OUTDOOR ARTIFICIAL LIGHTING EFFECTS ON LIVABILITY OF PEDESTRIAN PATHS IN URBAN HERITAGE CONTEXT

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outdoor lighting, artificial outdoor lighting, livability, urban heritage context, pedestrian paths, walkways.

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Abstract
Lighting is an important ecological factor that influences individuals’ outdoor activities as well as the development of livable communities in cities. Artificial outdoor lighting is vital in improving the quality of urban open places throughout the nighttime and has a significant impact on the pedestrians' nighttime perception and mental safety. This study aims to uncover whether outdoor lighting has indeed an effect on the livability of the pedestrian paths of a community and if so, what is the optimal design that fits an urban heritage setting. The research employs a mixed methods approach, where both qualitative and quantitative methods are used. The first part of the study, being qualitative, used a survey conducted in the historic region of the city of Batroun in Lebanon to collect data concerning what the paths’ users regard as important when it comes to artificial outdoor light design with concerns to perceived urban design qualities related to neighborhood livability. The second part of the study is based on simulations of proposals of outdoor artificial light using Dialux in order to find the design the most appropriate to the context of Batroun.

Keywords
outdoor lighting, artificial outdoor lighting, livability, urban heritage context, pedestrian paths, walkways.

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1. INTRODUCTION

Lighting is an important ecological factor that influences individuals’ outdoor activities as well as the development of livable communities in cities. Artificial lighting refers to illumination that derives from an electrically driven device (lamp, bulb, or tube), and may be controlled to obtain the desired resulting effect. Based on the circumstances, such illumination can be reduced, enhanced, controlled, guided, or colored (Sholanke, Fadesere, & Elendu, 2021). The usage of suitable night illumination in outdoor settings can improve the well-being of a community and its residents. Being able to experience and appreciate night-time and take part of the activities that are held during that time is a fundamental element of human life. Furthermore, proper illumination for urban outdoor places might boost an individual’s social health and the livability of an urban context (Pan & Du, 2021).

The livability of a city, which includes social, economic, environmental, and other aspects, assumes a central role in determining the quality of life (Cao, Li, Xi, van Bilsen, & Xu, 2021). On the other hand, artificial outdoor lighting is vital in improving the quality of urban open places throughout the nighttime and has a significant impact on the pedestrians’ night-time perception. It is utilized not just for security and stability, but also to increase the visual quality of urban places. It might be viewed as a crucial component of life in the city (Wickremasinghe & Hettiarachchi, 2022). The research also aims to fulfill the following objectives:

1. To improve the livability of the Batroun’s pedestrian paths through the implementation of artificial lighting;
2. To provide adequate illumination during the nighttime that fits the standards and requirements of the city’s historical paths.

The research employs a mixed methods approach, where both qualitative and quantitative methods are used. The first part of the study, being qualitative, used a survey conducted in the historic region of the city of Batroun in Lebanon to collect data concerning what the paths’ users regard as important when it comes to artificial outdoor light design with concerns to perceived urban design qualities related to neighborhood livability. The second part of the study is based on simulations of proposals of outdoor artificial light using Dialux in order to find the design the most appropriate to the context of Batroun. The existent literature on urban livability and outdoor lighting shows gaps in creating a clear relationship between the livability of a community, particularly in a heritage context and the design of outdoor artificial lighting.

1.1. Artificial Lighting
1.2. Importance of Artificial Lighting

Nowadays, artificial outdoor lighting is employed for a number of objectives. It is critical in supplying useful levels of visual accessibility as well as mental safety for pedestrians throughout the nighttime and hence increases mobility of users in pedestrian paths (Rahm & Johansson, 2018). Aside providing illumination, lighting design may be employed for artistic reasons by generating forms and behavioral reactions or giving a location a feeling of place. Its purpose is to highlight architectural or historic aspects, as well as to illuminate pedestrian paths (Wickremasinghe & Hettiarachchi, 2022).

Lighting may be utilized to accentuate or limit what individuals perceive. It may be utilized to draw attention to an attractive feature while also highlighting a particular activity in the area. Artificial illumination, on the other hand, has both ecological and financial disadvantages. This may be reduced by successfully considering both technological and psychological issues when redesigning and improving the energy efficiency of current outdoor lighting installations (Rahm & Johansson, 2018).

