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Lighting monuments: Reflections on outdoor lighting and environmental appraisal

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Abstract

For more than 10 years, highlighting urban pattern, revealing the artifacts in our surroundings, and providing relationships among the elements of cities, outdoor lighting practice gained more significance. The following study aims at suggesting the needs for monument lighting, taking it as an essential architectural and outdoor lighting issue, and focuses on aspects to be considered both in the approach and application phases by discussing some examples from Ankara, the capital of Turkey. In order to determine approaches in attaining an effective lighting scheme, a case study was conducted. The participants were shown a series of photographs of the Bilkent University Atatürk Monument and its model taken under daylight and artificial lighting conditions, and the differences and tendencies in their perceptional preferences were examined. The results implied that lighting the monument with down-lighting technique is more preferable compared to up-lighting. The findings also suggested that there is no significant perceptional difference on the figure when daylight condition (direction) is imitated using artificial lighting sources. In the analyses, it was also observed that the difference in the incident angle (45° and 60°) of light did not considerably change the perception of participants.

Keywords: Lighting; Monument lighting

1. Introduction

Since the 90s, along with an increasing concern with outdoor lighting [1], city beautification programs have been progressively employed aiming to promote and expose the identity of the cultural and architectural assets of the city by directing more flux on the facets of landmarks, sculptures, monuments, buildings and structures; and cities have started to glitter more at nights. There are surely more people enjoying nightlife today, when compared with the early 90s, and lighting is one of the dominating forces for that particular shift. It is more than the sense of safety while people walk around parks and gaze at sparkling fountains. Entering a well-lit environment, looking at a floodlit structure or landmark, walking around a light-washed artifact, sculpture or monument, spectators are appreciating the importance of ambience and the ability of lighting to reveal character, form and atmosphere. "Such lighting encourages them to come and walk in the area in the evening, which is something that they would probably not consider doing with purely functional street lighting" [2].

Monuments, in a general sense, are artifacts in the fields of art and architecture, and more often the term is being used with, and attached to, structures; but from an artistic point of view, they are sculptures that have entered the public domain for commemorative purposes. They depict moments in history, describe an event or just express an emotion through the perspective of their artists. They are the witnesses of an historical period or represent a well-known idea or concept. Ankara, the capital of Turkey, having hosted several civilizations from 2000 B.C. [3] till today together with

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their true symbols of art, is one example where one may find many monuments. More than 70 of these artifacts represent Atatürk, the founder of Turkish Republic, and this gives the city a distinctive character when compared to many other capitals. Looking at a monument of Atatürk, one literally remembers his doctrines, principles and philosophy. It can be recognized that their scenery defines a concrete ideology, but sometimes they are solely abstract artifacts with intrinsically defined symbolic meanings.

The monuments in Ankara are found within various places. Some are located in parks, some are situated in public squares, some are placed within military districts and others are sited in front of governmental buildings. Most of them are lit in an inaccurate manner so that it is not possible to perceive and understand their ideological implications or their formal appearances. However, it is important to express the aforementioned meanings by the creative usage of monument lighting. Fig. 1 shows

Fig. 1. Ulus Atlı Atatürk Monument, Ankara.

Fig. 2. Tarımcı Atatürk Monument, Ankara.

Fig. 3. Atatürk Monument on Mithatpaşa Boulevard, Ankara.

the Atatürk Monument in Ulus Square in Ankara with the luminaries, being located at the corners of the base of the monument. Far from illuminating the main figure, they just reveal the base and the horse. This flawed positioning of luminaries brings about unexpected and grotesque shadow patterns on the surfaces, excessive brightness on the figures located around the base, and creates light pollution and trespass. Besides problems of achieving an effective modeling, in some applications as in Figs. 2 and 3, it is not possible to perceive the setting and the figures at all. Light sources are mounted within the visual field of spectators and drivers, without appropriate cut offs or louvers to eliminate glare.

2. Aim and approach

The examples discussed above illustrate the problems that form the basis of this study. The aim is to concentrate on the relation between monuments and lighting—taking both as bodies of art—and as an interaction between individuals and monuments in terms of functional, aesthetical and psychological factors. Means of approaching the problem and aspects that lighting designers and sculptors have to bear in mind are discussed. The problem can be broken down into three related questions: how can artificial lighting be used to accentuate and manipulate form; how can it enhance aesthetic quality; and in what ways can it express ideas, reveal meanings, and support abstract implications. The answers of these questions are acquired within three requirements, namely, functional, aesthetical and psychological needs for monument lighting.

