The Impact of Light and Shading on Creating Interactive and Active Urban Spaces

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Abstract. There are many orientations to find and enhance architectural trends and methods related to the principle of planning and designing light and shading in urban spaces, particularly after the advancements that have happened to the dimension and components of the urban space. The research aims to reach a vision of the aspects and indicators through which light and shading play an active role in finding valuable interactive urban spaces, and enhancing the relationship between the user and the surrounding environment to achieve the opportunity to create visually enjoyable and visually meaningful experiences, through improving the functional, environmental, social, and aesthetic aspects. The research problem: “lack of knowledge about the role and effect of light and shading on creating interactive and effective urban spaces. The research concluded the main and essential terms of the theoretical background from a synthesis literature review and these terms are represented by the functional, environmental, social, and aesthetic aspects of urban spaces, their subsidiary, and parameters, finally enhancing these aspects, light, and shading can be effective in creating and finding interactive and active urban spaces.

Keywords: Light; shading; interactive; active; urban spaces; local microclimate; optically interesting experiences.

1. Introduction
The idea of shading with the existence of light started with the first idea that humankind had in their attempt to find out the synchronization of two solutions to contradictory variants in their surrounding environment, namely, opening or closure with the external surrounding. This leads to highlight the role of light and shading in creating focal spots and interactive urban spaces.

Many architects confirm the importance of light and shading and among them Le Corbusier, whose works in the design of homes and cities, and Tadao Ando Architect in Church of the Light, in this literatures on light and shading present there is a close correlation between light and architecture as at the beginning and over the ages and they used light in different ways to define and shape architecture [1], techniques that are controlling solar radiation in planning old cities [2], the reasons that make the connection with natural environment significant and hence[3], displays the necessity for engineers and planners to know the urgency of getting lighting in space [4], how the sun can be used to enhance the aesthetics through the surfaces of smart textiles in urban spaces [5] designing urban spaces and providing shading to get cooler and more comfortable environment is one of the distinctive features of hot European climates [6], and that merging sunlight in structures has been key designing element in the buildings of many civilizations that have taken into consideration the concepts of constructing in regard
to daylight [7]. The result of research it’s the interactive urban space of the user can be enhanced through the surrounding environment having light and shading and by finding out opportunities to create optically interesting experiences that are visually significant, which can be achieved by enhancing all of the functional, environmental, aesthetic, and social aspects in the urban spaces. Accordingly, the functional aspects incorporate subsidiary terms represented by planning, designing, economic, and health aspects. The environmental aspects include local, realistic and humanitarian as sub-terms, whereas the social aspects include psychological, behavioral, and interactive sub-terms. Finally, the aesthetic aspects incorporate optically perceived, stimulating, and symbolic aspects.

2. Research methodology
   - The first part investigates light and shading duality, the significance of light and its own reflections on architecture and urban design, and the importance of light and shading duality in urban spaces.
   - The second part investigates the shift from light and shading in old cities to shading in modern and contemporary cities (sustainable and environmentally friendly cities) as that investigated a group of studies and presentations and followed a descriptive and analytical approach in order to highlight and come up with the main terms of the theoretical background represented by the functional, environmental, social, and aesthetic aspects in urban spaces besides its subsidiary terms and indicators and by enhancing those aspects, light, and shading can have an effective role in creating and finding out the active and interactive urban spaces.
   - The third part includes some examples of urban spaces in different cities, and eventually it rounds off with some conclusions and recommendations.

3. Light and shading duality

3.1. Significance of light and its own reflections on architecture
Light is "one of the essential elements that affect the visual perception of things in space and it is divided into natural lighting and artificial lighting. It is also one of the essential determinants of space identified as the direction and quality of lighting is a powerful influencer for showing space elements as being sharp or weak. Light also focuses on borders, shows fabric or hides features, and light can be used to create a sense of breadth or minimize the size of space [8]. In addition to that, there is no need to specify what natural light is as we need to remember that light allows us to identify what is around us day and night- the changing vision of things or the bodies that affect them as well as the space that contains them. Moreover, the presence or absence of light can change the space every season, every day of the year, every hour of the day, and every second. [3].