1.3. Usage and Quality of Artificial Lighting in Open Public Spaces

The most visible change in space in terms of visibility occurs when daylight is replaced by artificial lighting. At night, vision starts to deteriorate, and distinguishing ecological features requires the use of artificial lighting. In this perspective, lighting might be a useful design tool for changing both urban environments and social interactions (Rakonjac, Zorić, Djokić, Milojević, & Rajić, 2022).
A steady flow of individuals renders a community more livable, and also that continuous use of outdoor public area during the day is considered a major important livability criteria. Safety also makes a significant element of a livable urban context. On the other hand, multiple crime-prevention research have discovered artificial lighting as an essential component of the physical characteristics that contribute to a sense of safety in open spaces and greatly affect crime reduction (Green, Perkins, Steinbach, Edwards, & place, 2015), while lighting and visual accessibility of public places contribute to a stronger sense of safety in communities by allowing people to identify potential dangers (Ivana Rakonjac et al., 2022).

Utilization of spaces, as well as the regularity of users’ visits, length of time, and interests of pedestrians, impact the livability of open public areas in an urban setting. Individual’s interactions in public areas might be classified as obligatory, voluntary, or social. Apart from the essential behavioral patterns, the physical environment and temporal attributes of the region serve a crucial part when participating in outdoor activities. The additional activities, on the other hand, are heavily influenced by what a location can give and the way it affects how individuals interact and react (Gehl, 2010).

1.4. The Link between Livability and Lighting for Open Public Spaces

Lighting helps to promote a site's character by emphasizing its cultural and architectural heritage since appropriate illumination is a perceptual state that renders the architecture recognizable, in addition to being secure and sufficient for different functionalities. The effect of lighting on the user-space relationship shapes the nighttime perception of place. The proximity between a visitor and distinct spatial aspects is regarded as crucial based on the level of subjective perception and may be viewed as personal, social, or public. Furthermore, the pace with which individuals travel alters their perception of spatial qualities (Ivana Rakonjac et al., 2022).

A person can observe spatial qualities from a small range whilst travelling in a pedestrian area. Walking provides a closer strong connections between both the individual and their surroundings than other transportation methods, allowing for further detailed perception and memorization of the surroundings. As a result, the distance connection between a person and environment is evaluated while establishing qualitative components of lighting design inside open public places meant for enjoyment (Ivana Rakonjac et al., 2022).

The regularity of nocturnal pedestrian activity may be divided into three categories: extremely active (commercial zone), fairly active (middle zone), and few active area (residence zone). The impact of the ambient brightness, is classified into three classifications: high, medium, and low (Jackett & Frith, 2013), or based on the urban setting (Vogiatzaki, Zerefos, & Hoque Tania, 2020).

Certain sets of criteria depending on the classification of current traffic in space, visitor movement speed, and the generally designated dominating space function define the lighting technical classes. Participants’ delayed movement allows for grouping, dialogue, and engagement. As a result, lighting must meet the needs of individuals to locate in space and feel safe and secure; to conduct a scheduled activity; to provide a pleasant sensation and appealing environment; and to perceive the aesthetic and ambience qualities of the area (Ivana Rakonjac et al., 2022).

1.5. Heritage Sites and Artificial Lighting

Architectural and archaeological landmarks serve as key reference points for the local inhabitants, improving their feeling of safety and serving as an essential component in defining social character. Such locations also assist to encourage tourism, which is a significant source of revenue for surrounding areas. Illumination design is a crucial feature in these venues to keep people interested during nighttime. For numerous years, these locations have progressively been accessible to both regional and international visitors and are now utilized for a range of uses besides the ones for which they were initially designed. As a result, these locations necessitate the use of acceptable and scientific
illumination approaches that are consistent with historic and cultural values (Bista et al., 2021).

Lighting quality must be measured not just based on technical specifications and regulations, but also by social intelligence and impressions of local people and tourists. Visitors also tour heritage and historical places for their natural features, community interactions, cultural events, and in pursuit of psychological tranquility. As a result, illumination is vital in order to emphasize the building as well as to favorably affect a wide range of activities in the surrounding area (Bista et al., 2021).

2. METHODOLOGY

- The first criteria for choosing Batroun as a case study is its classification as a touristic attraction where tourists are found wandering at all times of the day thus rendering this city a very livable place. The second criteria is its historical sites that add another layer of richness to the city such as the old souks of Batroun, which are known for their historical importance and architectural landmarks. The third criteria is the presence of artificial lighting that is unfortunately currently absent in most Lebanese cities due to the economic and electric crisis in Lebanon.

