures and paintings, as well as in home lighting and hospital lighting (Frank, 1988).

2.3.2.2Gas discharge lamps

Gas-discharge lamps are characterized by high light efficiency, they do not have a filament, they operate at low pressure, require time to obtain the highest light energy, the size of the light source is large and its cost is high and it is difficult to control the light

coming out of it except by using reflectors and large lighting fixtures, and it is difficult to dim The light emitted by it. Gas discharge lamps are divided into two types (Frank, 2006).

a.Low pressure discharge lamps: These lamps contain inert gas or a mixture of inert gases and metal vapor with a pressure much less than 1 bar. Their luminous yield depends on the size of the lamp. To achieve adequate light energy, the lamp must have a large vacuum tube.

b.Discharge lamps with high luminous intensity:Discharge lamps with high luminous intensity can be divided into four families of lamps: mercury vapor, metal halide, and sodium lamp of both high and low pressure, and these lamps produce light by creating a relatively small electric arc, and therefore they can be considered from point sources and this means that the output light is more accessible. From linear sources such as fluorescent lamp, and these lamps need a warm-up period when operating, and in the event of losing electrical power during operation, it needs a cooling period before producing an electric arc again and re-lighting it, some lamps need 10 minutes to restart.

1) *Fluorescent lamp*:The fluorescent lamp consists of a long glass tube, the inner surface of which is coated with fluorescent powder, and two completely sealed ends, each equipped with an electrode. The principle of operation of this lamp depends on the gaseous discharge between the two electrodes, and the color of this light depends on the type of fluorescent powder used. The fluorescent lamp is distinguished by its large size that helps the light spread uniformly, and its price is very cheap compared to most other lamps, it can be dimmed by special electronic ballasts, and the brightness of the lamp is light compared to other lamps, and the life of the fluorescent lamp reaches 20000 operating hours, and a transmission manual The colors are excellent, the color of the light is cool white, and one of its disadvantages is that it cannot control its light to produce narrow beams of light, the size of its devices is large, which makes it not ideal for use in important architectural spaces, it is not suitable for showing the luster or luster of jewelry and metal objects, the luminous flux decreases with time, and it needs A

starter, used in lighting offices and libraries, indoor parking lots, factories, workshops and large warehouses, and lighting for indoor sports fields, school halls, halls and rooms with a height of more than 7 meters (Loew, 1999).

2) *Compact fluorescent lamp*:These are the so-called energy saving lamps, and they have the same characteristics as traditional fluorescent lamps, except that they are characterized by their small size, which provides new and wide application areas. Compressed fluorescent lamps are distinguished by the following: They are characterized by energy saving, their small size and longevity, their high light yield, they are available in the form of tube lamps, types of which can be operated on electronic operating accessories, and one of its disadvantages is that it reduces the luminous flux over time, and the luminous flux is affected. The lamp has an ambient temperature and is used in lighting corridors, general lighting for indoor places, lighting for offices and toilets, and has limited applications for external lighting.
3) *Cold electrode lamp and neon*:Similar to fluorescent lamps, but the electrodes are not heated to produce light. For this reason, this type is called the cold electrode lamp. It is a long and thin tube, which makes it easier to bend and shape. This type of lamp is characterized by flexibility in shape and size, it is available in many colors, and its longevity ranges between 20,000 to 40,000 hours, and it has the ability to produce more than one color in the same tube, as for its disadvantages it has poor light effectiveness, and it must be protected from moisture and cold and protect people From its high voltage, its transformers are large and noisy, which makes it necessary to place inaudible to people, the initial cost is high, its luminous flux is less than the fluorescent lamp, and it is used in the external lighting of traditional buildings, hotels, conference buildings and office buildings, indicative signs. Fixing buildings, advertisements and advertising banners (Gauthreaux, 2006).
4) *Discharge lamp without electrodes*:This type of lamp has been developed during the past decade thanks to advances in electronics technology. It is a type of fluorescent lamp and has the same properties and because without electrodes, its

life ranges between 60,000 to 80,000 hours. When operating this lamp at a rate of 12 hours per day, the lamp lasts more than 20 years and this type of lamp is characterized by the following:

- Long life up to 100.00 hours and therefore it is used to illuminate all places that are difficult to reach to the place of lamps such as bridges, tunnels, highways, airports, etc., are not affected after start-up operations, unlike fluorescent lamps.-
- The lack of electrodes prolongs the life of the lamp and raises caution about the use of some elements that may lead to the destruction of the electrodes.
- Their ability to transmit colors is very good, and they have high luminous efficacy (Branch, 2004).

5) Mercury vapor lamp:It produces light by passing the electric arc through mercury vapor, and the mercury vapor lamp is characterized by the following: The period of time from the moment of starting the lamp until its maximum illumination ranges from 3-7 minutes, the light that results is white tends to Greenish blue, the lamp life ranges between 16,000 to 24,000 hours and its electrical capacity depends on its luminous power, it is not affected by the number of start-up operations if the number of hours of lighting between each operation is within two hours, mercury lamps are available high pressure lamps in different shapes and sizes, the color performance is weak But it remains constant throughout its life, as for the disadvantages of this lamp, it has poor color transfer integrity, and a large size compared to other high-intensity discharge lamps, and the luminous efficacy is limited (Cinzano, 2011).
6) *Metal halide lamp*:It is an advanced type of mercury lamp, but it also contains a mixture of metal halide, which by adding it improves the light efficiency, and the color performance increases. One of the advantages of this lamp is to have light that has excellent color transmission integrity, excellent control over the light coming out of it, as well as has a long life and high efficiency, and a small size compared to fluorescent lamps, and one of its disadvantages is that metal halide lamps cannot be dimmed, and need a relatively long cooling time. Before re-operation, its price is high, and it is used in street and public squares lighting,

airport and stadium lighting, exhibitions and shops, in addition to lighting public buildings and hospitals and coordinating sites (Baker, 2015).

7) *Low pressure sodium lamp*:Low pressure sodium lamps are similar to fluorescent lamps in terms of construction and operation method. In this case, the sodium vapor is excited instead of the mercury vapor. These lamps are distinguished by their high luminous efficacy, the lamp life is up to 15,000 hours, the resulting glare is less annoying than the glare of other lamps, and the light emitted by it is yellow in color, as for its disadvantages it has low color transmission integrity, and colors cannot be distinguished on its light, the period ranges. The time between starting the lamp and giving it full lighting is between 7 and 10 minutes, it has poor control over the light coming out of it, and is not suitable for interior lighting, it is used in street and highway lighting, and it is also used in security lighting (Coleman, 2015).
8) *High pressure sodium lamp*:It is similar to mercury lamps in terms of its construction and operation. The high pressure in it enhances the resulting color performance characteristics, becoming medium to good. High pressure sodium lamps have a very high luminous capacity, the lamp life is up to 24,000 hours, it has excellent control over the light coming out of it, this lamp produces a small percentage of ultraviolet rays, and there is no significant decrease in the luminous flux over time, and its color performance from medium to good, as for its disadvantages, the color of the light emitted by it is warm golden yellow, and it is monochromatic, which makes the appearance of plants inanimate. High pressure sodium lamps have a start-up time of several minutes, require a cooling time to restart, used in lighting stadiums, parking lots, airports and large areas, workshops and factories (Akl, 2011).
9) *Xenon lamp*:This lamp produces light by passing the electric arc through the xenon gas. The advantages of the lamp can be summarized as: Small in size, it can be installed in small places, the coefficient of safety of color transmission is excellent, and its disadvantages are poor light capacity, and it is used in street lighting and parking the cars (Buchanan, 2006).

2.3.4Light-emitting components

Semiconductors are called light-emitting diodes, and lighting workers have predicted that in the not-too-distant future they will replace many traditional lamps as a source of light, and this system relies on semiconductors that allow flow in one direction only and convert electrical current directly into light, and the color of light depends. The emitted material depends on the type of material used, as the material used in the semi-conductor element (LED) determines the color of the light emitted by it, and the advantages of the light-emitting rectifiers (LEDs) can be summarized as having a high efficiency of up to 90% and is improving continuously, a very small size and does not generate heat. The degree of color distinction in it reaches 95%, it can be electronically dimmed, and it resists heat, cold and vibrations, in which the desired color of light is obtained, and it does not contain ultraviolet rays, but one of its disadvantages is that there are no devices of them with high light flux quantities, that their small size. The variety of its colors has made it a wide range of uses, the most important of which are lighting for corridors and external areas, interior design and effect lighting, illuminated signs and advertisements, lighting of stairs, directed lighting in buildings, traffic lights (Mrykalo, 2004).

2.3.5Lighting systems

The use of lighting systems is not limited to showing the space and illuminating it, but to facilitate use, move in the space and work in it effectively and safely, as the lighting creates a pleasant climate in the interior and exterior design and with lighting highlights the function of the space, its dimensions and decorations, and determines the prevailing atmosphere, whether it is cold or warm, pleasant or formal, and here enables the task of an engineer Lighting to determine the different lighting systems and their location in the

space to provide the highest level of comfort for users, these systems are as follows (Viviani, 2009).

1) *General lighting*:With it, a certain space can be illuminated so that the user can move easily and safely, define the space and make it a comfortable space visually, and this type of lighting is necessary and important in the lighting scheme, and it can be achieved using direct or indirect lighting, where direct lighting makes the elements and surfaces bright, while giving Indirect lighting A sense of spaciousness, and general lighting can be obtained from lighting devices that give a scattered spread of light (such as chandeliers), and the focus is on lighting the contents more than the aesthetic aspects (Beier, 2006).
2) *Task lighting*:It is an additional lighting used to illuminate the area that contains visual activity such as reading and writing, preparing food, games and hobbies and other activities that need this, and it is often obtained by means of close and independent lighting devices, and the light is directed to the work surface and in this type less reliance on general lighting The illuminated task is provided with good and sufficient direct light, directed and free of shadows, and works to diversify the lighting within the space as a whole (Buchanan, 2006).
3) *Focused lighting*:It is similar to task lighting as it relies on directed light, but this lighting is a plastic lighting that is used to focus attention on works of art such as wall paintings, sculptures, special techniques and museum exhibits, or on other decorative elements or to set moods and emphasize special elements, and this type of Lighting is usually easy to install and adjust, and it helps to create visual interest in those elements, which contributes to strengthening the decorative ideas, and to create an atmosphere of excitement and aesthetic touch. It is also used in lighting the external spaces to highlight a specific element in the external coordination, such as paint and external texture, or to show a certain type of trees in the garden (Cinzano, 2011).
4) *Architectural lighting*:In this case, the goal is to focus part of the lighting on the architectural features in the space, on the ceilings, walls, and floors, and to show these features without looking at the lighting of the contents of the void of

functions and others, and is usually used in those places public lighting with architectural lighting, where the latter gives a modest part of Luminescent needed (Baker, 2015).

5) *Ambient lighting*:It is usually a combination of the previous four types of lighting, or some of it, to create an attractive and comfortable atmosphere within the space, and the work of public lighting, task lighting, focused lighting, and architectural lighting with each other in an integrated and harmonious manner helps in presenting the whole surrounding of architecture and interior design in the best way (Coleman, 2015).

For the distribution of lighting, the designer must determine his need for the quality of general lighting for the various spaces of public and private buildings, which can be classified into five levels as follows: (Nichols, 2014).

1) *Direct lighting*:In this case, all the light energy is concentrated downward, and it may be ceiling or wall, surface phenomenon or be free to move and move, and this type is characterized by good dispersion of light inside the space, and this type is used in workshops, warehouses and places of fine work where the lighting is high on the work surfaces and it is also necessary in operating rooms.
2) *Semi-direct lighting*:In this type the lighting is concentrated downward by up to 90% of the total luminous energy of the source, and in this case the colors of the walls and furniture have a great effect on the lighting through the reflection and influence of the light from it, and this type is suitable for residential rooms, corridors and laboratories.
3) *Semi-indirect lighting*:The light model in it is directed by its light intensity towards the ceiling with a small part in the lower direction, and this light system is not suitable if the ceiling height is large or if the ceiling color is opaque, and the successive reflection from the walls of space helps to reduce the dazzle on the operating surface and the ceiling must be a scattered surface has a reflection coefficient that does not change over time (Duffy, 2015).

