MONUMENT LIGHTING

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MASTER OF FINE ARTS

By

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September, 2001

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ABSTRACT

MONUMENT LIGHTING

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This thesis is related with the concept of monument lighting. It focuses on the interaction between two elements of art; light and the monument, and also the interaction between human and monument regarding the psychological, physical, and sociological factors. The study concentrates on the approach to the problem and discusses the facts that lighting designers and sculptors have to be concerned about in bridging the gap between public and monuments. Rather than expressing general lighting criteria, discussions are carried upon the examples to suggest a better understanding to the topic. The recommendations involve the case studies of two monuments and the evaluation of observer responses among different lighting schemes.

Keywords: Lighting, Monument, Monument Lighting, Outdoor Lighting

ÖZET

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Bu tez anıt aydınlatması üzerinedir. Tez dahilinde iki ayrı sanat unsuru olan aydınlatma ve anıt kavramlarının ilişkisinin incelenmesinin yanısıra, insan ve anıtlar arasındaki etkileşim psikolojik, fiziksel ve sosyolojik faktörler ele alınarak ortaya konulmaya çalışılmıştır. Çalışmada anıt aydınlatması problemine akılcı bir yaklaşım getirilmesi amaçlanırken, yapılan tartışmalarda aydınlatma tasarımcıları ve heykeltraşların, anıtlar ile halk arasında oluşan boşluk ve yabancılaşmayı ortadan kaldırmaya yönelik göz önünde bulundurmaları gereken şartlar ele alınmıştır. Bu noktadan hareketle, tartışmalar genel aydınlatma kriterlerinin sıralanması yerine, konuya dair doğru bakış açısının yakalanması yönünde şekillenmiştir. İki anıt üzerinde yoğunlaşarak yapılan çalışmalar, gözlemcilerin farklı aydınlatma uygulamalarına verdikleri tepkilerin değerlendirilmesi ile desteklenmiştir.

Anahtar Kelimeler: Aydınlatma, Anıt, Anıt Aydınlatması, Dış Mekan Aydınlatması

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1. INTRODUCTION

Over the past twenty years there has been a movement in lighting practice from illuminating engineering to lighting design, a movement from calculations of illuminance to judgments of aesthetics, a movement from quantity to quality. (IESNA Lighting Handbook, ix) The movement has been assisted by the progression in lighting technology, which allows designers to propose new solutions on existing situations and work on new and innovative fields with an extending variety of lamp and luminaire types.

In time, we have seen an increase in the usage of the nighttime, as there was a sense of spectacle commonly enjoyed by all people. Outdoors, the untouched dark canvases of night turns out to be more significant for lighting designers. Also, the increase in the efficiency of artificial light sources has resulted in a growing interest in the use of outdoor lighting to help improve the attractiveness of the environment. Outdoor lighting has become a focal point for city beautification programs around the world, and aesthetics, ambience, identity and image are become the hallmarks for modern nighttime lighting (Camminada, 28). Outdoor lighting practice, comprising a range of fields extending from roadway lighting to landscape lighting, from pure functional to more aesthetical, allows us to better read the city and the environment.

Entering a nicely lit square or looking at a floodlighted building or landmark, examining a light washed sculpture or monument, spectators are setting in to appreciate the importance of ambiance and the ability of the

lighting to reveal character, form and atmosphere. Such lighting encourages the visitors 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.

Lighting up the monuments, statues and sculptures that have always been seen as true symbols of history and art, is a crucial factor that outdoor lighting discipline should employ and be concerned with. The monuments or sculptures in a city define its history or an event or just an emotion through the perspective of their artist or creator. Sometimes they are the witnesses of an historical event or represent a well-known idea or concept. Looking at a monument of Atatürk, we literally remember his principles and philosophy. It can be recognized that their scenery defines a concrete ideology, but sometimes they are the solely abstract artifacts hiding their meaning behind.

Forms are rendered differently under different lighting conditions. At night, the brush strokes of daylight change to artificial lighting. The perception of the total environment changes rapidly. In monuments, we now perceive different facets, cutouts and transitions. What can be the role of outdoor lighting in this relation between man and the artifact? What can be the requirements of the viewer with the general environment, including the backgrounds against which the exhibits are viewed? It is more than discussing the lumens and lighting levels but rather focusing on the divine and metaphorical sacredness that reveals itself by the creative usage of lighting.