Functional necessity can be defined as the provision of visual clues intended to make the monument identifiable within the environment. "Unless the mind is directed, visual scenes pass before the eyes without

conveying any impressions to the brain and so the visual experience is not registered, but goes unseen'' [4]. Basically, lighting ought to be used to establish a kind of identity and promotion that would capture public attention and increase the level of recognition of the monument.

Lighting is a body of art in itself, and besides being a reinforcer of spatial perceptions, it is a definer of moods and behaviors. The notions of art, aesthetics and beauty are complexly linked and are shaped and thus discussed differently for each monument. Therefore while considering the aesthetic needs and lighting design, aspects that constitute plastic composition, the expressiveness of the work, the beauty of expression, the beauty of the medium—shape, form, colour—and the sense of beauty regarding judgment [5] should be borne in mind.

The third necessity, psychological need, is proposed to emphasize the supportive component of lighting to reveal the meaning that is being conveyed by the monument. Two related questions concerning the content and the context of the monument would figure the approach of the designer in discussing the psychological as well as the aesthetical needs: What does the observer need to see, and how does the object need to be seen? The theme, the emphasized ideology and the anticipated effect would help in formulating the approach, both content and context wise, and can be utilized to uncover the hidden meaning legibly, by offering the lighting designer clues regarding the type, direction, intensity and colour of the light source(s) to be installed.

3. Previous studies

An increased awareness on city beautification programs and a changing mood to city life has altered the approach to exterior lighting subjects. Broken barriers of economical crises together with innovations in lighting technology have changed the movement in lighting practice. Starting from the late 80s and followed by 90s, significant attempts can be seen that are willing to emphasize the character of lighting on personal impressions [6–8]. Judgments, feelings and evaluations of the goodness, beauty and meanings of the outdoor environment became more important than satisfying basic biological needs of safety, security and orientation [9,10].

Regarding monuments—sculptures and statues in general parlance—analysis and discussion has been limited to museum and exhibition environments where lighting design is mainly formulated by the curator, architect and lighting designer who decide on the lighting design priorities to balance matters of vision and preservation [11–13]. In a museum, visitors are subject to the judgment of curators, who arrange the light as they see fit (usually privileging a single viewing angle), and there is no way a visitor can change it [14]. However, at the outdoors, as one looks and walks around a sculpture, one can take note of the revelation that comes when the light whether natural or artificial does something extraordinary to the form. The lighting requirements for monuments in outdoor settings are far removed from preservation. They allow spectators dynamic quality of visual perception through day and night and each are perceived within a different setting that affect visual impression. Recently, the Illuminating Engineering Society of North America, proposed the subject of ''Hardscape Lighting'' to apply to on outdoor sculptures, vertical displays and gazebos [15].

However, the authors believe that current approaches overlook the notional aspects of the issue taking just the quantitative portion of lighting in most application projects.

4. Research methodology

Is it an appropriate approach to use fixed sources at night to illuminate monuments which are perceived under changing daylight conditions? In other words, is it rational to imitate certain daytime settings to achieve a resembling lighting scheme during the nights? Considering the possibility of proposing an imitative solution, how can the designer determine the appropriate luminary location, height and direction? In this study, a survey was conducted in order to find answers to such questions, and approaches to monument lighting design are investigated by examining the effects of different lighting treatments on experimental set-ups and the related human responses to these simulated lighting schemes.

This study, including an experimental set-up and a questionnaire session, was structured to discuss the following approaches to monument lighting:

Step 1: Seeking to propose the most effective nighttime lighting scheme, regardless of the perceptional state of monument under daylight conditions:

a. By illuminating the artifact in contrast to its daylight modeling, i.e. contrary to the daytime illumination conditions, which are defined by the monument's orientation with respect to the solar path (illuminating it from the opposite direction to the sun and, comparing the effectiveness of the two directions of illuminant(s)).
b. By exploring the perceptional differences and effectiveness with regard to varying incident angles (comparing the effect of angular change of artificial illuminant(s)).
c. By comparing the most frequently used lighting techniques (up-lighting and down-lighting) in current monument lighting applications.

Step 2: Determining the best perceptual condition of the monument under daylight and using the acquired solar parameters attempting to propose a similar situation at night.