3.2. Significance of light and shading duality in urban spaces
Robert Krier defines urban space as the external space in a city and it is considered an opened space with unrestricted movement with public, semi-public, and private areas. It includes all kinds of spaces between buildings and areas surrounding cities with regard to aesthetic standards. According to social, political, and cultural trends, it is noteworthy here to say that urban spaces can be organized. In addition, Robert Krier states that urban spaces are built according to laws similar to those of buildings where rooms and hallways are basic elements as squares and streets are the basic elements of urban spaces but with different functional patterns. [9].

3.3. Light and shading in urban spaces
(Kutlu, 2000) states that light is the origin of existence, as light gives independence to things and at the same time it describes their mutual relationships; light has tremendous movement resulting from its continuous transformation in order to let people rediscover the world constantly. [1] Which affirm the significance of green areas and the importance of allowing natural light to infiltrate inside buildings and to make use of its advantages. Le Corbusier (2007) states that 'architecture is the masterly, correct, and magnificent play of masses brought together under the light [7] In fact, the energy crisis in 1973 had been a critical moment in many aspects of our life and as a result, an awakening started to appear in the
whole world to grasp the quantity of energy being consumed in buildings and to clarify the significance and scarcity of resources. It is safe to say here that the solar architecture initiative in the late seventies and the beginning of the eighties of the twentieth century is the core of the green architectural practices in architecture [7].

Thus, light and shading have a tremendous significance in architecture, especially in areas where there is a higher ratio of solar radiation, a situation which one must take advantage of as possible in order to improve the quality of use, to provide energy in internal and external spaces, and to secure better containment for the user. It is also essential here to mention that the received quantity of energy per day depends on the length of the day (i.e. the period between sunrise and sunset- solar exposure period) and because of that factor, the daily rates of solar radiation will be higher at the opposite poles of the Earth in midsummer time- due to the long period of daytime. In addition to that, the annual rates of solar radiation will be approximately 2.5 times higher at the equator than is the case at the opposite poles of the earth [2]. Furthermore, the Arab Homeland region owns tremendous capacities to invest solar energy due to its geographical location and its climate circumstances that have been all owing the region to get the biggest amount of solar radiation as the invested solar radiation is one of most essential renewable energy resources in the future because it is an inexhaustible natural resource and because it has very few environmental effects [10].

4. Literature review

4.1. H. Gokhan Kutlu, "the peculiaries of light as a quality in architecture" (2000)

This study maintains that, in designing, it is important to consider "the feeling of rest in the presence of light, particularly when lighting level permits looking at the intended objects. The sense of unease comes as a result of minimizing that freedom and restricting the ability to see the luminous environment and as long as there is an increase in the power, quality, and information about the content of stimuli, a person can see well. However, these factors are also affected by the features of the surface components, the resource features and quality, and the lighting quantity. Moreover, the experience and attention of the viewer also affect the human vision quality [1].

In addition to that, there is a close correlation between light and architecture as at the beginning and over the ages, man has used light in different ways to define and shape architecture. Literally, light has been used almost always to provide vision and to create perception relationships between man and the material background, and light has always been a genius gadget to design space [1].

The study mentions that "the most significant effects of light on spaces are the following:

- The Interaction of Light and Structure: The Roman Pantheon showed how Romans had used light to clarify the space as they used light where solar radiation could determine the movement necessary to express the situation of light, no light, light, and no light, which by itself affects the sensory perception of how strong a structure is, of light presence, or of its concealment.
- Relating Spaces through Light: Without light, space is optically unperceivable, and transparency enables the redefinition and mediation of space.
- Connecting Spaces through Light: The divergence in light can identify the difference between the inside and outside and connecting spaces key lies in creating equal or divergent lighting circumstances.
- Separating Spaces through Light: Artificial light is the clearest separator between the inside and outside as lighting produces bright interior designs and creates big differences in lighting levels between inside and outside.
- Differentiating Spaces through Light: It is possible to make different places through light as these places are regarded as parts of the total space. They are caused by the functional differences that decide the necessary spatial relationships to enhance the optically interesting experiences in spaces.
- Use of Light as a Means of Direction: Brightness is a key to creating a movement with light because the strongest lighting effect gets the attention first, determines people's movement and stimulates movement [1].
4.2. Firas Salim Nouri. "the effect of fixed structural networks on controlling solar radiation infiltrated into buildings." (2004)