A variety of monuments surround our periphery. Turkey's capital city, Ankara, is encircled with more than 50 monuments of Atatürk. At night most of them are left in darkness waiting for a glimpse of light (Fig 1.1). The rest are lit inaccurately that it is not possible to perceive their implications as well as their formal appearances.

The Ulus Atlı Atatürk Monument in Fig. 1.2 is seen under nighttime lighting condition. The luminaries, being located at the corners of the base, are far from illuminating the main figure, Atatürk. Rather, they reveal the base and the horse. The flawed positioning of luminaries brings about unexpected distribution patterns on the surfaces, excessive brightness on the figures around the base, and creates light trespass. A similar example for the base lighting can be seen in Fig. 1.3, which shows the Zafer Monument with its glittering base. Both examples reflect the misconception of lighting design on two olden monuments. Fig. 1.4 is an evidence for a recent disturbing lighting application on the Atatürk Monument, that is located at the Atatürk Square. It is difficult to perceive the details of the figures around the base. The background façade was not taken into account while positioning the luminaires and the light source characteristics does not match with the material of the monument.

The observable facts above have formed the basis of the reason for choosing the topic of this thesis. Furthermore, it creates a chance to glance towards the field of outdoor lighting, which needs as much attention as interior lighting does.

The aim in the present study is to put an emphasis on the interaction between two elements of art; light and the monument; and the interaction between the human and the monument regarding the psychological, physical, and sociological factors, furthermore to expose light's increasing prevalence and importance at the outdoors. The problem is broken down into three related questions: how can artificial lighting express ideas; how can it be used to influence behavior and manipulate form; and how settings are affected. The study concentrates on the means of approaching the problem and discusses facts that lighting designers and sculptors have to be concerned about in bridging the gap between the public and monuments. Reasons for lighting the monuments are clarified to set forth arguments on the subject. Rather than expressing general lighting criteria, discussions, from both the artists' and lighting designers' standpoints, are carried through examples to suggest a better understanding the topic. The recommendations are the result of the evaluation of observer responses on the different lighting schemes applied on two monuments.

Following this introductory chapter, the second chapter includes information on the concept of monuments. The development of monuments in Turkey is examined and definitions of sculpture and monument are investigated to put forward the differences in between. The concept of plastic arts and the development of monuments in Turkish culture are discussed, from the Islamic to the Republican periods, to question the reasons for the reaction against sculpture and to understand the struggle for the formation of plastic arts. Additionally the preliminary stages of electric lighting are investigated to

find its place in art and the relation between technological improvements of electric lighting and reveal of lighting concept on monuments are questioned.

In the third chapter, the need for monument lighting is discussed in order to expose general design aspects. Monument lighting is thought to incorporate three components and discussed under as functional, psychological and aesthetical factors.

Light acquires meaning in arts relationally, that is, as part of a sequence of luminous relationships. Light is approached in an integrated way, both conceptually and practically in the fourth chapter. Through a conceptual framework, the philosophy of the artist is analyzed, in order to grasp his aim, and to associate it with the subject of lighting.

In chapter five, the relations between daylight and artificial light are examined to further discuss the use of artificial light for daylight imitation. The dynamic quality of daylight is stressed to point out the dynamic formation of shades and shadows on three-dimensional objects. The interaction of the dynamic quality of perception with the dynamic quality of daylight is explained and artificial lighting is discussed from the point of its static property. In accordance with the light source characteristics, the ideas of imitating daylight or creating an alternative setting are considered to figure out the appropriate luminaire location. Additionally, the importance of the orientation of monument with respect to sun's movement is pointed out with

some examples posing debatable orientation schemes that diminish the quality of daylight modeling.

Chapter six deals with the criteria in selecting the appropriate luminaires and deals with the goals of illumination standards, by transforming the light into illumination. The indication of the importance of luminaire distribution characteristics is followed by the discussions of quantity and quality; comprising color properties of light and material characteristics of the artifact. The energy consumption criteria in exterior lighting applications with an emphasis on spill light are also discussed to draw one's attention on the significance of luminaire design.