Step 3: Ignoring daytime lighting conditions, and using artificial lighting techniques, trying to emphasize the main theme of the artifact in collaboration with the artist.

5. Subjects

The participants of the study were 113 undergraduate students (64 were male and 49 were female) who were randomly selected from the Interior Architecture and Environmental Design Department of Bilkent University and the Interior Architecture Department of Çankaya University, both located in Ankara, Turkey. The age and gender information of each participant was recorded. Each subject participated in an experimental session lasting approximately 6 min.

6. Experimental set-up

The experimental set-up was created as follows:

- The room (Fig. 4) in which lighting settings were prepared and questionnaires were carried out, was a dark space with no windows. The floor was covered with gray terrazzo tiles, and both the walls and the ceiling were painted white.
- The Bilkent Atatürk Monument[1] was photographed at each hour from front side and backside, between sunrise and sunset, on the vernal equinox on 21 March. (The daylight photographs of the monument and of its model were taken under clear sky conditions) (Figs. 6 and 7).
- Daylight conditions for the two solstices (June 21 and December 21), were simulated and photographed on 1/20 scale model of the monument[2] (using a sundial).
- The model was also illuminated and photographed in the three following conditions:
  - contrary to the daytime situation; that is, illuminated from the opposite direction of the sun,
  - using the light sources at two different altitude angles (45° and 60°),
  - with up-lighting and down-lighting techniques.
- For the simulation of lighting schemes (up-lighting, down-lighting—single and multi point with key and fill light techniques), slide projectors with 100-W tungsten halogen lamps, and 12 V 35 W halogen spot lamps with 8° parabolic reflectors were utilized as light sources. By adjusting the focal distance of the lens in the slide projectors, a light similar to the intended parallel beam—to represent the sun—could be achieved. For adjusting the lamp intensities, manual dimmers were used. The necessary degree of dimming was determined with the help of an illuminance meter.
- The photographs used in preference schemes, in the interviews were arranged in sequence using a computer software [17]. The background grading of the daytime photos were prepared to be consistent with the actual daylight conditions, gradually decreasing from top to the bottom since the horizon is brighter than the zenith under clear sky conditions.

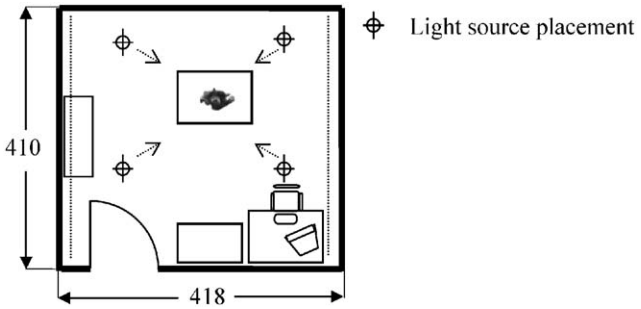


Fig. 4. Plan of the room.

The interview procedure was as follows:

- The subjects entered the room one by one.
- To each one, photographs of the monument and its model were shown, in relation to nine questions. The inquiry for all questions was the same: "In which of the photographs do you perceive the monument and conceptualize its theme in the best[3] way?" The second and eighth questions were related to the theme of the artifact.
- There was no time limitation for the selection process during the interview. Subjects were allowed to examine the photos for as long as they needed.
- They were not allowed to see the previous schemes again.
- The answers were recorded by the interviewer.

7. Findings and discussion

The Bilkent Atatürk Monument is a two-faceted artifact. The front side of the artifact depicts Atatürk and there are two figures on the backside representing

[1]The Bilkent University Atatürk Monument was made by sculptor Hüseyin Gezer in October 2000. The monument is located at the entrance of the university and aims to symbolize the notions of independence, freedom, science, and ethics (Gezer).

[2]The model used in the survey, is at 1/20 scale, cast in gypsum plaster and painted with a cover dye representing the material of the monument that is bronze.

[3]The best perception was assumed as the state in which appropriate modeling, balanced shades and shadows with appropriate brightness and contrast levels occured.

Turkish youth. The front side of the Monument is looking towards east, and the backside towards west (Fig. 5). Therefore, the front side is illuminated from the southeast direction in the morning (Fig. 6), and the backside from the southwest during the afternoon (Fig. 7).