The study presents techniques that are controlling solar radiation in planning old cities (i.e. traditional ones) and these include the following:

- The Organizing Method of Compact Textile: The compact composition that distinguished traditional Arab cities is the most efficient and the most convenient one to the hot and dry climate due to the low percentage of opened spaces in the area and to the fact that the rates of the dimensions of those spaces approximate their heat rate, which is limited to a short period of time during the day when the sun's angle of elevation is significant.

- Spacing between Buildings and its Relation to Height of Buildings: The left spaces between buildings have a significant role in determining the nature and quality of the solar radiation falling on the fronts and roofs of buildings. Because that issue has an important relationship with the height of buildings, the relation between the two can be identified according to a standard called space angle, which depends on the geographic and climate nature of the region as well as the functional nature of the buildings.

- Winding Narrow Roads: The winding and narrow nature of road network result in, from an environmental aspect, self-shadowing of these roads, shadowing of some buildings due to being adjacent to other buildings, and impeding the movement of winds that are full of dust and sands by reducing its speed.

- Setbacks and the Relation between the Building and the Road: Setbacks, in all its types (frontal, side, and rear setbacks), affects the climate since the popping up of balconies, porches, shanasheel (Arab style of balcony), and parts of the upper story of a building helps shadowing downstairs and parts of the road areas.

- Road Network Direction: The way road networks are directed results in divergent efficiency and according to their direction. Thus, the road from east to west is dim and cold during winter, whereas the road from north to south is sunny during summer and winter. See Figures 1, 2, and 3 [2].

**Figure 1.** Compact textile of the city of Shibam. The Arab cities were featured by compact textile.

**Figure 2.** Spacing between buildings and its relation to height of buildings (space angle).

**Figure 3.** Winding narrow roads that traditional Arab cities were featured by [2].
4.3. Derek Phillips "daylighting and natural light in architecture" (2004)
The study mentions some of the reasons that make the connection with the natural environment significant and hence that connection is historically worth reviewing. Those reasons include the following:

- Significance of light for better vision and for working inside the space.
- The natural look of space and the comprehensive experience for viewing the formatting of entities and surfaces via sunlight and during specific times of the day.
- The periodical change from daytime tonight time that is more divergent with weather and seasons of the year than with other factors.
- The direction that comes with a person's knowledge of their location in regard to the outside world.
- The outdoors experience achieved by looking at the outside and it is related to the direction factor.
- The natural color experience and observation of the impact of daylight on colors change from morning to night [3].

4.4. César Portela, "light and architecture" (2011)
The study displays the necessity for engineers and planners to know the urgency of getting lighting in space, whether natural or artificial, because correct lighting enhances space value. Besides, architectural engineering and light are interrelated concepts over the ages to the extent that one of the most important articles of Bruno Zevi is entitled "Light as an architectural form." Thus, that relation between light and architecture happens inevitably either consciously or unconsciously at some other times, and it is difficult to imagine mastering work without its efficient relation to light.

Etianne-Louis Boullé claims that the art of light touching effects is part of the architecture, and depending on its use, light can transform the physical context to create feelings of acceptable or unacceptable atmosphere and noble or mysterious ones. Simply put, light can show off those sides of space that we are interested in most such as making space bigger or smaller, and most importantly, making space more acceptable, more comfortable, more vital, and clearer than it is the case with the absence of light. In addition, the study presents different forms of light, that is to say, the aesthetic, decorative, and man-perceived sides that have become outstanding features and manly perceived such as light in worship places in ancient ages architecture, namely, worshipping light, the ornamented light of Egyptian architecture, the precise light of Classical Creek architecture. The light that is distilled as it passes from the outside to the interior of Roman architecture as it is the case in the Pantheon, the supernatural light through stained windows in Gothic architecture, the humanized light of the architecture in Renaissance, the sublime light of the Baroque period and the fluid light that allows us to use glass enclosures in contemporary architecture [4].