4) *Indirect lighting*:One of the basic characteristics of this type of lighting is that the luminous intensity of the light model of the source is absent in all the lower directions, so we find that the brightness of the source is less than possible for the viewer and this type of lighting is not accompanied by any illusions or shadows, and it is not suitable for seeing fine objects and is used in galleries and museums and usually The lighting units are hidden in it in several ways to be illuminated by the beam reflected from them on the wall or ceiling.
5) *Even lighting*:The lighting in it is distributed almost evenly between the upper and the lower half of the interior space, and this type of lighting combines direct and indirect lighting, and this type of lighting is suitable for objects whose three dimensions are to be shown, as it gives an embodiment of it (Cinzano, 2011).

2.4Lighting in Architecture

Lighting is a science and art, and the visual image formed and understood by the recipient occurs when light rays are reflected and fall on objects, surfaces and materials, the first event is the fall of light, the final effect of it is our understanding of things. Light is an essential element in architecture, which is the reason for interaction with The emptiness affects the way we perceive it, the way lighting, color, and other things related to the effect on the visual sense, and thus determines our perception of space and its psychological acceptance. Appropriateness of lighting for users, as there are three basic factors in lighting design, which are people, beauty, technology, knowledge, and lighting design is a mixture between science and art, and a successful designer is the one who balances between being an artist and a scientist, so lighting is not the process of achieving a certain level of illumination for a specific space, but rather an innovative process. It adds aesthetic elements to the architectural space, which increases its special beauty (Gehring, 2010).

With lighting, the designer can increase the space with joy and pleasure, or a poetic atmosphere, and the lighting units they are the same complementary aesthetic elements.

The principle, the main lighting design is a creative process for arranging the functional and aesthetic values of architecture, so understanding both the science and art of lighting will have a positive role in reaching effective design solutions. It is not limited to fulfilling the design requirements for spaces despite their importance, but exceeds those limits to express the architectural form, as well as providing the appropriate environmental atmosphere to express design ideas. Many architects have talked about the importance of lighting and its role in architecture. His definition of architecture is the elaborate play of blocks under the light (Birney, 2001). He considered that architecture and lighting have a strong relationship that cannot be separated when he said, "*The history of architecture is the history of the struggle for light,*" as Renzo Piano said, "*Light is not only an intensity but has ripples and vibrations that work on soft materials are roughened to give the viewer a sense that they are three-dimensional*, while Richard Meyersays,"*In architecture we find that lighting promotes certain constructive ideas* " and Lewis stated thata vacuum is not a vacuum (Gehring, 2010). Architecturally unless it has natural lighting, and the light affects architecture in a reciprocal way. The structural elements that we need to confine the space cannot be perceived until it is seen and recorded in the feeling of people through lighting. Light is what defines the space, and the characteristic and color appear, and the shape shows, it indicates the scale, and prefers the space functionally and aesthetically (Baker, 2015). Through good lighting, we can make the building appear in the style and shape that the architect wants in both the day and the night. The artistic composition is in the most beautiful form, and vice versa, and the beautiful formulation of lighting is what makes the fabric and architectural features more beautiful and wonderful than they are during the day (Ruhtz, 2011), He found that lighting is the process of integrating light with architecture, and the concept of lighting integrates with the concept of architecture in three ways, namely: Increasing the aesthetic values of the designer's main idea of the space, enhancing it and supporting it. Activity within the space, highlighting some areas to highlight it, while other areas not intended to emphasize are dimmed (Beier, 2006). Since the message speaks of night lighting, it is important to know the fact that architecture during the early twentieth century began It takes its strong and prominent position during the night after

being restricted to appearing in the day only, all due to the growing interest in artificial lighting.

In the mid-1920s, General Electric Company conducted many experiments and researches to prove the appropriate use of lighting, and studied the effect of lighting on various building materials such as bricks, concrete and glass, as well as the effect of color on them. Materials in order to alert designers to take into account when choosing building materials, texture, finishes, as well as the color of materials and decorations when designing lighting for (Buchanan, 2006), and night lighting is an important and essential factor in the continuation of the work of spaces at night in addition to highlighting the aesthetics of the building and has the ability to balance between aspects Aesthetic and functional in order to achieve comfort for the user, and he is responsible for determining the different atmospheres and impressions in the internal spaces, and the property of the building is at the level of the external spaces, and therefore it is responsible for showing and defining the place (Aubrecht, 2012).

Most of the lighting designs for buildings, despite their different functional and expressive natures (Rodríguez, 2009).Reaching the comfortable and appropriate aspects in the visual environment is a process of marriage between lighting and architecture towards achieving the common goals of reaching a state of comfort, which is carried out by trying to harmonize all the conditions affecting the building, whether in terms of architectural treatments, interior designs or related effects With spaces, therefore, achieving environmental comfort in a vacuum depends on the following aspects:

a) The shapes and sizes of the optical structures used and the extent of their harmony and proportionality with the dimensions and shape of the space.
b) The locations of these structures and their relationship with the architectural elements used and the rest of the structural systems.
c) Technical formation of optical structures.

The design styleis done by using optical compositions and optical architectural formations as happened in the deconstructive architecture, where the use of these superposition's and configurations to highlight the great diversity in colors and formations, especially lines and surfaces that are appropriate, curved and compound, which form the structural envelope of the architectural space. It is used in irregular dismantling movement projects which reinforced the distinctive pattern of this movement.

The design team must agree on the concept of flexibility and define it in advance due to the possibility of understanding and defining it within multiple levels. Therefore, the concept of flexibility is defined that the lighting design of the project aims to reach. That the quantities and qualities of lighting remain constant as users move around it without any change in the light, or it may mean changing the quantities and qualities of lighting, according to the approved light control system.

The lighting of the kinetic corridors helps people to move from one place to another easily, taking into account that the creation of strong effects is done through lighting the floors and with the same level and importance of lighting used in lighting the walls and ceilings.

The walls and ceilings give the physical definition of a space and that lighting these elements would multiply the aesthetic effects of the place provided that it is done in the correct way, and this does not mean that it should be illuminated completely, but in-depth study and definition of the strengths of the landmarks and highlighting it doubles the importance of that The element also that the artistic formation of lighting at the level of using specific light compositions or a specific design works to strengthen the spatial identification identity (Buchanan, 2006).

The successful lighting design serves to serve and strengthen the basic design philosophy associated with the project, and it is responsible for highlighting the appearance of the building in terms of being good or vice versa in addition to providing a three-dimensional understanding of the structure and according to how it is shed on the

surfaces as well as the necessity Integration of this system with the rest of the other systems that make up the building (Salmon, 2006).

Identifying and knowing these factors would lead the designer to the correct and ideal contours of the successful architectural and optical design, so it is considered a tool to enhance and strengthen the aesthetics at the general architectural levels of the origin and the interior of the spaces (Beier, 2006).

In order to understand the specific nature of lighting design and before going into its more specialized details, the designer must take into account the stages that the lighting design goes through with the need to understand and understand the naturalness of the origin, whether it is an outlet and needs the requirements of redesign and development or it is a new structure, despite the nature of understanding It is prevalent that successful lighting design starts from the early stages of design, but the development and rehabilitation processes take the same level of importance, so the lighting design is according to the time sequence, whether the goal is to connect the integrated production of the design with lighting or the goal is to re-develop and qualify the product (Perkins, 2015).

2.4.1Lighting design standards

The following design standards have been referred to in many institutions specialized in lighting design, and they are provided with standard values that must be taken into account when designing to avoid errors, namely:

a) Level of illumination.
b) Balanced lighting.
c) Reducing glare.
d) Shadow direction and shadows.
e) Light color and chromatic performance (Harris, 2015).

Also, a set of important rules must be observed when designing lighting, namely:

a) Defining the visual mission.
b) Lighting the things you want or need.
c) The quality of lighting represents an important factor that must be studied engineering.
d) Darkness is important as is light.
e) Making use of natural lighting as much as possible.

Each lighting design goes through a set of stages until it is completed and according to the nature of the project and the goals of the work team, and it is not necessary for all projects to pass the same stages in a sequence, according to the specificity of the building, whether it is designed lightly or not, and despite the difference and distinction of each project from the other, but it is possible The division of these stages according to chronology and according to importance is as follows (Major, 2005).

Aspects related to the pre-design stage: There are a group of things that the designer or design team must understand before starting to develop the design idea for a group of lighting schemes, so understanding these matters will make the project as a whole. Understanding the nature of the activities required within the spaces of origin, their need for lighting and according to the specificity of these activities.The different types and specializations of the employees and thus meet their needs in order to achieve the optimum condition. The following steps should be taken into consideration;

1) Determine the objectives of the lighting design process to reinforce the basic objective of designing the facility as a whole.
2) Set priorities for standards involved in the design process.
3) Determining lighting standards and patterns while determining how to control them.
4) Aspects related to the design planning stage: This stage includes starting to develop hypothetical scenarios and defining a set of important aspects consistent with the following:

5) Make a preliminary plan according to real measurements, taking into account the existing or proposed furniture, the locations of the panels and the electrical strength sockets.
6) Record notes on the plans about the sites of light features and determine what those features are.
7) Determine the importance of the architectural landmark, therefore, the nature of appropriate lighting design.

After going through the aforementioned stages by hand, a preliminary design was made:

- Review the design team with all its components: the architect, the interior designer, the electrical engineer, and the mechanical, for the preliminary design.
- Begin to define the final design direction for the project.

2.4.2Aspects related to the development of the design process

In this stage, the final design prepared in the previous stage is strengthened, or in a specific case the goal is to redesign and develop what is actually there, in both cases the work at this stage is on the following aspects (Beier, 2006).

1) Choose the type of lighting and the techniques used in it to determine the general lighting of the place in order to obtain the best effects.
2) Choose the right bulbs.
3) Attention to detail.

2.4.3Aspects related to the completion of the design process

The process of completing the lighting design of the project requires the designer to take into account a set of important aspects that, if dealt with appropriately, will enhance and strengthen his final product so that it reaches the best effects, as follows: (Buchanan, 2006)

1) Determine the importance of the optical effects of the vacuum in general.
2) Determine the importance of the artistic light effects of light compositions.
3) Determine the locations of the structures.
4) Light finishes.

With regard to the implemented projects, and the designer's goal is to develop them, they go through the following stages (Cinzano, 2011).Rehabilitation processes is one of the stages through which lighting schemes and realistic illustrations are developed and the missing shortcomings are completed. Some aspects that were not taken into consideration in the early stages of design represent the most important stage in order to develop lighting schemes and show the project in an appropriate manner.

Reconstruction operations includes replacing the cables with new ones, restoring existing finishes, replacing switches and lamps, as well as new implementations for areas and shaded surfaces.Whether the design began with the beginning of the project or as a process aimed at its final development, it is imperative for the lighting design to display the architectural product in a distinctive way and relate to its place. Lighting is closely related to the definition of the place, as the first goal can be to show and strengthen the final product to express its spatial specificity (Mahdi, 2008).

2.5Factors Affecting the Lighting Design Process

There are a set of factors that greatly affect the lighting design process, which must be taken into consideration in order to reach the right solutions, namely (Lou, 1996).

- *Spatial factored*: is the necessity for all disciplines to work, starting with architectural design, interior design and lighting design within a compatible and coordinated system, with the need to define priorities in order to express them in the design of night lighting, so identifying the physical aspects affecting the architectural form and brightness would achieve the ideal state of design Provided that he serves the main philosophy associated with the project and expresses it correctly.

- *Visual environment pleasantness factors*:Reaching the comfortable and appropriate aspects of the visual environment is a process of marriage between lighting and architecture towards achieving the common goals of reaching a comfortable state, which occurs by obtaining harmony between all the conditions affecting the building, whether they are architectural treatments or designs Internal or external, and the visual environment comfort occurs if there is harmony in all the conditions of the built environment, and this is achieved when interaction and coordination within the work team is high, and the ergonomic aspects include the following: (Coleman, 2015).
    a) Shapes and sizes of optical superposition's used.
    b) The location of these structures and their relationships with the architectural elements and the rest of the structural systems.
    c) Lent formation of the used optical compositions.