In chapter seven, a survey study involving the Bilkent University Atatürk Monument and the Hacettepe University Bayraklaşan Atatürk Monument is introduced. The participants in the survey were shown a variety of photos, demonstrating the monuments under different lighting schemes. The aim was to examine their perceptional preferences among daylight and artificial lighting schemes to discuss the possibilities of day and nighttime lighting interaction on a proposed lighting plan of Bilkent University Atatürk Monument. The effects of different directions, incidents and intensities of artificial lighting on the monument were analyzed. Additionally, both of the monuments were photographed, under different months of the year, utilizing a sundial to depict the distinctions of daylight conditions in different seasons and to point out the importance of orientation. Similar to the artificial lighting schemes, sets of seasonal photographs were shown to participants to find out

the most recognizable and perceivable scheme. The results of the survey are discussed in detail.

2. HISTORICAL BACKGROUND OF MONUMENTS

"Sculpture is a form of aesthetic expression in which hard or plastic materials are worked, as by carving, molding or welding, into three-dimensional art objects" ("Sculpture"). Simply it is the three-dimensional art concerned with the organization of solids and voids. "Sculpture is not a fixed term that applies to a permanently circumscribed category of objects or sets of activities. It is rather the name of an art that grows and changes and is continually extending the range of its activities and evolving new kinds of object" (Yılmaz, 12). Yılmaz defines sculpture as the art of creation of projections and recessions in space (13). As an area in fine arts, the art of sculpting is the shaping of the material that would reflect the feelings and ideologies of the artist.

A monument is an artifact conveying a profound historical event, reflecting or symbolizing a special ideology, or representing a hero or a heroic action to the following generations. In a general sense, it covers artifacts in the fields of art and architecture; but from the artistic point of view it is a sculpture that entered the public domain for commemorative purposes.

The tradition of setting up monuments and sculptures in public spaces and squares started with the ancient civilizations. By the classical period of Hittite, Egypt, Indian, Chinese and Greek civilization, religious, political or sociological functions were undertaken. Through the Roman period, monuments were built up to emphasize the magnificence of the emperor and to

stress his political identity. A similar understanding emerged with the Renaissance in Europe. Donatello's Gattamelata is regarded as the first public sculpture of the period (Osma, 18).

Looking at the urban design context in 20th century, a physically oriented urban planning system is observed, with sets of environmental objectives, such as the orderly arrangement of parts of the city, the provision of recreation and other community services of adequate size, location, and quality, an efficient system of circulation within the city and to the outside world.

From the late 60s, monuments and sculptures in the city districts, nodes and squares are laid on with more urban provisions, in addition to their sociological and artistic functions. As images of spaces, they become the tangible elements of city beautification programs and city master plans (Kaya, v). Creating enlivening spaces of interaction, attracting visitors and enhancing the value of urban pattern that they belong, monuments have various levels of influences on the city. These, what we may call elusive contributions, are interpreted by the public through perceptual processes and cognitive acts.

2.1 DEVELOPMENT OF MONUMENTS IN TURKEY

To understand and examine the development of monuments in Turkey, the concept of plastic arts in Turkish culture needs to be analyzed.

During the emergence of Islam, the idols of gods and thereby sculptures were accursed. They were taken to be the main characters in an era of darkness and had to be prohibited to set up the new ideology-ideology of one-god. In the beginning nearly all sculptures received the same evaluation without any distinction. Although Islamic ideology has an open-minded structure in its formation, it was impossible to observe an improvement in the plastic arts till the foundation of the art school "Mekteb-î Nefise-î Şahane" in 1882. (Berk and Gezer, 3) The use of human figure in the art of miniature seems to pose a conflict in this manner, however, Gezer states that the reason for the reaction against sculpture rather than the art of painting and miniature is that having the three dimensional form, sculpture possesses the shadows imitating the idols. As a result, sculpturing had the field of application with its strong connection to architecture and its meaning was charged on structures such as mosques, tombs and madrasas. The stone works and tombstones with relief and carvings produced during the Seljuk period are accepted as the abstract formation for the plastic arts. (Cumhuriyet Dönemi Türk Heykeli, 12) The need for the plastic arts found its reflection through the works of calligraphy and handwritings in the later periods. During the reign of Sultan Abdülaziz, there exits a struggle to abolish the prohibition of depiction with the building of the Abdülaziz monument by Füller. ("Türk Heykel Sanatı", 20) (Fig. 2.1) So 1871

can be regarded as the turning point of Turkish plastic arts. (Giray, 31) In that century, with the influence of western culture, the use of small figurative sculptures of animals in yards, gardens and houses were also observed (Osma, 24) With the proclaimlion of the new Republic, the attempt for the progression followed the constitution of new acts in the field of art, science, and technology.