4.5. Jansen and Ledendal “light and shadow play – the sun as an aesthetic trigger for urban textiles” (2011)
The study aims at investigating how the sun can be used to enhance the aesthetics through the surfaces of smart textiles in urban spaces and it also investigates the divergence of the nature of the interaction between textiles as a factor in solar testing in general exterior architectural space. Therefore, The Royal Danish Academy of Fine Arts, School of Architecture in Copenhagen has used a solar laboratory to build a simplified interactive 3D model of a part of a road to display sun sails using the artificial sun to create light and shading patterns in the road environment, that stimulate the sun 24 hours. The study has also presented the concept of energy generating sun sails which incorporates printed solar technology and by which shading and energy areas can be composed simultaneously.

This technology also contains thermochromic dye or (sensitive dye) that can change and play with the color of sails and by that, it is safe to say that changing temperature leads to color changes and discovery of the optical effects of movement using different patterns of sunlight. Consequently, that process aims to create a dynamic interaction and enhance the aesthetic experiences through light and shading in urban spaces. On top of that, the study has shown that it is possible to extend the use of textiles as elements of solar shading in urban spaces, whether in ancient historical environments as it is the case in the South of Spain or contemporary architecture. It adds that instead of the permanent
stopping of sunlight, it is possible to combine light and heat to use them in designing as the integration of solar energy technology in textile structures provides an ample amount of possibilities to designers, which is an environment friendly solution to the growing and persistent needs of mankind to using energy [5], see Figures 4, 5, 6, 7, and 8.

**Figures 4.** Monitoring changes in light patterns and shading in the street environment using different patterns of artificial sunlight [5].

**Figures 5.** Film stils, animation 1+2 [5].

**Figure 6.** Smart textiles as raw materials for solar sails [5].

**Figure 7.** Shading by sun sails in Ancient historical urban spaces.

**Figure 8.** Extensive use of textiles as elements of solar shading in urban spaces.

4.6. **Energy Research Group,** "shading systems- solar shading for the European climates" (2013)
The study refers to the fact that, for a long time, designing urban spaces and providing shading to get a cooler and more comfortable environment is one of the distinctive features of hot European climates; as a result, the urban compact composition can provide mutual shading with the adjacent buildings. In
addition to that, the study also mentions the most significant elements of traditional shading systems in urban spaces and which are represented by the following:

- **Vegetation:** Selective agriculture helps improve the microclimate of urban spaces as vegetation can shade not only the windows and openings but also the whole surfaces and fronts. It also restricts conductivity and heat gain and once it is conducted accurately, the need for interior and exterior shading systems can be reduced to the minimum. Moreover, the impact of shading vegetation relies greatly on the type and age of plants (i.e. trees, bushes, and vines). Furthermore, Givoni states that vegetation cover affects the inside temperature and cooling capacity of buildings via different ways listed in the following points:
  - Tall trees and pergolas are placed within a short distance from walls and windows to provide shading without greatly restricting ventilation.
  - Vines are placed on walls.
  - Tall bushes placed near walls will provide shading but will also restrict the movement of the winds near the walls.
  - Vegetation land cover around the building reduces the reflected solar radiation and the longwave radiation coming up to the walls from the surrounding region. Vegetation cover on the eastern and western sides of the building can also provide effective protection from sun gain in summer.
- **Urban Morphology:** The format of constructed urban environment, in those areas that have hot summer, is a mainly compact one, with narrow streets that are sometimes wholly or partially covered. The main purpose of such precautions is to provide relaxation outdoors and indoors as the well-studied urban design can to a great extent, overcome such side effects by judging the distance between buildings and by distancing the streets because shading can be achieved not merely by improving the street width, but also by using courtyards as the latter can be used to build whole urban format. [6] As is illustrated in Figures 9. (a, b, c). The figures show off some of the treatments on how to design urban areas to obtain shading.