- Data concerning the location of the lighting fixtures as well as their conditions are collected on site, as for data concerning the livability of the city, a survey was sent to users of the pedestrian paths in the old souks to determine their definition of livability and how the artificial lighting in the city affects the activity of visitors in those paths.

- The tools employed in the research are as follow:
  - **Survey** to measure the effect of artificial lighting on the livability of pedestrian paths in an urban heritage context. It includes two sections, the first one discusses personal information about participants such as their gender and age group. The second section are based on how people utilize pedestrian paths in the old souks of Batroun during the nighttime and activities that can be done during the evening to determine the link between artificial lighting and livability. The questions are as following: (Question 1 (Q1): How regularly do you frequent such areas at nighttime? Question 2 (Q2): How much time do you stay within those areas at night? Question 3 (Q3): What kinds of activities do individuals utilize these areas during the evening? Question 4 (Q4): Are you pleased with the placement and general quality of artificial lighting within those areas? Question 5 (Q5): Do you sense safe and at ease in such locations at night? Question (Q6): How satisfied or dissatisfied are you with activity during the night? This section examined three major aspects of evening consumption: frequency (Q1), time (Q2), and activity (Q3). Moreover, user contentment with artificial illumination, in addition to user perceptions of security and convenience, were investigated (Q4-6). To determine the satisfaction levels with accordance to safety and wellbeing, a five-point likert scale was employed, as it is a form of response scale in which respondents define their degree of agreement to an assertion in five points, from the smallest (grade or point 5) 1) to the highest (grade or point 5): (1) very dissatisfied; (2) dissatisfied; (3) neutral (4) satisfied; (5) very satisfied.

  - **Dialux**, a simulation software that is used to simulate the impact of artificial lighting fixtures on its surroundings.

- Data resulting from both the survey and the simulation is analyzed and then a conclusion is made about the link between artificial lighting and the livability of the pedestrian paths in a heritage context such as Batroun’s and on what is the optimal solution to increase the livability of a path using artificial light.
3. CASE STUDY

3.1. Location and Site Selection

Batroun was chosen as a case study since it’s considered a very well-known touristic attraction where pedestrians wander at all times of the day, thus increasing the livability of the place. It is a frequently visited tourist attraction in northern Lebanon. The coastal city also serves as a significant seaside resort with a thriving nightlife that features restaurants and nightclubs. The city is full of historical sites that add another layer of richness to the city such as the old souks of Batroun, which are known for their historical importance and architectural landmarks. Cycling along the Batroun shoreline is really popular, especially during the late summer months. Recently, the significant transformation of the historical roles of the local economic structure into a recreational service-based economic system has now become the town's sole and distinctive growth lever (N. J. J. o. Sfeir & Planning, 2013). The economic transformation has led in the relocation of homes to growing city outskirts, resulting in the overvaluation of the city center property sector. It evidently depicts the structure of a commercial city centre (directed towards pleasure and commerce) complemented by the structure of residential suburbia, where rapid urban development has resulted in the loss of natural lands and the catastrophic increase in land values (N. J. S. J. Sfeir, 2018).

Fig. 1: Location of Batroun and the zone under study according to Lebanon (openstreetmap.org)

The study is based in the old souks of Batroun. These historic souks were built in the nineteenth century and reconstructed in the early 2000s. Although the shops have become increasingly popular with nightclubs and restaurants, the street markets preserve certain artisanal services, such as local supermarkets, bakeries and fruit and vegetable sellers. While the streets linking the old souks together serve as the only paths providing access for pedestrians, they also allow vehicles to pass through.
The spatial component map depicts the pedestrian walkways of Batroun's historic souks, which serve as fundamental routes for users' mobility, as well as space passages for various recreational outdoor activities. They also provide automobile accessibility. These characteristics determine the type of utilization employed for these spaces. The activities in the site range from dining at restaurants, grocery shopping, walking/running or practicing sports, shopping for arts and crafts and a variety of other activities that are unique to the city.

Fig. 2: Batroun zoning (Author, 2022)

Fig. 3: Activities in the zone under study (Author, 2022)
3.2. Pedestrian Paths Selection

The study of pedestrian walkways is provided in connection to the patterns of outdoor leisure and entertainment activities. Batroun has become a popular tourist destination for both local and foreign visitors looking for amazing adventures. Professional monitoring and modeling of the geographic variation of users throughout time offered insight into user regularity, space utilization, and the dynamics of recreational events.