Özsezgin discusses the history of sculpture in two different ways: The traditional or classical understanding of sculpture, and the free-explanatory understanding. The classical understanding has its roots connected within the formal or governmental ideology and this is the reason for the vicious circle of art and function. The free-explanatory understanding, on the other hand, stands as an action of alteration, breaking its ties with the classical formation (27). However, Turkish plastic arts and sculpture did not find its way through the interaction of these approaches but rather they were induced by governmental orientation and support. The reason can mainly be found in the late interference of plastic arts with Turkish culture, which was already mentioned above.

While the new Turkish Republic was facing issues of plastic arts there was a similar struggle, in other countries such as America. There, traditional memorial sculpture took a figurative form and was built with the assumption that the community that commissioned it existed as a historical continuity and the values it expressed were shared, whether it was funerary in nature or dedicated to ideas, events or individuals. (Senie, 15) However in the 20th century history is no longer seen as a continuous, rationally explicable

progression and other needs of public realm have begun to be considered, and addressed by the artists. (Senie, 16)

Regarding the world wars, sufferings, and the victories that it comprises, the period from 1900 to the 1950s was a convenient medium for monuments in Turkey. As Nilgün discusses, most of the sculptors were dreaming of constituting a monument (235). However, the fast spread of monuments through the country came along with problems of diminished quality as an outcome of inexperienced sculptors, and a conflict between artistic and political approaches. The scarcity in the number of good examples made by the foreigners like Krippel and Bellini is pointed out as another reason for this problematic development (Gezer, "Atatürk, Heykel ve Anıtları" 70).

2.2 ATATÜRK MONUMENTS

From the first years of the Republic, groups of students were sent to Europe for training in art, music and literature. The main aim was to provide an efficient information transfer to the society with these apprentices. Throughout the period of their education, foreign instructors and tutors were utilized in the field of plastic arts (Gezer, Cumhuriyet Dönemi Türk Heykeli, 12). With the return of first artist groups to the country and by the help of the foreigners there was a sparkle of advancement in painting, sculpting, music and in other fields of art. As Günyaz states, this rapid influence in art was stacked in the exhibition spaces and art galleries and could not be carried to the public (29). According to Gezer, this problematic issue was the main factor influencing the born of Atatürk monuments and sculptures. The city squares, hills were hosting the new monuments that were built especially for emphasizing the new social, cultural system and development in the new republic. (Cumhuriyet Dönemi Türk Heykeli, 14) Foreign sculptures played an important role in the primary phase of this movement. Monuments became a part of city development and beautification plans. The public, unaware of the subject of art till that time, was now faced with artifacts affecting their sense of aesthetics, and psychology.

The artifacts were reminding them the hard times of their near past and make them be proud of the victory that was hardly achieved. As Berk and Gezer point out they were not dealing with the convenience of the forms with the real ones, but rather were focusing on the figure, that is reminding them the

savior of the country, the one who gave them their freedom (14) So, the concept of sculpture was attached to the Atatürk Monuments in the minds of public. According to Gezer, this attachment is strengthened with the busts of Atatürk that are spread upon the entire country. The reason for the prolification of monuments was supported by two distinct ideologies. One is the spatial need for ceremonial activities, so busts and monuments were utilized in this functional manner (Gezer, Cumhuriyet Dönemi Türk Heykeli, 15). The other is, as Özsezgin explains, the formation of a barrier against the reactionary ideology (28).

Discussing the state of art, the financial position of the country was a barrier for the evolution. Similarly, art was closely associated with luxury in other cultures. According to Senie, during the time of American revolution funds for monument projects never existed and moreover it was seen as antithetical to the philosophy of the new republic (5). On the other hand Atatürk, being a foresighted leader, gave great importance to the artistic development of the country and began the movement of this new development by commissioning the first monument for the republic in Dumlupınar to a Turkish sculptor, Arif Hikmet Koyunoğlu in 1924. The first Atatürk Monument in Turkish history is commonly accepted to be the Sarayburnu Atatürk monument, which was built in 1926 by Krippel (Fig. 2.2).