Pertaining to the first approach (step 1-a) to monument lighting, the primary aim was to compare lighting schemes in which the monument is lit from opposite directions: From southeast (as it is lit under daylight) versus northeast for the front side, and southwest (daylight condition) versus northwest for the backside. The results indicated a tendency towards lighting the monument with the luminaries located on southern side, which was similar to daylighting conditions (Table 1). Regarding the frontal view comparisons, 84% of the subjects favored the setting that simulated lighting from

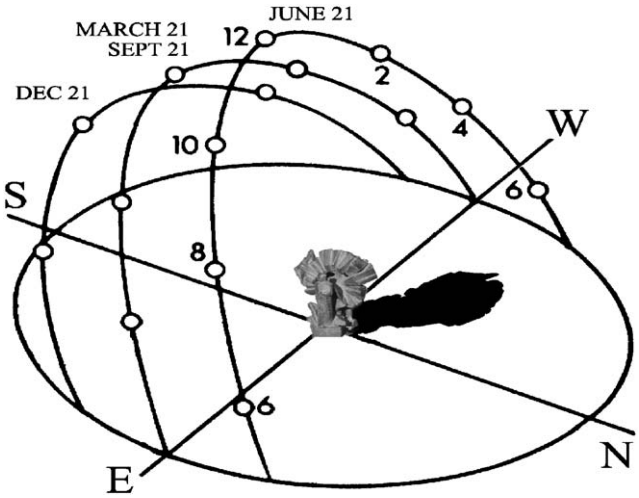


Fig. 5. Solar path 40° N latitude.

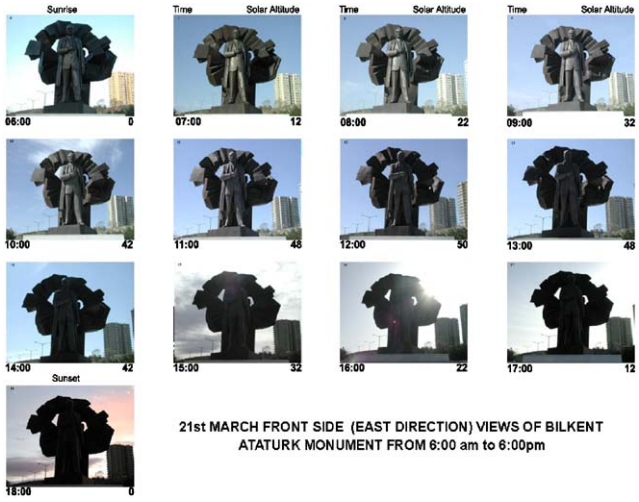


Fig. 6. March 21, Front views of Bilkent Atatürk Monument (6.00a.m.–6.00p.m.).

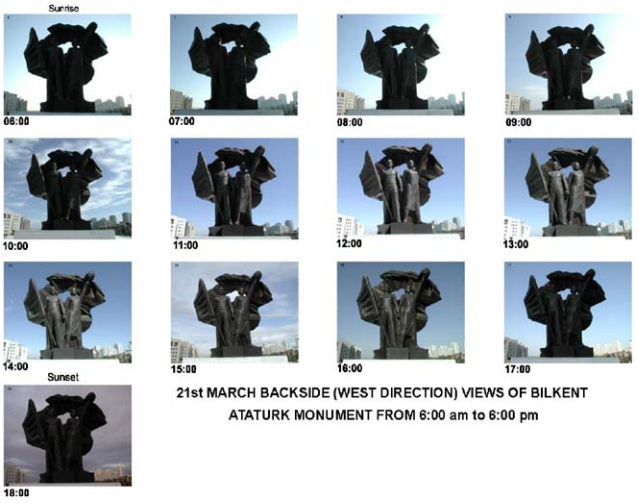


Fig. 7. March 21, Backside views of Bilkent Atatürk Monument (6.00a.m.–6.00p.m.).

the southeastern side, and 16% of the subjects favored northeastern direction. When the backside views were considered, 78 people (69%) selected the scheme with southwest lighting direction, and 35 people (31%) selected northwest direction. Thus, for the Bilkent Atatürk Monument, the provision of contrasting lighting conditions regarding direction was found to be insignificant. This result may be explained by the subjects' familiarity with the daytime conditions. However, justification of this statement requires further research.