- *Aesthetical Factors*: The study of the distinctive elements of a place and the identification of strengths in it, whether they are surfaces, blocks, details, or treatments, thus lighting them in the correct manner, works to double their importance, thus the importance of the place as a whole, so the artistic formation of lighting, whether at the level of the optical compositions used Or a specific design that doubles the importance of the place, for example, the focus may be on the structural structure or on the inscriptions or important architectural elements, for example, the focus may be on the structural structure or on the crunch or important architectural elements and lighting them differently from the rest of the parts in order to achieve aesthetic aspects It relates to the primary purpose of the design.

Lighting design is considered one of the most difficult design ideas to understand and implement, as it has multiple levels of influence to be responsible for creating the atmosphere and defining the different impressions at the level of internal spaces, and defining the characteristic of the structure at the level of the external system of the

spaces, thus it works to show and define the place, thus it is considered a tool to strengthen and enhance the field of architectural creativity if it is understood and properly employed, then it creates the important technical aspects of the project (Baker, 2015).

The defect in the lighting design process can be in how the thinking is applied to the process, as the initial idea of the project is a small group of ideas and that every part of the project or every space in it carries an idea for a specific lighting design, these small ideas carry visions Architecture converges to become the expressive idea of the project as a whole, and here lies the problem where the lighting design for each space in isolation from the other keeps the process fragmented, and does not rise to give the final distinctive design (Buchanan, 2006).

Determining the general impression that is intended to be conveyed to the recipient from the early stages of design is a guarantee of reaching the creative product, the most important movement in this process enables the naming or title of the most important spaces, which represent the heart of the project and give it importance by dropping the idea and design philosophy on it, while the rest of the spaces work As a support background for the important spaces, thus updating the state of integration between the parts of the project, as all parts of the place are taken into consideration, starting with the external borders of the site, passing through the architectural details used in highlighting the project and ending with the interior designs, so that the lighting process includes the design and signature of the most accurate details, especially the optical compositions, and it is necessary to indicate that the process of highlighting the set of architectural details for each project is not done in the early stages due to the difficulty and accuracy of the stage with the possibility of defects or alterations in the design and implementation, so it is implemented in the later stages (Duffy, 2015).Lighting of a place can be thought of in levels as follows:

- *Comprehensive lighting*:It represents the basic level and is designed according to the architectural envelope of each project, and includes the surfaces and the outer covering, and it provides a thin light for the place.

- *Illumination of the important functional parts*: mainly related to the events taking place inside and whether their nature allows them to appear transparent to the outside or not, and thus they are designed according to the specificity of that event.
- *Emphasis on lighting*: It centers on the focal elements, architectural details, landmarks, and special formations.

These levels and overlapping with each other to give the final view work to give the place a distinct identity (McGowan, 2013). Meanwhile, night lighting is concerned with the outside scene of buildings and it represents one of the concepts associated with the concept of architectural identity. Defining the project and giving it identity works in turn to give it the place, which represents the nominal goal of architects, with their various affiliations and orientations, and despite the multiplicity of concepts capable of achieving the architectural identity, night lighting is one of the most important of those concepts which It can work on it, as it guarantees the achievement of social interaction, which is one of the most basic factors to reach the architectural identity as it guarantees the interaction between humans and the place through the facility and thus enhances the first sense of belonging, as night lighting works to give the building privacy in addition to achieving aesthetic aspects (Flynn, 2003).

The lighting of façade levels is achieved through impartiality in expression, which represents one of the most important features of the resulting lighting design due to its ability to add aesthetics to the place, provided that the distinctive elements are properly focused on, whether the building is old or contemporary, with an emphasis on the tools that help the designer achieve his goals, which are represented in At the same time, the levels that are being worked on to highlight the aesthetics of the product and include: (Duffy, 2014).

- *Bottom lighting*: It has direct effects and is usually placed in the recesses of the ceiling. This type is used extensively, achieving a fertile field for imagination and reflections that serve the user, and in the case of relying on this type only, the space may appear dark, so it needs wall lighting support.

- *Overhead lighting*: It enhances the feeling of height, as it can make the place appear more spacious and spacious than it is, so the ceiling is highlighted directly. This type is more flexible than the first type and can be at high or low levels, according to the design specificity.
- *Distinctive landmark lighting*: It is used for the purpose of illuminating the distinctive landmarks in the place and emphasizing through them the important details where the lighting is indirect and frightening most of the time. The human eye moves subconsciously on the location of the light and point lighting is used for this purpose.
- *Color*: It represents one of the most important tools used by the designer and it is his responsibility to define it, thus determining the nature of the atmosphere achieved by determining the color or group of colors.

The effect of aging on the performance of the eye: aging is considered to have a significant impact on the performance of the eye, and its performance efficiency decreases with the passage of time, as it begins slowly and then proceeds rapidly with the advancing age, due to the lack of eye water and hardening and yellowing of the lenses, so a person who reaches 60 years of age needs to 15 times as much light as a year old child would need to get the same level of vision, the same degree of comfort and visual effectiveness (Janet, 1992).

The psychological effects of lighting: The perception of the light environment is the result of the mind's interpretation of the physiological interactions resulting from this lit environment, and this perception is what constitutes the psychology (psychology) of lighting, which does not depend only on the intensity, distribution and color of the light, but on the interpretation of previous experiences and experiences, culture and psychological state For humans, while many people may agree on the level of comfort, the degree of attractiveness, the characteristics of a vacuum such as the visual arrangement, the size and the simplicity of the space, and the sense of the character of the void, is it an intimate or general void, for this reason, the psychology of light is an intangible thing, and its result is uncertain, unlike the physiology of light.

Despite that, a series of studies over the years have proven that light affects perception in a meaningful and somewhat predictable way, so people tend to go to spaces that give a sense of comfort, and many people relate to a sense of relaxation, familiarity, fear, clarity and so on, all of the aforementioned reactions are affected much like what people see, (Flynn, 2003) has suggested that shapes and styles of lighting could be defined as the visual language through which mood impressions are communicated. It creates psychological effects such as privacy, warmth and familiarity. He also noted that both impression and mood are the basics of satisfaction and satisfaction in garage. Light has a direct effect on feeling and mood from a scientific and medical point of view, as light affects the production of cortisol, melanin and serotonin These three hormones affect the psychological state of people, so it is important to keep these hormones in an appropriate balance, and one of the methods of treating depression is light therapy (Akl, 2011), so the lighting designer has a great responsibility in designing lighting, directing and intensity of lighting is not only in favor of the physiological response desired by people but in favor of the psychological and personal responses of people.

Perception of brightness: The phenomenon of brightness is essential in the experience of seeing the surrounding world, it is considered the basic component of visual perception, and here it is necessary to distinguish between luminance and brightness, so luminance is the visual effect resulting from light reflected on a surface, while surfaces are the personal impression of light that illuminates a surface compared to another surface, and accordingly, the brightness needs two or more surfaces to judge one of them as being brighter than the other.

Perceiving the difference between luminance and brightness is an important thing for a lighting designer, and doubling the amount of light in a vacuum does not make the space brighter. The perception of brightness as the perception of shapes and colors is affected by a wide range of factors such as the color, texture, angle of incidence of the ray of light and the function of space. Both context and expectations may play an important role, so a moonlit night is described as bright or a cloudy day as dark (Phillips, 2000), and the brightness of the surface is a result of its background and the context in which it

is located, not the absolute light that receives it, and in Figure 2.6 we find that both squares in the center have the same degree of gray, except that the normal background makes the gray square brighter while the white background makes it darker (Michel, 1996). Figure 2.6 shows that there substantial differences in brightness as a result of the background.

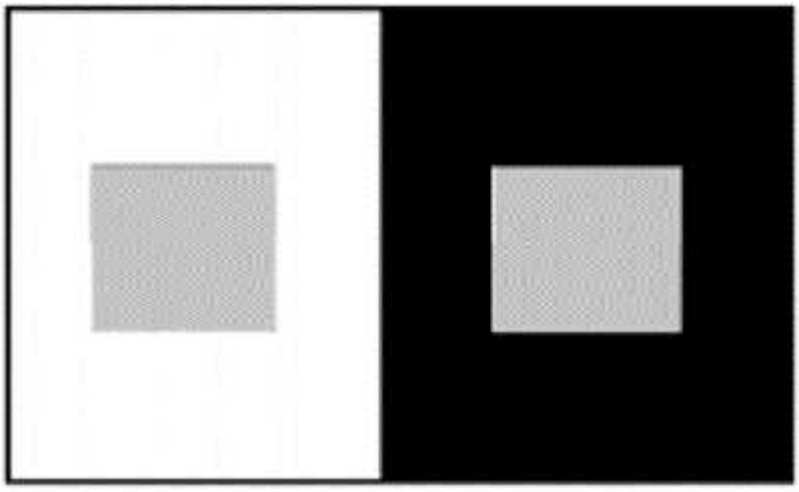

Figure 2.6: Brightness as a result of the background (Wright, 2013)

- *Emotional effect*: the personal impression of a vacuum is a function of brightness contrast, which is defined as the relationship between lit surfaces with background or surrounding surfaces that are relatively dark.

Table 2.4: The effects of positive and negative psychological colors on the soul.

Organic Influence	Negative Psychological Impact	Positive Psychological Impact	Color
Suggests activity and euphoria, is one of the stimulating colors of thought cells, some degrees of it affect the occurrence of intestinal disorders.	Irrationality, fear, emotional vulnerability, depression, anxiety, and suicide	Optimism, confidence, self-respect, relaxation, emotional strength, friendliness, and creativity	Yellow
Helps with digestion, recommended for use in the dining room	Deprivation, frustration, frivolity and immaturity.	Physical comfort, food, warmth, safety, feeling passion and fun.	Orange
Increases the speed of the heartbeat, causes a revolutionary excitement, is one of the most nerve-racking colors.	Challenge, aggression, visual impact, stress.	Physical courage, strength, warmth, energy, survival, fight or flight, motivation, and excitement.	Red
Has a good effect on the heart, lungs and blood vessels and increases the resistance of body tissues.	Autism, degeneration, oppression, inferiority.	Spiritual awareness, inclusion, vision, luxury, authenticity, truth, and quality.	Violet
It is a calming color, used in the treatment of some mental and neurological diseases, such as nerve fatigue, and it is effective in calming insomnia.	Boredom and stagnation, emotional cold, frailty.	Harmony and balance, love, comfort and reassurance, environmental awareness, peace.	Green
Helps relieve nervous disorders, calm rebellious souls, and reduce blood pressure.	Cold, introverted, irritable, unfriendly treatment.	Intelligence, communication, confidence, efficiency, serenity, reasoning, contemplation and calm.	Blue
It affects the mind more than it affects the body.	Prevention, emotional phobia, and physical weakness.	Material tranquility and care, warmth, femininity, love, sexuality and the survival of species.	Creatively
	Lack of confidence, sadness, depression,	Psychological neutrality.	Gray
	Persecution, coldness, danger, and heaviness	Sophistication, security, emotional security and efficiency.	Black
	For coldness, unfriendly and sterility.	Cleanliness, sterility, clarity, purity, simplicity, and efficiency.	White
	Lack of fun and	Seriousness, warmth,	Brown

	heaviness, and lack of sophistication.	nature, confidence, and support.

- It poses a real challenge for the creative designer, and if objects and surfaces inside a certain space are exposed to the same amount of light, then this will lose the contrast and the lack of this contrast causes apathy and depression for the users of the space (Table 2.4).The brightness and contrast have an effect on the way a person perceives architectural void, and how can this void affect it. Thus, that architects often use lighting to enrich the emotional impact, or to convey some meanings and suggestions through lighting (Akl, 2011).
- Perception of colour: When colored light falls on a specific surface, it changes its colors, and thus the reactions of a person change, and his behavior may be affected when seeing things illuminated in an unfamiliar way, because light affects the activity of the mind and the mood and feeling of the person, and whether it is this light is colored or fell on colored surfaces, it has psychological and organic repercussions that scientists have worked hard in explaining and developing theories related to it, and the researchers here indicate that there is evidence of the effect of colored lights on the emotion center inside the visual system of the hypothalamus in the brain, as they indicated that this effect is transmitted to the pituitary gland, which controls all the endocrine glands inside the body, including the thyroid gland and the sex glands, thus affecting the level of hormone secretion inside the body and its reflection on the nervous system and human moods, and the discovery of the deep physiological impact on the vital human functions helped find ways to employ this property To treat many disease problems (Richman, 2009). The following table shows the psychological and physiological effects of color on the psyche.