2.3 TECHNOLOGICAL IMPROVEMENTS AND THE REVEAL OF LIGHTING CONCEPT ON MONUMENTS

The public has always understood lighting as a powerful symbolic medium, and yet the history of lighting usually has been presented as the triumph of science in providing the useful. Before gas and electric streetlights, people had to find their way with lanterns, and the city at night seemed fraught with danger. Public lighting made the city safer, more recognizable, easier to negotiate, but such a functional approach cannot begin to explain why electric lighting had its origins in the theater or why spectacular lighting emerged as a central cultural practice. Light used as a form of symbolic expression in world's fairs, theaters, and public events. (Nye, 29)

The making and manipulation of light entered into art and changed how artists see the world. Paleolithic artists could not have painted their caves without illumination from small oil lamps. In the sixteenth century Caravaggio was said to have painted under artificial light to produce his dramatic effects (Perkowitz, 13).

In the late 18th century what resulted from the trade fairs was, understanding the importance of the classification of electric lighting as a viable physical, aesthetic and commercial entity, subject for improvement and modification of the environment (Rossell, 59). Electricity, it was argued, should no longer be seen as a purely scientific enterprise nor should there be limited control over it.

The illustrations and numerous drawings prepared by 1880s point out the transfer of preliminary electric light bulb to the profession of illuminating engineering. Figure 2.3 shows that the head of Laocoön, part of the famous Hellenistic sculpture of that name, ranged considerably in appearance as light served in accentuating or marring the effect of pain, sadness, humor, or other emotions intended by the sculptor (Rossell, 80). Rossell mentions that illuminating engineers were employed to restore Abraham Lincoln's appearance as the figure looked craggy and stern with the natural light coming through the doors of Washington's Lincoln Memorial (81). (Fig. 2.4) The examples indicate analyses on the imagery that is associated with the transition from the carefully engineered light bulb to the engineered image. The bulb appeared as a static, idealized form expressed with an engineer's interest in exactness and detail. It asserted a sense of practicality. By contrast it was understood that light, projected from different directions could help us to understand the forces and ideals shaping meaning and changing form.

The use of artificial lighting for the arts can also be observed in opera houses and theaters with the design of spotlights, rainbows, and luminous fountains in the late 1870s. (Nye, 30) With the spread of the Edison electricity system, national landmarks and monuments also began to be permanently illuminated. As Nye points out one of the most effective display was the lighting of the Statue of Liberty in 1886, that made the statue stand out against the darkness of the New York harbor. In addition to the great emphasis on its torch, lamps of eight thousand candle power were placed around the base for

the further dramatization of the statue. (Nye, 32) Spectacular lighting was dramatic, non-utilitarian, abstract and universalizing. It provided a brilliant canopy, connecting many elements, statues, monuments, fountains, and memorials. In the 1930s artificial lighting became more than the theme of displaying a building, but it provided the steps of progress for the civilizations and its arts. (Nye, 35)

Light was further defined in the late nineteenth and early twentieth century by its increasing use in a large-scale, unified manner, and by the continued emergence and influence of independent electric consultants.

> In the first years of the twentieth century the basic vocabulary of lighting, or light's sake on the one hand, and evocative associationalism on the other hand, was replaced by a sharpened discourse of illumination, or the act of putting a particular amount of light on a specific object. Illuminating engineering served as a practical and metaphorical tool defining environments and relationships in a time of rapid change. Electric light, in the guise of illumination, ultimately reoriented people's relationship with space and design by providing not just visibility, but normative layers of meaning giving shape to new era. Electricity opened a new world of clear, efficient, and convenient light. Light wrapped whatever it touched in a compelling vision of new meanings and new applications. (Rossell, xvii)

From appending a sign to integrating a sign with a building façade to designing the building as a sign to projecting signs on monuments or other structures, the use of electric light extended traditional advertisements at the same time that it undermined architectural form and muddied the proprieties of public and private space.

As electric lighting installations became more prevalent, notions of illuminating efficiency and cost determined which sources of light to use, and it was understood that a system of illumination should appeal to the senses of beauty, harmony and art in addition to the production of sufficient intensity (Rossell, 32).

Electric lighting underlines significant landmarks, highlight important locations, emphasize statues and allowed the spectator to grasp the environment in a simplified pattern. It became an essential part of experiencing both natural and national symbols. (Nye, 61)

3. THE NEED FOR MONUMENT LIGHTING

Finn discusses the relationship between light and the artifact as follows:

> Essential to the appreciation of sculpture is light. Whether the light is coming from the left or right, the top or the bottom, makes a crucial difference in the appearance of the forms. Soft light helps you appreciate subtle undulations, strong, direct light accentuates dramatic details. Or a strong light may be necessary to reveal the bulges of a figure that represent muscle and bone and give strength to work, or a texture of tool marks that show the artist's personal touch. Light from above may throw deep shadows that obscure the forms below or create misleading or disturbing shapes, but it may be the only way to bring out the dramatic forms of the work that enable it to speak forcefully to you, as is often the case with Oceanic or African works which the artists carved in equatorial climate with the sun shining directly overhead. Light creeping around an edge of a sculpture can produce breathtaking outlines; light shining on a surface can reveal exquisite colors of patination. As the light changes on outdoor sculpture, the work itself is transformed (Finn 13). Fig. 2.4

For most people lighting is simply a matter of "Turn the lights on, you see," and "Turn them off, you don't". Today we see that it actually comprises various dynamics that influence the way we live. As Perkowitz states, light extends from a large scale of the universe into the ordinary human world and no other single phenomenon crosses so many human and physical categories. (2) It defines the boundaries of our life, the space in light years.

Directing the beams to the urban context, as Philips indicates, outdoor lighting shapes our overall feeling about the city at night, creating an almost infinitely variable range of effects and emotions that are effective image-builders for any city (*Outdoor Lighting Catalogue*, 117).

A city is made up of many elements or components: streets, squares, parks, buildings, monuments, activities and so on. The essence of a city is not understood by simply summing up all these elements, it comes from the relationships between them. However, it is not the intent to discuss the essence of the relationships but rather focus on one constituent, monuments as profound image conveyers to urban and social structure.

Societies constitute their common identities and social structures through their collective memories. The social structure is positively influenced and developed by means of historical components, knowledge acquisition and works of art. As mentioned in Chapter 2 monuments are structured to execute the functions of commemoration and remembrance. The term monument, with a wider sense, is generally attributed to the fields of art and architecture. Rather like the architectural products, the term monument is referred and constricted to figurative sculptures in plastic arts in Turkish culture, specifically on Atatürk monuments. Lighting up the monuments, statues and sculptures that have always been seen as true symbols of history and art, is a crucial factor that outdoor lighting discipline should employ and be concerned with.

We may state the objective of lighting these monuments as: Conveying the monuments' social and psychological meanings to the public and revealing their form with the aesthetic assets it involves; by studying each in terms of its function, historical meaning, symbolic quality, shape, dimensions, color and so forth in order to develop lighting solutions that will form a harmonious composition within the city's or the corresponding district's lighting plan.

Lam introduces human biological needs as the dominating requirement in lighting practice (12). These include psychological responses, as cognitive, aesthetic and emotional ones.

Essentially, each monument needs an artificial light render to be identified, to have legibility in meaning and to have a common aesthetic appeal. Therefore, monument lighting is thought to incorporate three components and discussed as the encounter of functional, psychological and aesthetical factors.

3.1 FUNCTIONAL NEEDS

All events take place between people in an environment or between people and their environment. Light is the catalyst that unites the two (Erhardt, 39).

The primary need for the monument lighting can be discussed in relation to humans' primary need for light, namely vision. "Visibility is the selectively emphasized composite of everything that contributes to awareness, to perception, to recognition, to orientation, and to comprehension; all of the elements of cognition" (Erhardt, 6) Thus visibility for the purpose of understanding is a much broader concept than that suggested by the engineer's definition, being perceived by the eye, or the simplest awareness.

According to the Illuminating Engineering Society (IES) visibility is the state of being perceivable by the eye (IES Education Commitee, 2-2) or as International Commission on Illumination (CIE) identifies its threshold, barely visible at a specified informational requirement such as detection of presence, recognition of spatial detail, or recognition of meaning. Visibility includes all of the factors of recognition and cognition, and forces us to set forth our own list of exclusions but it does not contain any elements of aesthetics, of emotion, or of comfort (Erhardt, 12).

As touching artifacts is often prohibited, the most and even the only sense, that is used in observing and experiencing the sculptures is the sense of

seeing. A sense of physical contact is established with our eyes with the three-dimensional creation standing. “It is not the touch of the material that provides the critical impression, it is as if your eyes have fingers that are able to explore the work from all sides” (Finn, 22).

All living substance is sensitive to light, seeks it, avoids it, or absorbs its energy. The eye has developed a high degree the photosensitivity present as a rudimentary activity throughout organized substance, and can thus be regarded as a specialization to gain additional information from the light stimulus (Wyburn, et al. 67).