![Figures 9. Show off some of the treatments on how to design urban areas to obtain shading](image)

4.7. Mohamed Boubekri "daylighting, design-planning strategies, and best practice solutions" (2014)

The study points out that ancient civilizations such as the Persian, Arab, Greek, and Roman civilizations had houses similar to courtyard that receives natural light, reduces the harsh climate outside, and becomes the central house part. The study has also mentioned some of the factors that are affected by light and shading and these are the following:

- **Light and its relation to human perception:** light and shading have a tremendous role in fulfilling the optical and physiological requirements to perform the visible tasks with regard to the user's emotional, psychological, and aesthetic needs.
- **Daylight and Its Effect on the Economy of Energy Costs:** The recent efforts in the whole world to reduce the consumption of energy in buildings or the building system of Leadership in Energy and Environmental Design (LEED).
- **Daylight and Its Relation to Seasonal Affective Disorder**
Renewal of Energy or Refreshment during Daylight: Human being, by nature, has been in harmony with the natural environment since his existence on earth because sunlight enables us [people] to communicate with the outside world and let us know the place, season, and time in the daily cycle.

Visual Comfort and Glare: Disturbing glare is one of the most common problems in designing, and it is very important to control the amount of light that enters the building to provide visible environment efficiency and make daylight effective [7].

By summarizing the literature review, it finding the most important aspect see Table 1 to illustrate the different aspects of the role of light and shading mentioned in this study:

### Table 1. The most important aspects are presented in the literature review.

| Literature review     | Functional Aspects | Environmental Aspects | Social Aspects | Aesthetic Aspects |
|-----------------------|---------------------|------------------------|----------------|-------------------|
| Gokhan Kutlu [1]      | *                   | *                      | *              | *                 |
| Firas Salem Nouri [2] | *                   |                        | *              | *                 |
| Derek Phillips [3]    | *                   |                        | *              | *                 |
| César Portela [4]     | *                   | *                      |               | *                 |
| Jansen and Ledendal [5]| *               |                        |               | *                 |
| Stack et al.[6]       | *                   |                        | *              | *                 |
| Mohamed Boubekri [7]  | *                   | *                      | *              | *                 |

As shown in Table 2, the research comes up with the most important terms and indicators by which light and shading effectively enhance the different aspects of urban spaces. The studies include the following:

### Table 2. Summary of the main, subsidiary terms and indicators.

| Main vocabulary | Secondary vocabulary | Indicators | Possible values |
|-----------------|----------------------|------------|-----------------|
| Planning        | The role of traditional shading systems |
| Improving local microclimate to reduce heat gain by shading each of the following: |
| Significance of selective agriculture of vegetation that includes the following: |
| Adjacent or Compact Formatting |
| Distance between buildings and its relation to their heights |
| Winding narrow roads |
| Setbacks and the relation of the building with the road |
| Direction of road networks |
| Indoors courtyard |
| Other systems |
| Windows and openings |
| Roofs |
| Fronts |
| Roads |
| Squares |
| Tall trees placed near the walls |
| Bushes around the building |
| Vines placed on walls |
| Vegetation land cover around the building |
| Utilizing light and shading features in each of the following: | Connect and relate spaces via light and shading | Separate spaces via light and shading | Distinguish between spaces via light and shading |
|---------------------------------------------------------------|---------------------------------------------|-------------------------------|----------------------------------|
| Using light and shading as a means of direction              | Direction and a person's knowledge of their place in the external world. |
| Designing                                                    | The comprehensive experience of viewing the formation of entities outdoors and indoors. |
| Look and natural color experience in space                    | Periodical change from morning to evening. |
| Economic                                                     | Increasing flexibility and ability to generate energy from natural resources, that is, using the creative methods of shading, which are the following: |
| Integration of solar energy or any alternative energy with the structure of urban space components and on the level of: | Solar sails that can generate energy in all types, forms, and sizes |
| Economic                                                     | Solar or green roofs | Solar or green walls |
| Economic                                                     | Others | Others |
| Health                                                       | Daylight and Its Relation to Health and Vitamin D Production |
| Health                                                       | Daylight and Its Relation to Seasonal Affective Disorder |
| Health                                                       | Renewal of Energy or Refreshment during Daylight |
| Health                                                       | Others |
| Environmental Aspects                                       | Local Climate |
| Local Reality                                                | Local construction materials |
| Local Reality                                                | Local remedies and details |
| Environmental Aspects                                       | Activate the role of shading of all horizontal and vertical surfaces to provide (heat ease) |
| Humanitarian                                                 | Offering safe and protected environment (lighted-shaded) |
| Humanitarian                                                 | Strength, efficiency, and information on the stimuli contents (Vision rest) |
| Social Aspects                                               | Enhance individual's energy and conduct |
| Psychological and Behavioral                                 | Motivate the viewer's experience and attention |
| Psychological and Behavioral                                 | produce serotonin hormone, which is responsible for our wake state |
| Psychological and Behavioral                                 | create feelings of acceptable or unacceptable atmosphere as well as noble or mysterious ones (psychological rest) with the presence of light and shading by making the user's space: |
| Psychological and Behavioral                                 | More acceptable |
| Psychological and Behavioral                                 | Clearer |
| Psychological and Behavioral                                 | More viable |
| Interactivity                                                | create a dynamic interaction for light and shading |
| Interactivity                                                | correct light and shading enhance space value |
| Interactivity                                                | Find out perception relationships between mankind and the materialistic background |
| Interactivity                                                | |
| Aesthetic Aspects                                           | Symbolic |
| Aesthetic Aspects                                           | The perfect relationship with light as it is a genius gadget to design space |
| Aesthetic Aspects                                           | Enhance the identity and role of urban space in city |
5. Practical study