In the comparison schemes a secondary aim (step 1-b) was to implement the angular parameters of light into the settings. Two incident angles (45° and 60°—calculated for feasible luminary installation pole heights around the monument) were employed in preparing the lighting settings and subjects were asked to indicate their preferences among the schemes (Fig. 8). The findings showed that there was no significant effect of lighting the monument with these two altitude angles (Table 2). Because 72% of the subjects favored 45° incidence for the frontal view (and it was 28% for the 60° incidence), and for the backside views, the tendency was towards 60° incidence angle. Eighty percent of the subjects favored 60° incidence angle for the backside views (and 20% of the subjects selected 45° incidence) when the model was lit from the southern sides (southeast for the front side and southwest for the backside).

Illuminating figurative sculptures and monuments by up-lighting technique results in grotesque faces and unpleasant shadows. Literature suggests that this technique leads to unnatural and uncanny effects on figures [18–20]. It is widely a used lighting technique in horror movies. However, most monument lighting applications in Turkey conform to this method because of its low cost and, ease of installation and maintenance.

The findings in this study (step 1-c) indicated that down-lighting is more preferable to up-lighting technique (Table 3). 80% of the subjects favored lighting the artifact downwards, for an effective perceptual image (Fig. 9). Only 20% of the subjects favored up-lighting for the frontal view. The rate decreased to 9% for the backside view and 91% of the subjects selected down-lighting for the backside.

Differing from the preceding, the succeeding approach (step 2) was an endeavor and an exploration of the possibility of proposing a lighting condition using artificial lighting sources. The subjects were shown a series of photographs of the Monument taken on March 21 (13 photos, taken each hour from sunrise to sunset) (Figs. 6 and 7). The aim was to find the particular time interval in which the subjects state that they perceive the monument in its best condition. The answers indicated that for the frontal view daylight creates the best modeling effect, at 8.00 a.m. and 9.00 a.m. (61% for 8.00 a.m. and 31% for 9.00 a.m.). For the backside view, the preference shifted towards 1.00 p.m. and 2.00 p.m. 90% of the subjects selected these particular hours (Fig. 7). As the position of the sun is specified by the solar altitude and solar azimuth and is a function of site latitude, solar time, and solar declination, the selected hours were utilized for determining and calculating the location and height of a mast, to house the luminary that would imitate the daylighting condition on the most preferred hour. According to the site plan and topography, an appropriate position for the light source was calculated and designed.

It is important, however, to underline that all the calculations and efforts aimed at spotting an instant of daylight condition on 21 March and 21 September. Therefore, having the same objective, daylight conditions on two solstices (June 21 and December 21), were simulated on 1/20 scale model and shown to the subjects (Figs. 10–13). The findings indicated that for different seasons—as a result of change in solar azimuth and altitude angles—the best view and the best perception states change (Table 4) (Figs. 10–13). For instance, in June, altitude angle of sun is greater than the condition in March and December, resulting in shorter shadows. Consequently, if designing a scheme that would mimic a particular daylight condition is the consensus for the artist and lighting designer, an analysis on the artifact

Table 1
Results of Step 1-a

	Lighting direction	%
Frontal view	Southeast	84
	Northeast	15
Backside view	Southwest	69
	Northwest	31

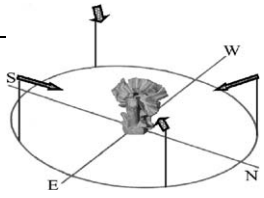


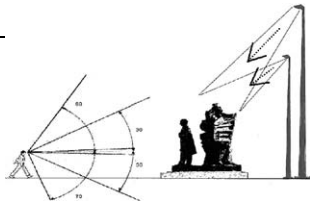
Fig. 8. Model of the monument under 45° and 60° illuminants.

Table 3
Results of step 1-c

	Up-lighting (%)
Frontal view	20
Backside view	9
	Down-lighting (%)
Frontal view	80
Backside view	91

Table 2
Results of Step 1-b

	Lighting angle (deg.)	%
Frontal view	60	28
	45	72
Backside view	60	80
	45	20



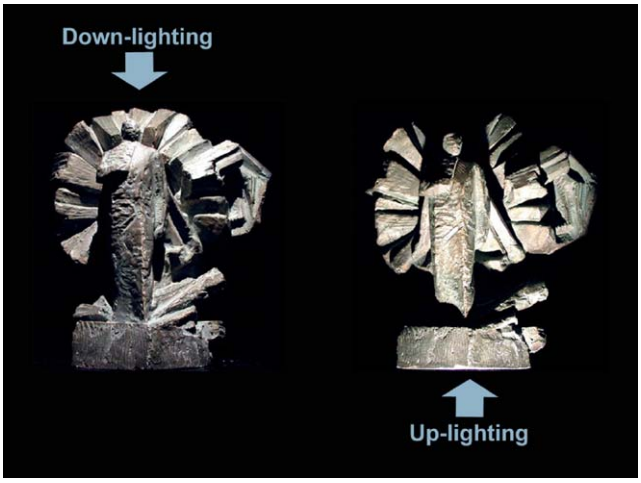


Fig. 9. Illuminating the monument by down-lighting and up-lighting.