2.6Requirements for Correct Night Lighting

Lighting is one of the factors affecting the level of comfort in every space, so it is necessary to meet the correct requirements to reach an integrated design that gives

comfort and the natural atmosphere of the building, where the conditions for good lighting are taken into account (Magnus, 2008).

1) The lamps should give the necessary luminous flux to provide the appropriate level of light for the work that takes place in the place.
2) The lighting should be homogeneous as much as possible, the level of lighting should be very close in all parts of the place.
3) Observing the working conditions based on visual comfort and effective vision for a long time.
4) Light stability, constant light stability and selection of the appropriate spectrum for vision.
5) Taking into account the cost of equipment and tools used in lighting and energy consumption expenditures.
6) Artificial lighting can be a means of decorating a place by making use of the shades and the color of the light used.
7) Eliminate severe shadows resulting from concentrated light sources of rays, and to avoid these shadows, it is necessary to choose appropriate places for the light sources, and it is preferable for these sources to have large surfaces for emitting light, and it is preferable for the walls and ceilings to be light-colored and not bright so that the light can see them well.
8) Avoid severe discrepancies in shade and light. When designing lighting projects, it is necessary to determine the power of lighting and the locations of the lamps, and take into account the provision of gradual transition between shadow and light and take into account the distribution of light values in a way that always achieves the comfort of the eye.
9) Avoid dazzling eyesight caused by the intense luminosity of light sources if they are used alone without being integrated into devices. The light sources must be placed at a sufficient height of not less than 2.5 meters from the ground level so that these sources do not fall in the direct field of vision, which causes dizziness and dazzle of the eye as well. It is desirable to place the lamps inside reflective devices to hide them from direct vision.

10) Avoid severe reflections that result on glossy surfaces in particular, which causes eye fatigue as a result of dizziness, although it may respond in some cases to the presence of reflections, as is the case for jewelry or crystal stores because of the increase in the luster of the exhibits and thus the rate of sale increases.
11) Fair distribution of light with the choice of the lighting method most appropriate to the dimensions of the space and the purpose of use.
12) The possibility of access to lighting devices in order to clean them or change the damaged ones, as dust and fumes that accumulate on the lamps and lighting devices cause the absorption of light flux to a degree that reaches more than 50% of it, and therefore it is indispensable to facilitate access to lamps and devices to clean them from time to time (Aubrecht, 2012).

2.7Interior Lighting and Its Uses

Most countries tend to adopt almost similar models in interior lighting in terms of light sources and lighting needs in places of rest and work. The requirements for lighting at present are much greater than they were a decade ago, and the reason for this is not poor vision or damage to the eyes of modern humans rather, people tend to see clearly wherever they are without having to approach the source of light or wait for the sun to rise to do their work (Gary, 2002). The following is a brief presentation of some examples of interior lighting in a number of different spaces.

1) *In the role of housing*: The lighting design in residential buildings is considered to have special and sensitive characteristics, so each space in the residential building has a special design that differs from the living salon as a space with a social character than in the bedrooms with a high privacy character, due to the multiplicity of the uses and the different functions of the lighting here needs more attention to lighting each space separately in proportion to the use of that space, taking into account costs, and satisfying different tastes, and the following must be taken into account when designing home lighting.

a) The main focus is on natural lighting of spaces as much as possible, not only in order to save energy, but because of the advantages and benefits of natural lighting on visual, psychological and health comfort.
b) Lighting that can be controlled in intensity is used in most spaces of the house, as the lighting varies from one space to another, and it varies in the same space from time to time.
c) Timed lights are used for inclusions and external lighting.
d) Fluorescent units are used in kitchens, study places, and bathrooms, mercury or sodium lighting units are used for outdoor lighting.
e) All spaces must be provided with adequate general lighting for the purposes of movement (Cinzano, 2011). This can be illustrated using Figure 2.7.

Figure 2.7: Night lighting in internal residential spaces (Awattha, 2010).

2) *In offices*:Natural light entering from the windows was the basis for lighting in offices during the day, so the windows had to be wide and directed, while artificial lighting was intended for work after dark or in offices that do not receive natural light, and studies have shown the advantages of integration between the two natural lighting. There is no longer a need to make windows sufficient to provide the necessary light during daylight hours, but their presence is very important because they connect office workers with the outside world, and this principle has been adopted in most countries, and it has not been adopted in the United States of America. The work is separated by artificial lighting day and night, even if by hanging the curtains to reduce the glare of the natural light.

If the offices are fixed and the employees' locations are known, then special lighting is provided on the offices and places of visual targets required for work, with appropriate general backlighting, but if the offices are not fixed regular lighting can be made to illuminate the backlight with the addition of moving lighting on the desks, and in this case the lighting should be indirect to avoid glare (Gary, 2000).

3) *In restaurants:* lighting in eating places is considered a kind of contribution to creating an idyllic atmosphere that achieves familiarity and calm, so the level of brightness must be controlled, as it prefers dim lighting at night, with an emphasis on attention to the characteristics of the color performance of the lighting units used in lighting, because color is necessary and important in the appearance of food with its fresh and attractive natural colour (Birney, 2001). Such can be supported by Figure 2.8 showing different lighting systems used in restaurants.

Figure 2.8: Lighting in restaurants (Beier, 2006).

2.8External Lighting and its Uses

The external lighting of the projects represents an important element as it allows the use of external areas and their use at night, and the external lighting has two types (service and decoration) and the main purpose of service lighting is to provide adequate conditions for movement outside, in terms of providing personal security for individuals.

The security and safety on roads and pedestrian paths, reducing traffic accidents, and reducing crime. Service lighting is generally subject to specific equations that provide correct clarity and direction while avoiding the dazzling effect of used lights. And the reflections and very light spots on the elements that shed light on, giving them a wonderful view, regardless of the distinction of their details, as well as lighting the landmarks and gardens surrounding the building (Buchanan, 2006). The external lighting must be designed elaborately, taking into account the location, intensity, timing, color, duration, and good external lighting that meets many goals, including the following (Awattha, 2010).

1) *Enhancing safety and security:* More light does not necessarily mean better, as it may generate unsafe glare, which in turn will obstruct vision and cause accidents.
2) *Saving money:* When adhering to the recommendations of specialists on the levels of lighting that provide us with adequate lighting, and the use of good and energy-saving equipment and appliances.
3) *Protection of natural resources:* the illumination of the vacuum in excess of the required limit leads to the waste of natural resources and the pollution of air and water, due to the unnecessary burning of the limited fossil fuels.
4) *Good neighborhood:* where excessive lighting can disturb the neighbors and harm their privacy, when the glare from the lighting encroaches on others to an unwanted extent.
5) *Reducing light pollution in the sky*: Excessive and excessive lighting directed at the sky causes a lot of light pollution, and sky glow.
6) *Protection of wildlife from plants and animals:* Studies and research have indicated that night lighting disrupts migration, nutrition and some habits of large types of wildlife, and impedes the growth of certain types of trees.
7) Reducing health risk***s:*** The lighting at night not only disturbs you, but also causes a decrease in the production of melatonin, a hormone useful for humans, and resulting in an increase in the incidence of breast cancer (Gary, 2000).

The following are some examples of a brief overview of a number of different uses of outdoor lighting (James, 2013).

2.8.1 Gardens and landscaping

Garden lighting will create a group of different feelings to be like a reflective night mirror, so it is necessary to properly design it and highlight its distinctive features, whether they are trees, sitting places or architectural formations. The process of lighting the gardens is done in several ways, the most important of which are:

a) Arrangement of trees and their lighting, taking into account the nature of the location of the buildings, according to the designer's goal, the nature of the project and the function. The shapes and sizes of trees and their fit with the building play an important role that must be taken into account.
b) Emphasis on creating a dramatic scene by lighting the base of the tree with lighting sources that are signed in the ground, while lighting the tops of trees with point lighting sources. This formation represents an influential night scene in the garden system.
c) Dealing with the garden and its components (pathways, trees, water elements) as one unit with the building, so that they complement each other, and provide the appropriate environment for the users' psychological visualization (Harris, 2015). This also includes gardens and water elements (Figure 2.9).

Figure 2.9: The use of lighting in gardens and water elements (Awattha, 2010).

2.8.2Pedestrian walkways

Pedestrian paths are lit for a set of goals, the most important of which are: achieving the safety factor, reducing unwanted light from neighboring buildings, and aiming to avoid the risk of slipping and falling, and helping to define the road and not violating the borders of neighbors, in addition to the continuity of social interaction in the lit areas. Lighting takes place along the corridors and entrances to buildings.

Figure 2.10: The importance of avoiding glare in pedestrian paths (Branch, 2004)

Furthermore, it is used to remove all sources of reflection and dazzling light, to identify and clarify the identity of the road and place by controlling the intensity and lighting system(Marilyn, 2013). It can also be used to distinguish between the lighting of car roads and pedestrian roads, while providing adequate lighting at the intersections of pedestrian paths, and focusing the lighting on attractive distinct formations.

2.8.3 Roads

This lighting relies heavily on city plans, lighting devices and their themes, and humans have realized since ancient times the importance of road lighting as a security factor and a hindrance to crime, and there are many goals that are achieved when lighting roads, the most important of which are (Duffy, 2014).

1) Achieve safety at night by providing drivers and pedestrians with visual comfort and accuracy.
2) Improving the flow of traffic during the night by providing adequate lighting behind the car lights that mark the road boundaries and existing obstacles, and reducing street crime after dark.
3) Tunnel lighting during the day to provide more light and visibility to allow drivers to pass and drive safely, in addition to enhancing commercial traffic and attracting shoppers during the evening.

2.8.4 Stadiums and sports arenas

In its long history, sports were limited to daylight. However, the development of energy sources and light sources provided the economic feasibility necessary for lighting sports arenas and stadiums, and the lighting at the beginning depended on lights suspended directly above the stadium, but the basic method used today is to use rows of huge lighting devices in the corners of the stadium or on its surroundings, and special lamps with high light yield and relatively long life such as tungsten halogen are used in this

case, and stadiums may soon have more effective lamps of the type of xenon lamps (Baker, 2015).

2.8.5 Entrances

The entrances are the ones that receive visitors to the building, and often the entrance is the most visible element in the facade, and the good lighting of the entrances gives a sense of welcome and intimacy in addition to security. Well lit, the designer may not need to light the entire road leading to the entrance in order to avoid extreme brightness, but rather he is satisfied with lighting any change in the directions of the corridor, or the presence of obstacles such as trees (Beier, 2006). This can be noted from diagrammatic views shown by Figure 2.11.

Figure 2.11: Night lighting for entrances and architectural elements (Birney, 2001).

2.8.6 Advertisements and indicative signs

Lighting is used in commercial advertisements and indicative signs in appropriate ways so as to avoid looking at it and not distracting it from its surroundings, and this is done through either the illuminated letters, the illuminated panel, or through letters lit from

the outside, and the color of the light affects the response of the viewers (Birney, 2001). Figure 2.12 denotes some of the use of lighting in commercial advertisements.

Figure 2.12: The use of lighting in commercial advertisements (Buchanan, 1993).

2.8.7 Residential buildings

Residents tend to use night lighting in residential buildings for the purpose of guarding and lighting the perimeter of buildings around corridors and through parks, green spaces and outdoor sessions in periods of the sky. It can also be used in external spaces such as verandas, balconies, entrances and gates. This can be noted from diagrammatic views shown by Figure 2.13.

Figure 2.13: Night lighting for residential buildings (Branch, 2004).

2.8.8 Architectural uses

The main purpose of lighting these installations is the decorative effect lighting, and the style often used is flood lighting, intended to illuminate entrances, facades, architectural and archaeological monuments, monuments, fountains, signs and green spaces with multicolored lighting and spotlights of varying intensity and the general principle here is to shed light on the thing What is meant is to highlight it from a sufficient distance, so the facility is lit without what is adjacent to it, and the purpose of the flood lighting is to distribute the light in the direction and in the quantity necessary to illuminate all parts of the façade, so that its sculptures, drawings and shapes appear in broad daylight, and it may resort to marking the edges of buildings with glitter lamps or with visible or frightening colored lamps (Branch, 2004).