Figure 4 shows the pedestrian paths chosen for this study. They were selected according to the illumination ratio ranging from ‘strongly illuminated’ as the highest value to the weakly illuminated being the lowest. Streets 1 and 2 as seen in the map below are filled with restaurants and shops. Light fixtures situated along these paths are always switched on during the nighttime, their distribution is consistent and they provide adequate lighting to the existent function. As for Streets 2, 3 and 4, they are moderately illuminated and hold functions such as craft shops, bakeries, grocery stores and others. Artificial lighting fixtures are distributed at a larger distance and although they function during the nighttime, they are less consistent than the light fixtures present in streets 1 and 2. The least illuminated street in the selected zone is Street 6 since there isn’t much activity to be held in this part of town. This path experiences less activity than the aforementioned ones. As for artificial light fixtures, they are present along the path but they do not function at all during the evening.

![Image of Street Selection and zoning according to illumination](Author, 2022)
3.3. Survey Results

The findings of the questionnaires provided immediate insights into user opinion on the key parameters examined in this study. In terms of basic information about the individuals in a standard distinctive group, the sample utilized in this questionnaire constituted of 24% male and 76% female participants, with the majority of respondents (68%) between the ages of 18 and 30. Table 1 shows a more detailed composition of the group.

<table>
<thead>
<tr>
<th>Age</th>
<th>Participants (%)</th>
<th>Female (%)</th>
<th>Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 18</td>
<td>2%</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>18-30 years old</td>
<td>68%</td>
<td>78%</td>
<td>22%</td>
</tr>
<tr>
<td>31-64 years old</td>
<td>30%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>64+ years old</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>76%</td>
<td>24%</td>
</tr>
</tbody>
</table>

In terms of nighttime pedestrian walkway utilization in the selected paths situated in the old souks of Batroun, Streets 1 to 5 recorded the highest level of pedestrian activity from 8 p.m. to 10 p.m. with (45%) of visitors documented for Streets 1 and 2 and (49%) for Streets 2, 3 and 5. On the other hand, Streets 1 and 2 results show that individuals utilize these walkways from 5 to 7 p.m., (25%) and (8%) of individuals do so from 10 p.m. to 12 a.m. and starting 1 a.m. respectively. As for Streets 2, 3 and 4, (17%) of pedestrian activity is recorded from 5 to 7 p.m., (22%) from 10 p.m. to 12 a.m. declining to (12%) at 1 a.m. according to the participants’ response. Unlike the other paths, (62%) of Street 6’s users stated that they frequent the path from 5 to 7 p.m. with the percentage decreasing to (25%), (10%) and (3%) for 8 p.m. to 10 p.m., 10 p.m. to 12 a.m. and 1 a.m., respectively as seen in table 2.
Concerning the livability of the area, the pathways in Batroun’s souks were examined from three perspectives: frequency (Table 3), pedestrian behavior and activity (Tables 4 & 5) and duration (Table 6). According to Table 3, the largest percentage of respondents (64% - Streets 1 & 2, 52% - Streets 3, 4 and 5) reported using the walkways regularly except for Street 6’s participants with the largest percentage of individuals (62%) having stated that their visits are limited to ‘sometimes’. Further analysis showed that the frequency of pedestrian usage was significantly reduced as the nighttime progresses, and that inadequate lighting in different areas may be a limitation for developing outdoor activities.

### Table 2: Showing the percentage of participants based on visitor hours (Author, 2022)

<table>
<thead>
<tr>
<th>Visiting hour</th>
<th>Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streets 1 &amp; 2</td>
<td>Streets 3, 4 and 5</td>
</tr>
<tr>
<td>5-7 p.m.</td>
<td>22%</td>
</tr>
<tr>
<td>8-10 p.m.</td>
<td>45%</td>
</tr>
<tr>
<td>10 p.m. - 12 a.m.</td>
<td>25%</td>
</tr>
<tr>
<td>1 a.m. +</td>
<td>8%</td>
</tr>
</tbody>
</table>

### Table 3: Showing the frequency of activity (Author, 2022)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Streets 1 &amp; 2</td>
</tr>
<tr>
<td>Sometimes</td>
<td>20%</td>
</tr>
<tr>
<td>Regularly</td>
<td>64%</td>
</tr>
<tr>
<td>Daily</td>
<td>16%</td>
</tr>
</tbody>
</table>

The mobility and regularity of users were tracked for a duration of two months during the nighttime. The analytical patterns for outdoor events were observed for four various usage hours of the night, with emphasis on different sorts of activities and multiple users categories. The observed users’ activity in the old souks was divided into age groups: teenagers (17 years old and less), young adult (18-30 years old), adults (31-64 years old), and elderly users (64 years old and above). Results are shown in the tables below.