Fig. 10. December 21, Front views of the model of Bilkent Atatürk Monument.

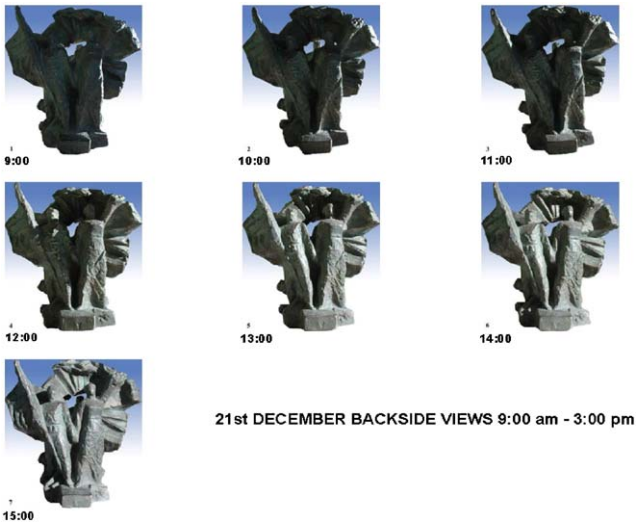


Fig. 11. December 21, Backside views of the model of Bilkent Atatürk Monument.

Fig. 12. June 21, Front views of the model of Bilkent Atatürk Monument.

Fig. 13. June 21, Backside views of the model of Bilkent Atatürk Monument.

Table 4
Preference tendencies March–June–September–December

		Hours						
		09:00	10:00	11:00	12:00	13:00	14:00	15:00
Mar/Sept 21	Frontside %	21	30	16	22	10	1	0
	Backside	0	0	0	23	20	20	37
Jun 21	Frontside %	18	34	38	9	0	0	0
	Backside	0	0	2	3	21	31	43
Dec 21	Frontside %	33	35	3	11	0	18	0
	Backside	0	0	0	1	11	37	51

across the year is of utmost importance. By analyzing different daylight conditions, the lighting designer and the sculptor can find the most appropriate direction offering the best modeling effect.

In the final approach (step 3), the aim is to accentuate the abstract depiction and to convey the main theme of the artifact. Within the context of this study, the sculptor of the monument explained the multi-faceted, half radial shape of the monument as being ''the most important aspect of the artifact: an abstract depiction of Atatürk's revolutions'' [16]. Therefore, the third approach was devised as an accent light, in order to reveal the importance of this form and to unleash the artists' intention. To fulfill this goal, authors' intent was to place means, such as laser beam emitters beneath the radial form to direct rays of laser light towards the sky from within the monument. However, it was understood that such initiatives should be discussed with the sculptor throughout the whole design and sculpting project so as to provide space within the artifact e.g. for laser beam emitters. Hence, it was not possible to realize the approach and the mentioned effort on the monument.

8. Conclusion

Monument lighting is more than the calculation of lumens, but rather it deals with the effective reveal of meaning. The influence of art and aesthetics, issues of vision and perception, environmental psychology, and sociology in the field requires an extensive examination of each artifact, considering its physical and socio-cultural context, its historical meaning and symbolic quality, and the information conveyed its physical attributes of shape, dimension, colour and material. Consequently, for each monument there are different and unique solutions. Therefore, lighting design projects should be carried out with the artist from the preliminary stages of production. In line with the techniques employed, monument lighting should be consistent with the city's lighting program, theme and character, and also with future development strategies within the monument's environment. Similar to the methods suggested by this study, public involvement tactics may be utilized in the decision-making processes at city scale. Each proposed scheme should be explored down to its basic elements to decide on the best lighting design approach. Then appropriate luminaries that will provide the best solution can be selected regarding their intensities, colour temperature and colour rendering indices, filters, forms, and distribution characteristics.

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