CHAPTER 3

THE AESTHETICS OF LIGHTING

3.1Night Lighting and the Beauty of the Architectural Shape of the Buildings

3.1.1Architectural form

The form in the language is how the external appearance of the object is known as the physical form as a material consisting of atoms or generally from a group of parts connected by relationships and between them fixed distances in the case of being balanced, these molecules are in a state of continuous movement (Aubrecht, 2012).The mosaic is known as the sum of the properties that make the thing what it is, as all sensory qualities combine and give together the form of the object composite of multiple parts, the form that is called the sum of the parts and their relationship with each other and between them of spaces, inside or around, all of which define a distinctive character of that thing or body which is a substance that can be perceived by the senses

Meanwhile, the form is an abstract characteristic that the mind realizes through the senses, but it is indispensable to one of the other and they are a coherent unit (Buchanan, 2006), Angerer emphasizes that good architecture is looking for the right forms to achieve beauty and efficiency to ensure stability, then look for functionally appropriate forms to achieve benefit and comes in multiple forms, including body, image, style and structure, so that Form is a homogeneous structure in which the number of elements perceived is associated with appropriate relationships to perceive the personal qualities of the mind that produces it.Those relationships are (creation, composition, arrangement and organization) all definitions that dealt with the form have two basic aspects: substance and appearance. Aristotle explained the first aspect of the form of the object to Osuski's saying that the form is only material, while others pointed out that the shape is a phenomenon and a sensory system of relations between parts of the lines, surfaces and colors (Buchanan, 2006).

When looking for the definition of architectural form in some theoreticians of architecture, we see that they say that (i.e. architectural form) is a set of surfaces that define an internal void, or that it is composed of one or more material or surfaces in a natural or industrial color, subject to treatments consistent with its natural properties, and shows its vitality in natural light, and the basic elements of architectural forms, lines and levels, objects, blanks and blocks can be easily observed the superficiality of this view of the form when the intellectual moral aspect is overlooked, but the form in its reality is known as theories that it is known as theories that it is theories that it is known as The architect's elements were realized as a whole, not as a result of any spontaneous gathering (Cinzano, 2011).

The architectural form reflects the tangible physical result of the architectural composition, which is the image of the architectural work of all its parts and relationships between them resulting from the designer's choice of elements, spaces, spaces and objects related to the construction to fit and embody the architectural work, and the concept of the shape may relate to the forms of elements used in the building such as the shape of the window or terrace or the entrance of the building and may

extend to the form of a set of elements or the building at the end, while the form is known as the architectural work, as well as the form of the architectural work.

As the point of contact between mass and space, the characteristics form the void and give it the spirit and value, the formal characteristics are one of the most important characteristics that affect the process of perception and help to understand and understand the surrounding environment, and these characteristics are: texture, materials, light effects, shadows, and color. The exterior that distinguishes the object and is often used in art and architecture to indicate the formal structure of the work, and refers to the elements and the style of their connection and the relationship between them while it is assumed that there is a set of vocabulary that determines the architectural form and of these vocabulary, and the boundaries and movement, the structural system and the type of construction, environmental control, and general palaces, and adds that the form itself is one of the most important elements that underpins the design process in the composition of the building, and then returns to the detail of the form in the architecture based on the fact that it is based on the structure of the building (Duffy, 2015). A number of related vocabulary: emptiness, organization, mass, balance, ratio and scale, as well as repetition, rhythm and finally unity and diversity.

The architectural form must support the meanings that exist in the collective memory, through which the individual understands the work and puts it within the world of known things, where architecture represents a civilized phenomenon whose elements are thought, art and language not isolated from other civilizational elements that make up civilization, the form in architecture is the result of a dialectic interaction between two rapporteurs, namely the social and technical demand, and the individual is the one who does this interaction as his way is not achieved and through it, and the form is visible only to the entity that has been achieved as a result of this dealing. Certainly, the form in the architectural work needs a content that controls its order, and the success of the form in expressing this content is followed by the recipient’s sense of impression of a particular mental image through his awareness of the work (Flynn, 2003).

3.1.2Beauty in architecture

Beauty in architecture as a term does not have a specific definition of the concept, because of its complexity, because of the differences of views between the orators, but most studies focus on the association of the concept with the concept of the pleasure of stimulating the recipient to question, and then his mental participation in the long, and then trying to understand the work which generates effective participation on the one hand, and then building expectations about the content of the work and the length of time of the act of receiving, which generates pleasure and beauty in the results for the recipient and beauty in the architecture according to the achieves When the building or parts of it achieve the function for which it was designed (Gehring, 2010), with a clear and explicit structural efficiency in the proportions of the building and its parts, and are these parts carrying or portable. We find Fisher knows the beauty with all that is good and true, while St. Augustus knows it as the splendor of honesty, but Alberti knows the beauty as the harmony of all parts, so that it cannot be added, removed or changed, except it was an abuse of design and it is a tight compatibility between the elements of the building all, while Cliff and Inri it is an expressive picture.

For any relationship between the lines and colors and sizes in itself, it is worth mentioning that the interest of the architect and urban and the designer of the coordinator of the sites and the plan to create an aesthetic experience for others is one of the most important considerations or design goals agreed upon by practitioners or theoreticians in the modern era after the attempt to seek a clear understanding of what is beautiful in the built environment is the subject of ridicule critics of art and architecture in antiquity and their most famous critic, John Ruskin who insisted that aesthetic values cannot be subject to any A scientific study, the desire to reach a positive science that cares about beauty and its philosophy has been the focus of discussions by many philosophers, artists and architects over the centuries (Frank, 2006).

3.2Beauty and Visual Perception

The term perception in psychology is called the mental process in which the identity of the outside world is recognized through the senses, and perception is a mental process aimed at drawing a special mental image of bodies by the light reflected in us, man sees through a sample, but he realizes through his mind the vision of the most important human senses because it conveys to him what surrounds him, and affects the amount of lighting and colors of bodies and their backgrounds, but does not add to the experience of man nothing, because the visual input is not integrated only in the human mind by processes a complex called perception. The process is formed according to the experience of the individual, and perception is a mental knowledge in which the individual receives and organizes information related to the stimuli, interprets it, gives it special meanings that may differ from reality (Gary, 2002), and then act according to this meaning, either the feeling or feeling is the reception of the individual to an external sensation through its five senses (hearing, sight, touch, smell and taste) is a physiological and neurological process.

Perception is more comprehensive than the sensory as it is a process of mental knowledge that selects and chooses from the information that the senses communicate to the brain, and then organizes this information.Interpreting it and giving it meaning, and therefore the feeling is part of the perception, the sense of form and emptiness is formed when achieving a certain cognitive relationship between the human and its surroundings. That is, that perception is a mental process determined by the effects that can affect the mind of the recipient without determining the type of effect negatively or positively, dealing with the environmental data of the ocean and the body of perception. Therefore, the process of visual perception is (the process resulting from the information provided to a human from the surrounding environment through the visual system and transmitted to the brain where it enters into different mental processes from it to be hence its use). Thus, it can be considered that the process of visual perception is an important process to identify the environment surrounding the human in addition to the awareness of time and space and everything related to this environment.

Since the process of visual perception is the most important process through which the human being is acquainted with all that surrounds him has come important for the architecture, the human eye works to classify everything you see, for example buildings such as what is ugly and beautiful and huge and proportional to the human scale, hence the architectural or planned attention to the subject of the formation of the formation of Buildings or city plans so that buildings are formed in a damaged environment and with the human being who is considered the most important element in this environment (Hanifin, 2015).

3.3 The Aesthetics of Lighting

Aesthetics is theoretically defined as the preservation of proportion, harmony, usefulness, relevance, and moderation (Ebbensgaard, 2020). Stone (2021) regards that this definition merely describes aesthetics as something good and true. Meanwhile, aesthetic lighting is examined in two distinct ways.First, involving a device's aesthetics device (lighting – placing, lenses, fixture), and secondan aesthetic effect (the object's appearance caused by lighting). Meanwhile, the hardware'saesthetics is usually regarded as being of high importance when assessingaesthetics in automotive lighting (Bist et al., 2017). However, it is practically difficult to predict automotive lighting's effectsbecause it is influenced by various factors such as ambient and the course of the road.

Nevertheless, in architecture, aesthetics is of vital significance in electric lighting because it revolves around the application of various concepts and standards like lighting utility,appropriateness, moderation, harmony and ratio of luminance (Zagan & Kowalska, 2017). Additionally, it aids in ensuring that the right lighting proportions are used in lighting a space or building. Thus, it is vital to ensure that both architects and interior designers avoid problems related to aesthetics carelessness and shoddiness, improper use of coloured lighting, lack of consistency,distortion of shapesand colors, disharmony, and glare.

In conclusion, each social or ethnic group has its distinct lighting aesthetics preferences. Therefore, the role and importance of lighting aesthetics can differ between these groups. However, it remains vital to ensure that uniform, consistent, and non-intensive lighting is used to enhance the aesthetic appearance of public buildings and spaces.

3.3.1 Aesthetic requirements for individual areas of lighting

Aesthetics can be applied in different architectural areas like public spaces, housing and street lighting (Smith et al., 2021). A study by Ebbensgaard (2020) contends that all these aesthetic lighting areas should have similar equal spacesbetween them, be neatly arranged, and with an equal heightfrom the curb. It is after meeting these conditions that they establish a good picture or view. The aesthetics of public buildings encompasses the use of various forms of light (housing and pole lighting). Studies contend that a good aesthetic of lighting whether used in public buildings, houses or streets, must be beautiful when switched off and stylish (Zagan & Kowalska, 2017;Stone, 2021). This implies that both building, house and street lighting must be aesthetically beautiful under both uniform and improperluminancedistribution conditions when subjected to a uniform. Therefore, an acceptable aesthetics of lighting requires that shadows and dark spots not be visible when luminance is improperly distributed on a building, house or street. Thus, a building, house or street lighting installation is unaesthetic pleasing when it produces severe glare. This is because it adversely affects people's emotions (Bist et al., 2017).

3.3.2 The aesthetics of interior lighting

Architects and interior designers must be considerate of the colour of light used either in public buildings, houses or streets. Furthermore, Zagan and Kowalska (2017) reiterate that all rooms should have lighting colours that are skillfully and consistently combined to produce an aesthetically pleasing appearance or view. Problems occur when wrong lighting colours are used, especially when light sources with various shades of white are

used in a single room. As a result, people can develop negative perceptions about the space (Smith et al., 2021). Stone (2021) contends that this creates imbalance effects, which are highly visible to users. Consequently, it is suggested that warm and white interiors with a colour temperature of 3000Kare vital for creating aesthetically pleasing spaces (Ebbensgaard, 2020). In addition, this effective and acceptable for use in bathrooms. On the other hand, minimalist and harsh buildings designs can have their aesthetic appearance enhanced by merely using a cold shade of white

Bist et al. (2017) state that aesthetic lighting should be designed based on the required purpose. Effective architectural and interior decoration designs must initially determine howthe general lighting is to appear, and in doing so, they can ensure that the lighting is evenly distributed across the whole room or building. Lighting illuminance should be uniformly distributed throughout the entire room or building (Zagan & Kowalska, 2017). Such is the importance of enhancing thermal comfort and reducing energy consumed by a building (Bist et al., 2017). Furthermore, Ebbensgaard (2020) contends that aesthetically pleasing lighting conditions are those that ensure that all the applied light sources' beam light is evenly distributed.

The aesthetics of lighting in any building, house or public space can be affected by the extent to which the lighting intensity is distributed over a given space.For instance, poor lighting intensity can adversely affect the uniform distribution of light over a given space. However, some studies argue that a lack of lighting uniformity does not always imply that the lighting conditions or outcomes are unaesthetic pleasing (Bist et al., 2017; Ebbensgaard, 2020). Hence, they argue that focus should be given to reducing irregular or uniform light spots. This problem is described as dissonance and occurs when there is a poor selection of a beam's direction,placement andangle (Bist et al., 2017).