The space usage by various activities as shown in Table 3 presents the frequency of users in the main pedestrian paths following the dynamic of outdoor activities in Table 4. By framing the space occupation, the usage of areas of open public space is presented depending on a time frame and the period of the day.

Table 4 illustrates the various types of activities that take place in the selected pathways at different times of the night along with the individual types (Author, 2022).
According to table 4, the activities taking place during the late hours of the afternoon (5 p.m. to 7 p.m.) range from walking and exercising or just passing through to dining in local restaurants and social gatherings with all age groups taking part in the activities. In the early evening (8 p.m. to 10 p.m.), the activities remain the same in the selected paths with elders no longer spotted or taking part in the events and rather preferring to stay indoors. In the late hours of evening, with only young adults and adults participating in the events, the activities including festivals, social gatherings and festivals.

When being asked about the type of activities that take place during the nighttime, (23%) and (22%) of Streets 1 & 2 users claimed that they utilize the paths to get groceries, shop for necessities and dine at restaurants while (19%) just use the paths for leisure purposes, (18%) said they go shopping at local craft shops, (14%) of individuals having responded with just passing through or walking, and (5%) visiting nightclubs. Shopping for groceries as well dining at a restaurant both ranked first (28%) according to users of Streets 3, 4 and 5, followed by walking and sports and browsing through local shops at (13%) along with other activities as well. As for Street 6, ‘walking or passing through’ seems to hold the highest percentage at (49%) followed by leisure activities at (17%), using the path to go dine at a restaurant (13%), and purchasing groceries and necessities at (11%) and other activities recorded a smaller percentage. Further details are shown in table 5.

**Table 4:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
<th>Type of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 p.m. to 7 p.m.</td>
<td>Walking, bicycling, exercising, sitting, sports</td>
<td>teens, young adults, adults and elders</td>
</tr>
<tr>
<td></td>
<td>Dining in local restaurants, outdoor recreation</td>
<td>teens, young adults, adults and elders</td>
</tr>
<tr>
<td></td>
<td>Social gatherings</td>
<td>teens, young adults, adults and elders</td>
</tr>
<tr>
<td>8 p.m. to 10 p.m.</td>
<td>Walking, bicycling, exercising, sitting, sports</td>
<td>teens, young adults, and adults</td>
</tr>
<tr>
<td></td>
<td>Dining in local restaurants</td>
<td></td>
</tr>
<tr>
<td>10 p.m. to 1 a.m.</td>
<td>Nightclubs, social gatherings, festivals</td>
<td>young adults and adults</td>
</tr>
</tbody>
</table>

Around (61%) of users of Streets 1 and 2 utilize the walkways for about one to two hours, which is also the case for the majority of visitors in Streets 3, 4 and 5 (68%). Regarding the duration spent in Street 6, around (76%) of its participants claimed that they use the path for less than an hour (Table 6).
Table 6: Showing duration spent by users in the pedestrian paths (Author, 2022)

<table>
<thead>
<tr>
<th>Duration</th>
<th>Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Streets 1 &amp; 2</td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>11%</td>
</tr>
<tr>
<td>1-2 hours</td>
<td>61%</td>
</tr>
<tr>
<td>2 hours +</td>
<td>28%</td>
</tr>
</tbody>
</table>

To determine the satisfaction levels with accordance to artificial lighting and livability, a five-point Likert Scale was employed, as it is a form of response scale in which respondents define their degree of agreement to an assertion in five points, from the smallest (grade or point 5) 1) to the highest (grade or point 5): (1) very dissatisfied; (2) dissatisfied; (3) neutral (4) satisfied; (5) very satisfied (figure 6).

![Survey results](image)

Fig.6: Showing the survey results relating to pedestrians’ satisfaction (Author, 2022)

The results of the survey also reported users’ general satisfaction with the location and quality of artificial lighting in the walkways of old souks of Batroun for Streets 1 to 5 (strongly and moderately illuminated pathways) as for Street 6 (poorly illuminated), users reported complete dissatisfaction with the artificial lighting quality, distribution and the type of activities that take place during the nighttime.
3.4. Simulation Results

The selected pedestrian walkways of the old souks of Batroun along were simulated using Dialux to determine the lighting distribution and efficiency in the selected walkways.