It includes examples of urban spaces in different cities that have hot climates and high solar gain. In the past, cities were built to create a sound society where a human being has a clear mind and soul. This society has continued to be as such and has been renewed at present, and due to advancement, the format of planning and designing become dependent on solar energy to get the city be more efficient in using energy and to achieve sustainability via minimum rates of wasting energy. So, this section will present three projects of three different areas. These are the following:

5.1. Metropol parasol - a stroll above the roofs of Seville

Jurgen Mayer H. Architects designed this project in Incarnation la de Plaza, the central public park in Seville city, historically rich. It is the biggest stroll in the world, and it consists of wavy parasols made of interwoven wood in the shape of a honeycomb coated with polyurethane. The aim of designing this place in this form was to cope with the acute divergence between all the modern facilities in Seville and the city center, which goes back to the middle ages. The project is built to display the space identity of the city and therefore, it becomes one of the important wonderful cultural destinations in Spain.

The capacities of Encarnacion la de Plaza have contributed to make the project the new contemporary urban center as the role of the stroll, as featured urban spaces inside the city fabric that goes back to the Middle Ages, provides huge diversity in fun and trade activities and where Seville people enjoy the shade below the giant parasol. The project has as well squares on the roof on the top of the parasols that give the visitors beautiful views of the archeological excavations in the city. Also, the sculpture raised by concrete bases forms a huge parasol above the park, whose role and advantage appear with the beginning of summer heat. The parasol incorporates below an archeological excavation, museum, restaurants, and community center and on top of that people can see the charming views of the city from above the building and the beautiful and luxurious shadows below at night. The new huge structure is an event gathering of various activities, and the parasol is a type of architectural ridge that transports people into city roofs and presents unexpected points of view, see Figure 10 [11, 12].
5.2. The city of Masdar project by Norman foster

LAVA architectural designing company awarded the first prize in Masdar city center design competition. The city center is located near Abu Dhabi Airport in United Arab Emirates, where the International Renewable Energy Agency (IRENA) office is located. The deep-rooted city of Shibam inspired architect Norman Foster, so he designed the building in a way that connects historical touch with desert climate as Foster adopted the project by studying it in order to achieve environmental goals with the purpose of clean energy production, by which, and by virtue of it, the ability to save water, store solar energy, managing Carbone, producing technology instead of consuming it, providing ventilation, and minimizing maintenance can be realized and available. Hence, it is the first city Carbone and waste-free in the world [13]. The city center design is featured by huge moving parasols inspired by sunlight flower shape to shade squares and public places at the city center in the morning besides its ability to absorb the sun heat and then it closes itself in the evening to release the heat it has absorbed. On top of that, those buildings built side by side have much inspiring social networking and emotional interference.