The aesthetic of the interior lighting is also influenced by lighting fixtures and there are several contrasting ideas about this subject matter. For instance, Stone (2021) contends that the aesthetic of interior lighting is subjectively and significantly influenced by lighting fixtures. Others suggest that these issues can be addressed by transforming both the function and appearance of lighting fixtures (Smith et al., 2021; Zagan & Kowalska,

2017). Therefore, there are several perceptions and concepts about the aesthetic luminaires and lighting fixturesused in interior design projects. Thus, it is essential to consider the aesthetics of lightingin design and for decoration purposes.

CHAPTER 4

CASE STUDIES

4.1Case Study 1: Emirates Palace Hotel (EPH)

Emirates Palace is a magnificent cultural edifice, built in Arabic form, and oversees the beach of Abu Dhabi City, where its roofs are decorated with 114 domes characterized by the finest stained glass mosaic paintings, and the Emirates Palace combines the splendor of design and quality in services, where the palace is equipped with the latest technologies and the finest services to meet all the needs of its guests and details of their personal requirements, the Emirates Palace Hotel, run by the Kempinski Group, has provided a vital space to show great hospitality to welcome the leaders of the world,

celebrities and travelers for the purpose of working from all over the world, and extends to the hotel.

A 1.3 km natural beach surrounded by an area of 100 hectares of meadows and green gardens, the palace houses the largest and most luxurious conference rooms in the UAE with a total area of approximately 7000 square meters including a theater of a type of capacity of 1200 people equipped with the latest technologies of the era to hold international conferences and meetings in the Middle East. In addition to the largest concert hall in the country, a sophisticated media center and 40 meeting rooms, as well as emirates palace 394 luxurious rooms and suites, all equipped with the latest international technologies Such as plasma screens and wireless internet connectivity, which covers all parts of the palace, the palace has enough underground parking for 2500 vehicles.

There are swimming pools and health products, in addition to a private airstrip, and the palace has a huge main dome with a diameter of 42 m, which was finished from silver and gold glass tiles topped by the solid gold finish weighing 20 kg and the color reflects the yellow and orange color of the sand desert.

a) *Shape*:The idea of designing to produce a saw representing the traditional and ancient environment, originating from the Arab desert, was embodied and highlighted by the night lighting that transformed the project from bricks and concrete to a vibrant building that radiates vitality, activity and movement as can be seen in Figure 4.1.

Figure 4.1: Emirates Palace, shape (Birney, 2001)

a) *Colour*: The palace is designed to harmonize the colors known for the sands of the Arabian Desert and the traditional environment of yellow and orange.In addition to the different and changing colors of the domes to strengthen the idea and enhance the overall color of the projectmovement as can be seen in Figure 4.2.

Figure 4.2: Emirates Palace, colour (Duffy, 2014)

b) *Texture*: The project is dominated by a sense of rough texture resulting from the use of desert color stemming from rough yellow sand. Such has been confirmed

by hidden orange lighting that contributes to the building's legacy and complexity (Figure 4.3).

Figure 4.3: Emirates Palace, texture (Aubrecht, 2012)

a) *Finishing materials*: Finishing materials from materials showing the shape, color and texture of the sand were used to confirm the main idea of the project, which was clearly demonstrated by night lighting (Figure 4.4).

Figure 4.4: Emirates Palace, finishing materials (Baker, 2015)

c) *Construction system*: The project adopted the reinforced concrete system as a construction system that was confirmed and highlighted by highlighting the columns and crowns and using them as aesthetic elements both in interior and exterior design (Figure 4.5).

Figure 4.5: Emirates Palace, construction system from inside (Buchanan, 1993)

b) ***Analysis*:** The hotel was built to be a landmark of the civilization of the United Arab Emirates, and the traditions of Arab hospitality in its finest form. So all the details of this palace were made at the highest level of quality and modern technology to provide maximum comfort to visitors and guests. The system lighting has embodied the night lighting architectural blocks of the project, and highlighted the architectural form of the palace with all its different elements such as openings, contracts and domes in different colors and explained the paths of movement in it. In addition to confirming the level gradient through the lighting of stairs and entrances. This became the general inspiration with the night light and the project was vibrant and more effective during the night. Night lighting was also used to highlight the elements of the coordination of the site by lighting corridors, trees, palms, water elements, floors and various tilings, in addition to confirming the homogeneity of all elements of the project using the same colors of lighting and finishing.

The adoption of the hidden lighting system provides the required relaxation state and enhances the design idea of the wine desert color emanating from the traditional environment, and increases the element of suspense and attraction. The interior design has a large and wide share of night lighting, which played the biggest role in providing amazement, astonishment and fascination with the palace's interior night scene, which contains many different interiors, amazing decorations and multiple colors that have been tasked with highlighting the night lights.

4.2Case Study 2: The Building Flame Towers (BFT)

Located in Baku, Azerbaijan, the architect has consumed the idea of Azerbaijan's history as a land of fire, due to the presence of rich layers of natural gas, where the design aims for a kind of tourist propaganda of the technical state with natural gas and the building is located in the upper part of the city, and in the pulsating center of Baku city overlooking the Caspian Sea, is considered the longest building and an important landmark in the heart of the old and historical city. The city is visible from large areas of the city consists of three towers resembling flames, each of which is considered the longest building and an important landmark in the heart of the old and historical city. It is also visible from large areas of the city consisting of three flame-like towers. Each of which is considered to serve various uses (residential - offices - hotel), connected to each other through the base of the three-storey building, which contains many activities such as cafes, restaurants, shops and cinema, which serves residents and visitors. In addition to providing parking at the rate of 50 cars per tower, triangular towers ending with a point, surrounded by the modern roof of the top of the base, and the construction system used for this building is reinforced concrete. The tops of the three towers have been made of iron for special use of the target. The design has used reinforced concrete and iron as mentioned above and the facades have been wrapped in light orange colored glass for use in the form of fire, but the lighting used LED technology on the glass cover of the

three towers has been used more than 10,000 units trampled on the facades to be seen from the farthest places in the city.

a) ***Sh****ape*:Night lighting clearly demonstrated the design idea as it was a central element of the design, and the project was built on the idea of lighting that embodied with the three arms of the building the burning flames as shown by Figure 4.6.

Figure 4.6: Building Flame Tower, shape (Buchanan, 2006)

b) *Colour*:Night lighting was used because it used large areas of glass and the entire area of all towers. This was confirmed by night lighting through light reflections on the glass surfaces as shown by Figure 4.7.

Figure 4.7: Building Flame Tower, colour (Gary, 2000)

c) *Texture*:The building has a soft texture due to its use of large areas of glass and the entire area of all towers, which was confirmed by the night light through the light reflections on the glass surfaces. Figure 4.8 shows the Building Flame Tower's texture.

Figure 4.8: Building Flame Tower, texture (Beier, 2006)

d) *Finishing materials*:The glass was used in the outer cladding of the three towers in full, while titanium panels were used for the lower floors of the base of the building, where night lighting contributed to the highlighting of glass surfaces and different colours. These ideas are shown in Figure 4.9.

Figure 4.9: Building Flame Tower, finishing material (Aubrecht, 2012).

e) *Construction system:*The reinforced concrete was used in the building, and the external lighting units were placed on the perimeter of the ceilings on each floor, so that the roles could be counted through the lighting lines behind the glass casing of the building. However, this could not show the construction structure of the building as shown by Figure 4.10.

Figure 4.10: Building Flame Tower, construction system (Birney, 2001)

f) *Analysis*:The architectural idea and the composition of the architectural form were designed based on the night lighting that embodied the design idea during the night, through the use of the arms of the three building as the edges of the flames, through which the designer wanted to enrich tourism in the country called land of fire where it is characterized by the abundance of natural gas, and the building was used in national celebrations by showing the building waving colors of science, and in the same way can use a lot of different colors changing and moving both on the building as a whole or by showing each arm in a different color, so we realize how important the night lighting is to the entity of the building and how effective it is and its ability to carry out its duties since without the night lighting the idea of this facility would not have been any value or importance.

4.3Case Study 3: National Center for the Performing Arts (NCPA)

The National Center for The Performing Arts is located in the heart of Beijing's Old City, close to the Great Hall of the People, Tiananmen Square and the Old Forbidden City.Titanium and the glass crust of the oval-shaped building who's mass appears to float on the surface of the water, which they call eggs. Surrounded by an industrial lake, green meadows and gardens, it looks like a cultural island in the middle of the lake, and when the building lights up at night, it looks like a titanium block and has been unveiled to show the glass part, and the building is entered through an 80-length corridor. Meters below the lake, the design of the building is considered an adventure and a combination of classicism and modernity due to its difference from the surrounding urban environment so that it appears as a pearl on the surface of the lake and is an architectural formation beyond imagination, and the building consists of three functional areas: The first is the northern hall and underground parking, the second, and the area includes an opera house, a concert hall and a theater, while the third is the southern entrance and other service areas, the corticosteroid structure of the center is studded with 506 lighting units, unlike the sparkle of lighting formed by Nearby buildings, the light from the center consists of countless shimmering lights, just like the stars in the sky, and the building is considered one of the deepest buildings in Beijing where it is 32 meters underground, equivalent to a depth of 10 floors, and from The strange thing is that the color of the dome glass is dark as the direction of sunlight changes.

a) *Shape*:The architectural shape of the building is unique and the transparent glass part of the building has doubled the ability of night lighting to highlight the building's charms through the emitted and reflected interior lighting as well as the exterior lighting of the building (Figure 4.11).

Figure 4.11: The National Center of Performing Arts, shape (Janet, 1992)

b) *Colour:*The night lighting of the building appeared in various colors, including what was focused on the architectural shape of the building.

Figure 4.12: The National Center of Performing Arts, colour (Birney, 2001)

Some emerged through the colors of the inner night lighting emitted, which was integrated with the external lighting to look the architectural product in its finest form (Figure 4.12).

c) *Texture*:Glass and titanium, which are smooth and soft surface materials suitable for the flowing material around it. They have been used and night lighting has contributed to highlighting the glass side of the building by emitting light from the inside with some external lighting and reflecting it in the water (Figure 4.13).

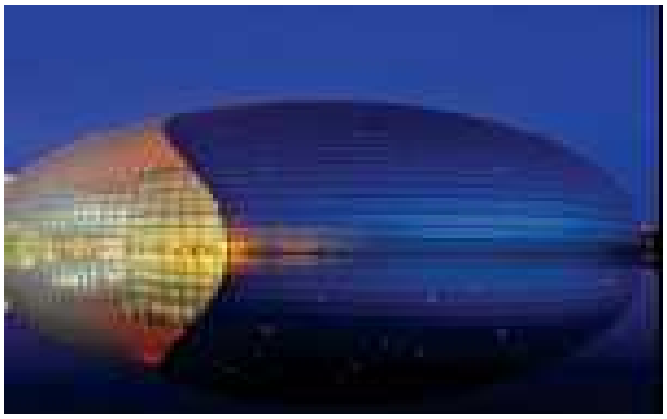

Figure 4.13: The National Center of Performing Arts, texture (Aubrecht, 2012).

d) *Finishing materials*:The finishing materials used are glass and titanium, bright and shiny surfaces that, with night lighting (Figure 4.14). Such contributes to the smooth state of the water flat, which is consistent with the musical symphonies in the building's spaces.

Figure 4.14: The National Center of Performing Arts, finishing material (Beier, 2006)

e) *Construction system*:In the dome's work, the designer relied on the titanium and glass-bearing metal structure shown by the night lighting from the outside through the glass flat, as well as the clarity of the metal structure in the interior design as shown by Figure 4.15.

Figure 4.15: The National Center of Performing Arts, construction system from the inside (Aubrecht, 2012)

f) *Analysis*:The building has a different architectural shape, which is the largest oval dome in the world, and has been characterized by the use of titanium and glass, which are shiny and soft materials, where they look harmonious and harmonious with the water flat around the building, in which the block of the building was reflected, and decorated night lighting built in different colours and multiple through the lighting of the transparent glass part of the building to complement with the external night lighting the quiet dramatic scene, where the lighting of the bright surfaces contributes to the formation of the night scene of the project and the urban ocean. This in turn helps to increase the social interaction with the building increases the turnout of the building (Figure 4.16). Therefore, it has achieved the architectural identity of the building, and contributed to the definition of the place, and the lighting highlighted the soft texture of the building clearly, as the mass of the building with a transparent side that radiates light reflects and extends inside the water flat to show the building full of vitality. The energy emitted from the inside out to indicate the depth of the building and movement and activity within the building.