![Simulation Results](image)

Fig.7: Simulation Results of the artificial lighting distribution in the selected pathways of the old souks of Batroun (Author, 2022)

4. DISCUSSION

The findings of the survey and simulation provided answers to the study issues raised. They demonstrated how artificial lighting can affect the livability of pedestrian walkways through space utilization, frequency of users, and spatial distribution in the aforementioned paths and comfort in a heritage context. Illumination has an effect on how people perceived space. Mapping outdoor activities and user dynamics revealed that illumination distribution defined users’ behavior and utilization of pedestrian paths. The decline in walkway livability at night is
influenced by artificial lighting distribution and types, demonstrating the link between an individual’s behavior and safety under the effect of illumination change.

The lack of artificial lighting restricts the space available for activities that rely on visibility during the nighttime. Survey results revealed that the frequency and general dynamics of activity in the selected walkways of the old souks of Batroun area decreased dramatically when artificial lighting was absent or not working properly at night, which was the case for Street 6 (Table 2), whereas the moderately and strongly illuminated streets were booming with pedestrian activity at all times of the night due to the presence and consistency of artificial lighting fixtures along the paths. This is consistent with the survey results, in which more than half of the participants of Street 6 utilize the path for activities and just pass through the walkway when needed.

The findings of the observations and questionnaires revealed a tendency of increased leisure activities (dining at a restaurant, walking, shopping and other) at night (Table 5), especially in Streets 1 and 2 (23% restaurant dining, 22% shopping and 19% leisure). This might be due to the major pedestrian path’s appropriate illuminance level— which offers enough illuminance level for the aforementioned outdoor activities (table 5). It is also evident that strongly and weakly illuminated paths provided a sense of safety for female users seeing most of the participants stated that they use the paths on a regular to weekly basis (table 3).

The effectiveness of the lighting conditions during the nighttime in the selected pathways - which are situated in a heritage setting - was investigated using quantitative and qualitative assessments methods based on livability variables and their link to artificial lighting. Although, the number of individuals decline progressively at night (table 2), the strongly and moderately pathways remain the most livable according to the recorded activity of participants.

On the other hand, the simulation results provided more depth on the effect of artificial lighting distribution in the selected pedestrian paths. Strongly illuminated (Streets 1 and 2) and moderately illuminated paths (Streets 3, 4 & 5) showed similar results for artificial lighting distribution and efficiency, unlike Street 6 which presented a lack of illumination all along the path. According to the results, there is a similarity when it comes linking the livability of the paths with the efficiency and distribution of artificial lighting in both moderate and strongly illuminated walkways, having had the same results when it comes to visitor’s number (table 1), frequency (table 2) and duration spent in the paths (table 6). Thus, moderate illumination can provide almost as adequate results as it comes to livability as the strong illumination and could be a sustainable alternative to save energy while still maintaining the livability of the place.

5. CONCLUSION

Artificial outdoor lighting is critical for increasing the quality of urban open spaces at night and has a considerable influence on pedestrians’ night-time perception and psychological safety. This research casts light on the vital function of artificial illumination in improving the livability of heritage places. According to the findings, well-lit streets had the greatest levels of livability, with both locals and visitors expressing emotions of safety and comfort. Moderately lighted streets produced viable findings as well, albeit to a smaller degree, with certain individuals reporting slightly lower degrees of livability than highly illuminated streets. However, poorly lit streets were linked with the lowest livability, with individuals experiencing feelings of discomfort and nervousness.

These results imply that, in order to maximize livability in heritage spaces, it is critical to make sure that public illumination is adequate and suitable for the area. Streets with considerable pedestrian traffic and degree of activity, such as business districts or tourist regions, may benefit from strong illumination. Moderately lit streets may be suitable for low-activity regions, such as residential communities. In contrast, poorly lit streets ought to be avoided or used only in certain situations because they have a negative effect on the usability of a place.

Overall, the findings of this research emphasize the significance of taking artificial lighting into account when designing and managing heritage places. Designers are able to enhance the livability and overall satisfaction of locals and tourists by making sure that illumination is suitable and adequate. Further study is suggested to investigate the particular
lighting architectural components that add most significantly to comfort in historic spaces, as well as the possibility for incorporating natural lighting sources into these types of environments. It is worth emphasizing that this study was carried out in a particular setting, specifically Lebanon's historic communities. While this study's results offer useful insights into the connection between artificial illumination and comfort in this setting, caution ought to be taken when applying these results to other historical contexts. Nevertheless, because it offers a foundation for examining the effect of lighting on the livability of heritage places, the technique and strategy employed in this study could act as a helpful framework for additional studies in other settings.

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