When we see Masdar from above, it looks like cubes as Foster, inspired by those conjoined squares and close surfaces of Shibam city, expanded those noble goals of a human loving their neighbors and family to design the formats of a better life as possible. Thus, we see houses in Masdar also match social goals in addition to the fact that the two cities of Shibam and Masdar minimize the need to maintain, provide many light holes, and use desert sands, all of which originally represent the traditional Arab architecture of the deep-rooted city of Shibam, see Figure 11 [14].

![Figure 10. The various details of the Metropol project in Sevill. [11,12].](image)

![Figure 11. Different details of the Masdar City project.](image)
5.3. Al Fayah Park by Heatherwick Studio

It is a beautiful design credited to Thomas Heatherwick, who has a rich history of implementing the natural surroundings of the site's locations into his projects. He uses the distinctive texture of a dry and cracked desert as the façade for the canopied design that shades in the park. Actually, the project evolved as a series of cracked pieces of the desert surface raised on columns to form a gentle dome across the site. These elevated pieces create a perforated canopy of partial shade under which a lush garden can grow, protected from the harsh excesses of the hot desert sun. [15]

Besides, this sunken oasis becomes a landscape of plants and mature trees, forming a series of interconnected public recreational spaces. A twenty-meter high shaded garden is conceived as a place for families to gather and picnic and a place for learning and festivals. By creating partial shade for the planting, the canopy aims to reduce the amount of water lost to evaporation and so will improve the park’s energy efficiency and sustainability. Whilst providing the shade for the oasis in the daytime, the elevated plates also become a network of social and meeting places in the cooler evening hours. Consequently, he elected to abandon the traditional park design that relies too heavily on irrigation to water its countless blankets of grass. Instead, Heatherwick opted for a natural solution that will limit the evaporation of the park's water by reducing the intensity of the sun [16], see Figure 12.

6. Conclusions

- light and shading have tremendous importance in architecture and urban design, especially in areas where the rate of solar radiation is high and where it is essential to make use, as much possible, of the natural resources that are environment friendly, and among them are the solar energy necessary to improve the quality of use and to provide energy indoors and outdoors spaces and secure the best containment for the user.

- Designing by using a collection of solar modules methods because the orientation nowadays has been shifted upside down, that is to say, the trend these days is to search for the sun and be exposed to it in the presence of shading to take advantage of it as a natural, clean, and sustainable resource for energy production.

- It is adopting perspectives related to the mutual influence of indoors and outdoors architecture on the one hand and the human conduct on the other hand and utilizing the natural environmental elements as natural, clean, and sustainable resources in planning and designing.

- The tripartite of (light, architecture, urban environment): This tripartite shows us the extent to which invented systems of light and shading use in indoors and outdoors architecture can impact the conduct of users and establish urban spaces that are activated for use, really active, vital, and containing significant optically interesting experiences.
The use of invented and diverse systems in shading leads to improve local microclimate and reduce heat islands and as a result, it enhances (heat rest, optical rest, and psychological rest) in urban spaces.

Light is one of the essential elements of optical perception and an effective means to identify the relationship between users and urban spaces, and light, whether natural or artificial, is the basic component of space creation process as it makes assets and things visible.

Finding out opportunities to activate the role of light and shading because it is one of most important dual, which in addition to its significance in the different functional, environmental, and social aspects, leaves a huge impact by adding on aesthetic touch to cities.

The correct use of light, whether natural or artificial light, has a decisive role in composing activated and active urban spaces and as a result creates more comfortable, more sustainable, more realistic, more humanized, and prettier spaces—vital and better in all aspects spaces.

The creativity of activating, establishing and enhancing light and shading cities, which can be described as an element of spatial quality that exceeds being merely energy metrics to eliminate the consumption of fossil fuel, but it also includes improving the performance of different aspects, which can be represented as follows:

- Functional aspects include planning, designing, economic, and health aspects.
- Environmental aspects include locally realistic and human aspects.
- Social aspects include psychological, behavioral, and interactive aspects.
- Aesthetic aspects include symbolic and triggering and optically perceived aspects.

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