Figure 4.16: The National Center of Performing Arts, shape analysis (Buchanan, 1993).

4.4Case Study 4: Palestinian Pension Authority (PPA)

a) ***Des****cription of the project*:The Building of the Palestinian Retirement Authority is considered one of the distinctive administrative buildings and an important architectural landmark in the Gaza Strip, where this building is located in the western part of Gaza City, and on the intersection of Al-Thawra and Said Al-As Streets, and between a group of public and government buildings such as the Ministry of Social Affairs and the Union of Churches, and separates it from Al-Thawra Street Mosque and its public park, as well as separated from the Stadium of Palestine street from the north side, making the building surrounded by streets from all sides, and this is constantly visible in the vicinity of al-Amrani. The building consists of six floors with an area of 574 m2, and the building was considered one of the first buildings that used glass surfaces in its facades, including what is in the mass above the entrance and the rest through vertical openings along the height of the façade, in which it dealt with open and closed and prominent flats and covered with natural stone in different sizes and colors, It is worth noting here that the building is not lit at night despite the presence of night lighting units on the building and officials have instructed this to mitigate expenses due to the financial crisis that the authority is going through and has

been specifically lit at the request of the researcher to put in the hands of the scenes the situation on which these architectural monuments and public buildings become in the formation of the night scene.

b) *Shape*:Night lighting highlighted the architectural shape of the building during the night by highlighting the submersible blocks to balance the prominent blocks where the glass floors looked like a black background to make the building look different from the rest of the surrounding buildings as shown by Figure 4.17.

Figure 4.17: The Building of the PalestinianRetirement Authority, shape (Eisenbeis, 2006)

c) *Colour*:The building is dominated by the natural white color of the vast expanses of white Jerusalem stone, which is interspersed with areas of colored stone in the prominent blocks and interspersed with these spaces and those glass flats, which seemed after the lighting as if they were black backgrounds interspersed with stone (Figure 4.18).

Figure 4.18: The Building of the Palestinian Retirement Authority, colour (Baker, 2015)

d) *Texture*:The lighting clearly highlighted the rough texture of the natural stone (Jerusalem) but at different levels according to the sizes of the stone small and large so that the small-sized stone looks rougher due to the general texture where the many lines of the stone as shown by Figure 4.19.

Figure 4.19: The Building of the Palestinian RetirementAuthority, texture (Gauthreaux, 2006)

e) *Finishing materials*:Night lighting helped to show finishing materials at night by focusing the lighting on the walls to highlight the white and colored Jerusalem

stone in different sizes interspersed with glass surfaces to be a public perspective during the night (Figure 4.20).

Figure 4.20: The Building of the PalestinianRetirement Authority, finishing material(James, 2013).

f) *Construction system*:The building was constructed from reinforced concrete, which the night lights could only highlight by focusing some lighting units under the roof of the prominent ground floor, as well as the end limits of the building, the last prominent roof and the main drive(Figure 4.21).

Figure 4.21: The Building of the Palestinian Retirement Authority, construction system (Flynn, 2003).

g) *Analysis*:The Building of the Palestinian Retirement Authority was characterized by its unique and distinctive design, which is characterized by a high-level beginning, speaking of itself as a public administrative building, which is characterized by a combination of luxury and simplicity in that one achieves balance in its general form by manipulating prominent and into dating blocks on the one hand, and using materials finishing (Jerusalem stone) in different sizes and colors (Figure 4.22).On the other hand, in addition to the openings of longitudinal windows as a common denominator frequently used between submersible and prominent and coated with dark green glass sheets, and focus on using large areas of glass surfaces to highlight mass. The main entrance, which was allocated a different kind of night lighting where the designer used the point lighting to distinguish the entrance, which is filled with huge columns high two floors covered with metal and in the middle of these columns star eight interspersed with lighting units and circled on its surroundings.

Figure 4.22: The Building of the Palestinian Retirement Authority, analysis (Hanifin, 2015).

4.5Case Study5: Jalil Khayat Mosque

a) *Project Description*: Jalil Al Khayat Mosque is one of the famous architectural landmarks in Erbil city, and enjoys this fame for its distinctive architecture and its site, where it was built on the west side of 60 Street in front of the Royal Mall,

and on top of a 10-meter-high slanted cliff, which required several architectural treatments that increased the elegance of this mosque, and its distinction as an optical element in its near and distant surroundings, where it became an important architectural shrine for the specialists and important on the level of the sector and despite the small area of Kempi but it is considered a masterpiece architectural masterpiece, the architectural form is similar in the interior design and exterior of the axis of the main entrance dome vertically on the mihrab and on both sides there are entrances to the floor under the ground, one of which is for the men.

b) *Shape*:The night lighting showed the mosque as a mass of light in the dark as it was trying to confirm the truth of the message of the mosque as a religious building that the Islamic religion takes man out of darkness into the light as shown by Figure 4.23.The mosque performs its role day and night as confirmed by the lighting form with all its architectural elements.

Figure 4.23: Jalil Al Khayat Mosque, shape(www.newsmatique.com).

c) *Colour*:The mosque is dominated by white color after the use of the stone in its natural color where the color of the outer stone is integrated with the color of the interior and exterior lights to look like an aura of light while confirming the height of the mosque from the surface as shown by Figure 4.24.

Figure 4.24: Jalil Al Khayat Mosque, colour.

d) *Texture*:The architectural shape of the mosque's building was characterized by the use of a soft-textured sacred stone covering the exterior and flooring, where the night lighting was involved in raising the level of softness to a great extent, which made the mosque very smooth, and this shown by Figure 4.25.

Figure 4.25: Jalil Al Khayat Mosque,texture
(www.google.com/images/jalil-al-khayat-mosque).

e) *Finishing materials*:The white stone was used as a holy stone in the exterior of the facades of the mosque with all the architectural elements that make up the

mosque with all the architectural elements that make up the body, including glass-wrapped arches with the Araysk, which the lighting contributed to highlighting the beauty of a great deal and this shown by Figure 4.26.

Figure 4.26: Jalil Al Khayat Mosque, finishing materials (www.google.com/images/jalil-al-khayat-mosque).

f) *Construction system*:The lighting highlighted the distinctive structural elements of this type of buildings, namely domes and minarets, which are a kind of definition of the place confirmed by the night lighting in addition to confirming the height, as well as the use of necklaces topped with small domes to determine the entrances (Figure 4.27).

Figure 4.27: Jalil Al Khayat Mosque, construction systemfrom the inside.

g) *Analysis*:The designer was interested in using the lighting on the architectural form including all architectural elements and construction columns, columns, domes and minarets, as the lighting focused on the entrances the work of lighting units on the entire perimeter of the entrances from inside the arches so that they look from the outside and have hidden lighting, and the central lighting unit of the mosque was mediated under the main dome, and around it distributed other lighting units to cover the entire area of the inner mosque, as contributed the lighting to confirm the height of the minarets by repeating the lighting units on each stage of the minaret, in addition to the lighting that the main door The mosque is in the center of a number of light units in a way that highlights its diameter, and the doorways of the entrances are illuminated. It is known that the building in the daytime is visible to everyone and may happen to not pay attention to the beauty and splendor of the design of the building, but by comparing the building of the mosque between day and night we find that the night is more effective in attracting the attention of the viewer if it is lit at night well, and the buildings are not illuminated externally so it attracts attention.

4.6Case Study 6: Erbil Rotana Hotel

One of Rotana's top five-star hotels, the hotel is located in Erbil, the capital of the Kurdistan Region of Iraq. The hotel opened on February 6, 2011. The cost of its construction was more than US$ 55 million. It is one of the group of projects launched by Malia Group through hotel line, which specializes in tourism investments. The building was considered one of the first buildings that used glass surfaces in its facades, including what is in the mass above the entrance and the rest through vertical openings along the height of the façade, in which the open, closed and prominent surfaces and submersibles covered with natural stone in different sizes and colors where the prominent blocks on the perimeter of the building were covered with colored Jerusalem stone and a small size to confirm the prominence while the submersible areas were covered with white Jerusalem stone in larger sizes, it is worth mentioning here that the

building is not lit at night despite the presence of night lighting units on the building, officials have instructed this to reduce expenses due to the financial crisis experienced by the authority and it was lit specifically at the request of the researcher to put in the hands of the viewer the situation on which these architectural monuments and public buildings become in the formation of the night scene.

a) *Shape*: The night lighting highlighted the architectural shape of the building during the night by highlighting the gassed blocks to balance the prominent blocks where the glass surfaces looked like a black background to gain the building a different appearance from the rest of the surrounding buildings(Figure 4.28).

Figure 4.28: Rotana Hotel, Erbil, shape

b) *Colour*: The building is dominated by the natural white color of the white spaces, which is interspersed with areas of colored stone in the prominent blocks and interspersed with these spaces and those glass surfaces, which seemed after the lighting as black backgrounds interspersed with stone.
c) *Texture*:The lighting clearly highlighted the rough texture of the natural stone but at two different levels according to the sizes of the small and large stone so that the small size stone looks rougher due to the general texture where the many lines of stone (Figure 4.29 and Figure 4.30).

Figure 4.29: Rotana Hotel, Erbil, texture 1

Figure 4.30: Rotana Hotel, Erbil, texture 2.

d) *Finishing materials*: The night lighting contributed to the display of finishing materials at night by focusing the lighting on the walls to bring out the white and colored sacred stone and in different sizes, which are interspersed with glass bodies in order to be visible to the public during the night (Figure 4.31).

Figure 4.31: Rotana Hotel, Erbil, finishing material.

e) *Construction system*: The building was designed of reinforced concrete structurally, which the night lighting could not highlight except by focusing some lighting units under the roof of the prominent ground floor in addition to the boundaries of the end of the building and the last prominent ceiling and main staircase as shown by Figure 4.32.

Figure 4.32: Rotana Hotel, Erbil, interior construction system parts.

f) *Analysis*: The building of Erbil Rotana hotel is characterized by its unique design and distinctive stands on the beginning of high asthma speaking for itself as a

general administrative building characterized by a combination of luxury and simplicity in one achieving balance in its general form by manipulating prominent blocks and submersible on the one hand, and using materials Finishing (Jerusalem stone) in different sizes and colors on the other hand, in addition to the openings of longitudinal windows as a common denominator used frequently between the submersible and prominent and coated with dark green glass panels, focus on the use of large areas of glass surfaces to highlight the mass The main entrance, which was allocated to a different type of night lighting, where the designer used the point lighting to distinguish the entrance, which rises to two columns high with metal and in the middle of these columns an eight star interspersed with lighting units and turned on its surroundings.

4.7Findings

Results related to the analysis of global study cases, access to international architectural works, the methods they took when designing night lighting, and the ideas they followed to highlight these buildings, is a strong indicator of the depth of the relationship and the extent of the close association between architecture and night lighting, its ability to influence and change the psychology of the viewer, and the review of a range of global and regional projects that used night lighting as an important and key part in highlighting these projects to greatly demonstrate the importance of this element in adding the aesthetic touch required to architecture global, and how much architects care about it. Night lighting in international school cases was specially designed and some were the basis of the design idea on which the building was built.Using night lighting, designers were able to advertise the construction methods, materials used in different colors, their diverse texture, enhance the vocabulary of the architectural form used, and use night lighting in buildings associated with water bodies helps to make wonderful reflections of buildings within those bodies, which strengthens and enhances the architectural entity and increases its attractiveness and beauty.The results of the analysis of local cases, in local cases, were lighting for the purpose of guarding and security, but

they may be sufficient at the current stage, and lighting them initially at night could be an incentive for the design of public buildings in the future. The use of specialized computerized software for any project introduced to the program in a way that simulates reality makes it easy to study night lighting and choose the best solutions suitable for the type and nature of the project. Night lighting distinguishes the building from other nearby buildings, encouraging uniqueness and architectural creativity in the design of buildings. The importance of highlighting public buildings at night is due to the protection of the building at night, the identification of the place, the identification of the vocabulary of its facades and its location.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1Conclusion

The use of each type of light bulb according to its efficiency and in the appropriate spaces for its type increases the user's comfort and reduces the costs resulting from the wrong use. The use of certain types of lamps may reflect negatively on the colors of the brushes and the inner spaces, which requires attention to the choice of industrial light capable of presenting the true color of the bodies. Natural or day lighting provides visual, psychological and healthy comfort to humans, and is a favorite of industrial lighting, and natural and industrial lighting can be combined in creative ways that enrich the beauty of the interior spaces. The elements emitted by light have great potential in the development of lighting for different colors and low cost. Adopting a clear lighting design philosophy that is linked to the main design idea of the project, supports it, evaluates it and is a reason to highlight it. The process of designing the night lighting of projects is linked to the early stages of the design idea and preliminary charts to ensure that the parts of the project are connected and developed as the idea develops and the design changes. Focusing the lighting on the elements most important for the project (shape, texture, color, construction system), so that the central component of the project, which in turn contributes to the building's architectural identity. Attention to linking the project to the external rags and surrounding green areas through the night lighting so that all parts of the project are coherent, harmonious and integrated, and express each other, to provide maximum psychological comfort and the appropriate atmosphere for the user. Night lighting distinguishes the building from the rest of the adjacent buildings, which encourages architectural exclusivity and creativity in the design of the buildings. The importance of the design of the night lighting is characterized by its ability to make the buildings look more beautiful, which gives them a different appearance than other

buildings that are not lightly designed to reflect positively on the overall shape of the city and look more attractive and beautiful. Night lighting has a significant role in advertising and is also a key element in the attraction of tourist and leisure areas at night. The importance of highlighting public buildings at night by lighting is due to protecting the building at night, identifying the place, determining the vocabulary of its facades and locating it.

5.2Recommendations

From the investigation of night lighting of the buildings, the results and conclusion acquired fromthe examples, these recommendations are accomplished;

1) Finding solutions to the problem of electricity and lowering the price of tariffs to light public buildings, which encourages the use and activation of night lighting in public and private institutions.
2) Work in balance between the use of night lighting to highlight buildings and their architectural details and the non-waste of a large amount of electricity, through the use of energy-saving lighting units or the installation of solar cells.
3) Avoid the dazzle of the eye by using sufficient light intensity to allow clear and easy vision without fatigue or stress of the eye, and to make gradual transition levels of light between internal and external spaces to reduce the resulting brightness without the need for change in the iris.
4) Work on the preparation of a guide for the design of night lighting models for buildings, containing the types of night lighting, lamps used and reflectors and all technical and executive accessories, in addition to general and special specifications.
5) Media focus and dissemination of architectural works with visual effect in night lighting in specialized magazines and highlighting them as study cases and distinctive form models.

6) Work to find innovative solutions to light some of the distinctive public buildings by presenting them as architectural competitions aspiring to reach the best night scene for the urban environment.
7) Attention to lighting the monuments and monuments in creative ways studied to highlight them and attract the inner and outer tourist, which contributes to drawing attention to the history and civilization of historical monuments in local architecture.

REFERENCES

Akl, M. (2011). Light and Architecture. *Master's Thesis*, Lebanese University Faculty of Fine Arts and architecture Branch III, 10(23), p. 67.

Aubrecht, R., (2012). Remote sensing to map influence of light pollution on Cory's shearwater in São Miguel Island. *European Journal of Wildlife Research*, 9(27), p. 94.

Awattha, T. (2010). Visual of Light;an Experimental Study about Art and Science of Light. King Mongkut's University Of Technology Thonburi, 10(28), p. 67.

Baker, D. (2015). Part-night lighting: implications for bat conservation. *Animal Conservation*, 18(26), p. 51.

Beier, P. (2006). Effects of artificial night lighting on terrestrial mammals. *Ecological consequences of artificial night lighting*, 7(23), p. 78.

Birney, K. (2001). Effect of light intensity on activity patterns of Patagonian leaf-eared mice. *Journal of Mammalogy*, 13(82), p. 53.

Bist, C., Cozot, R., Madec, G., & Ducloux, X. (2017). Tone expansion using lighting style aesthetics. *Computers & Graphics*, *62*, 77-86.

Branch, B. (2004). Effects of coastal lighting on foraging behavior of beach mice. *Conservation Biology*, 18(26), p. 143.

Buchanan, B. W. (1993). Effects of enhanced lighting on the behaviour of nocturnal frogs. R*esearchgate*, 7(45), p. 89.

Buchanan, B. W. (2006). Observed and potential effects of artificial night lighting on anuran amphibians. *Researchgate*, 9(28), p. 76.

Cinzano, F. (2011). Limiting the impact of light pollution on human health, environment and stellar visibility. *Journal of Environmental management*, 6(21), p. 27.

Coleman, D. (2015). Night-time lighting alters the composition of marine epifaunal communities. *Biology Letters*, 7(29), p. 103.

DeCoursey, P. J. (1986). Light-sampling behavior in photoentrainment of a rodent circadian rhythm. *Journal of Comparative Physiology*, 8(25), p. 161.

Duffy, B. (2015). Global trends in exposure to light pollution in natural terrestrial ecosystems. *Researchgate*, 7(28), p. 27.

Duffy, D. (2014). The nature, extent and ecological implications of marine light pollution. *Frontiers in Ecology and the Environment*, 12(24), p. 34.

Ebbensgaard, C. L. (2020). Standardised difference: Challenging uniform lighting through standards and regulation. *Urban Studies*, *57*(9), 1957-1976.

Eisenbeis, G. (2006). Artificial night lighting and insects: Attraction of insects to streetlamps in a rural setting in Germany. *Researchgate,* 9(28), p. 81.

Flynn, J. (2003). Procedures for Investigating the Effect of Light on Impression and Behavior. *Journal of IES*, 9(24), p. 57.

Frank, T. (1988). Impact of outdoor lighting on moths: an assessment. *Journal of the Lepidopterists*, 8(42), p. 63.

Frank, T. (2006). Effects of artificial night lighting on moths. *Researchgate*, 6(19), p. 87.

Gary, S. (2002). Architectural Lighting Designs. Second edition ed. Boston: John Wiley & Sons, INC.

Gary, S., (2000). *Time-Saver Standards for Architectural Lighting*. Second edition ed. california: McGraw-Hill.

Gauthreaux, S. A. (2006). Effects of artificial night lighting on migrating birds. *Researchgate*, 4(17), p. 67.

Gehring, K. (2010). Night migrant fatalities and obstruction lighting at wind turbines in North America. *Wilson Journal of Ornithology*, 22(35), p. 74.

Gordon, G. (2003). *Interior Lighting for Designers*, Fourth Edition Ed. New Jersey: John Wiley & Sons, Inc.

Hanifin, B. (2015). Short-wavelength enrichment of polychromatic light enhances human melatonin suppression potency. *Journal of Pineal Research*, 9(58), p. 35.

Harris, S. (2015). Impacts of artificial lighting on bats: A review of challenges and solutions. *Mammalian Biology-Zeitschrift für Säugetierkunde*, 10(27), p. 213.

James, W. (2013). Design: Interior, Exterior Lighting and Controls. *Unified Facilities Criteria*, 13(39), p. 78.

Janet, M. (1992). The Landscape Lighting Book. *Researchgate*, 13(29), p. 78.

Kane, P. (2011). Lighting Against Crime. *Researchgate*, 8(18), p. 110.

Karlen, M. (2004). Lighting design basics. R*esearchgate*, 11(29), p. 78.

Kerbiriou, A. (2015). Is part-night lighting an effective measure to limit the impacts of artificial lighting on bats? *Global Change Biology*, 8(21), p. 33.

Khodadad, N. (2004). *Artificial light & Architecture*. University of Cincinnati, 10(21), p. 46.

Kocifaj, A. (2013). Evaluating potential spectral impacts of various artificial lights on melatonin suppression, photosynthesis, and star visibility. *Researchgate,* 10(27), p. 89.

Loew, G. (1999). Light and diel vertical migration: spectral sensitivity and light avoidance by Mysis relicta. *Canadian Journal of Fisheries and Aquatic Science*, 8(56), p. 31.

Lou, M. (1996). Light: The Shape of Space Designing With Space and Light. *Van Nostrand Reinhold, United States Of America*, 14(31), p. 78.

Magnus, R. (2008). The importance of lighting to the experience of architecture. *The lighting approach in architectural competitions,* 10(27), p. 67.

Major, M. S. (2005). Made of light. *Researchgate,* 10(29), p. 67.

Marilyn, Z., 2013. Complete Lighting Design. *Researchgate*, 19(43), p. 110.

McGowan, M., 2013. Pedestrian Friendly Outdoor Lighting. *Pacific Northwest, National Laboratory*, 9(19), p. 67.

Molenaar, D. (2003). Road illumination and nature, IV. Effects of road lights on the spatial behaivour of mammals. *Green World Research*, 4(23), p. 78.

Mrykalo, G. (2004). Effects of artificial night lighting on endangered ocelots and nocturnal prey along the United States-Mexico border. A literature review and hypotheses of potential impacts, 4(21), p. 65.

Navara, T. (2007). The dark side of light at night. *Journal of Pineal Research*, 9(43), p. 215.

Nichols, H. (2014). Effect of artificial light on the drift of aquatic insects in urban central Texas streams. *Journal of Freshwater Ecology*, 8(29), p. 302.

Parker, B. (2014). Low levels of light pollution may block the ability of male glow-worms to locate females. *Journal of Insect Conservation*, 18(35), p. 73.

Perkins, S. (2015). The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysis. *Journal of Epidemiology and Community Health*, 7(15), p. 118.

Phillips, D. (2000). Lighting Modern Buildings. *Researchgate*, 12(37), p. 78.

Rich, L. (2004). Ecological light pollution. *Journal of Frontiers in Ecology and the Environment*, 2(31), p. 191.

Richardson, B. (2006). The effect of artificial light on male breeding-season behaviour in green frogs. *Canadian Journal of Zoology*, 9(84), p. 152.

Richman, M. (2009). Exterior Lighting for Energy Savings, Security, and Safety. *The U.S. Department of Energy*, 12(36), p. 98.

Rodríguez, R. (2009). Attraction of petrels to artificial lights in the Canary Islands: effects of the moon phase and age class. *Researchgate,* 19(36), p. 299.

Ruhtz, K. (2011). Cloud coverage acts as an amplifier for ecological light pollution in urban ecosystems. *Researchgate,* 7(24), p. 173.

Salmon, M. (2006). Protecting sea turtles from artificial night lighting at Florida's oceanic beaches. *Researchgate*, 10(29), p. 141.

Smith, A. K., Sedgewick, J. R., Weiers, B., & Elias, L. J. (2021). Is there an artistry to lighting? The complexity of illuminating three-dimensional artworks. *Psychology of Aesthetics, Creativity, and the Arts,* 15(1), 20.

Stone, T. (2021). Re-envisioning the nocturnal sublime: On the ethics and aesthetics of nighttime lighting. *Topoi*, *40*(2), 481-491.

Viviani, H., (2009). Investigation of the artificial night lighting influence in firefly occurrence in the urban areas of Campinas and Sorocaba municipalities. *Researchgate*, 7(25), p. 65.

Zagan, W., & Kowalska, M. (2017). The aesthetics of lighting. *Przegląd Elektrotechniczny*, *93*.

APPENDICES

Appendix 1: Similarity Report

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Appendix 2: Ethical Approval

YAKIN DOĞU ÜNİVERSİTESİ

ETHICAL APPROVAL DOCUMENT

Date: 13/02/2021

To the **Graduate School of Applied Sciences**

The thesis titled "The Role of Night Lighting to Expose the Architectural Aesthetics of Building Forms'' has been evaluated. Since the researcher will not collect primary data from humans, animals, plants or earth, this project does not need to go through the ethics committee.

Name Surname: Assist. Prof. Dr. Çiğdem Çağnan

Signature:

Role in the Thesis: Supervisor