Light and vision provide the strongest link between man and his environment. Most of what we know has been acquired through sight and vision. Vision is the sensation of seeing, and sensation is the mind’s link with the physical world (Erhardt, 7). In other words, as Jones points out, lighting design covers the notions of the luminous environment and the eye and mind of the human observer (3). In this sense the basic need for monument lighting can be defined as the functional need, the appropriate level of light allowing us to see, perceive, identify and distinguish the monument.

Sometimes spectators are not even aware of the work of art in the public space until it is taken away. Then, they recognize that they are missing something, as Senie mentions something intangible as it addresses the spirit or the soul (4). “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” (Erhardt, 6).

Mostly the unawareness comes from the problem of explosion in public sculpture and monuments, and from the fact that we are not really taught to look. The same problem is going to be discussed as a matter of aesthetic needs, a matter of art education but as a functional necessity, lighting can be used to establish a kind of identity and promotion that would take public attention and increase the level of recognition.

Hence the lighting design should provide a functional establishment to convey to the minds of the spectator the significant meanings of the monument quickly and easily by emphasis and organization, combined with the more elusive factors, which bring an overall pleasant sense.

3.2 PSYCHOLOGICAL NEEDS

"Sculpture is something that has been created by the artist to take you through the space in which you live" (Finn, 12).

Facing the challenge of lighting three-dimensional objects, the lighting designer must try to answer two general questions: what does the observer need to see, and how does the object needs to be seen? The first question is about the content of the object, and the second about its context (Turner, Designing with Light, 93). Context wise, each production in art expresses an ideological approach to the observer, namely, as Lam points out, its information context (58).

Traditionally, expression in figural sculpture is derived from the sculptor's illustrations of the subject's thoughts and feelings by means of facial and gestural articulation. The identity of the figure comes not only from its title but also often from the use of objects that are attributes or symbols. Since antiquity, sculpture has been a form of immortality for its subject, by presenting in the figure to the society, physical, intellectual and spiritual culture.

For each monument, a different contextual approach is proposed as a subject of discussion. Regarding Atatürk monuments, each reminds us of his ideology and his heroic character. Sometimes the heroic character is more emphasized with a dynamic form like in Atlı Atatürk monument (Fig. 3.1) in Samsun, imposing the heroic ideology of Turkish War of Independence; but sometimes it is rather a static form accenting a didactic meaning like worth of peace, importance of education, value of becoming contemporaneous. The Monument at the entrance of Ministry of Education symbolizes Atatürk's efforts in educational reforms. (Fig. 3.2)

This figure dominated process of perception includes various dynamics as Itelson notes. Cognitive, affective, interpretive and evaluative components, all operating at the same time (cited in Bell, 64). The mental representation or cognition occurs as a next phase. The concepts or ideas acquired from the image, the monument, are constructed as a meaning or analogy based knowledge through the mind.

The role of lighting in emphasizing the symbolic and ideological meanings hidden behind the monuments, and bringing out their psychological concerns is a factor to be considered in monument lighting. Lighting can be utilized to give emphasis to the dynamic form, stress the state of static monumentality, and create an indication of battle by color changes.

Hence the design of monument lighting needs a careful analysis of the ideological impact, psychological accentuation, and meaning prominence.

3.3 AESTHETIC NEEDS

From the ancient Greek word *aisthanesthai*, the word aesthetics literally refers to perception. This general sense is maintained in the definition of aesthetics as "knowledge derived from the senses". In general parlance, however, the word has become more specific during the last two hundred years or so, referring to the appreciation of beauty in certain objects, in particular art and architecture. Thus the "aesthete" is generally thought of as some kind of expert, skilled and/or talented in the appraisal and evaluation of beautiful things (Ungar).

The art of making sculpture is a sensual form of creativity. "It grows primarily out of the emotional relationship we have to the human figure our

own begin with, and more importantly those of others who arouse in us the passions associated with physical love" (Finn, 15).

According to the Parsons's framework, discussing the aesthetical needs in art, we have to focus on the subject (37). The ideas of art and beauty are complexly linked, but the concept of beauty can be discussed upon the beauty of the subject, the beauty of expression, strength of the feeling or generosity of spirit as he states, and the beauty of the medium -shape, form, color- and the sense of beauty regarding judgment. The obviousness of beauty and ugliness comes from the sense of their shared character, since it is shared, it can simply be seen, it need not be discussed (Parsons, 43).

In modern aesthetics, the theories of beauty find their way through the study of perception and the science of sensory cognition (Porteous,19). Studies of aesthetic quality judgments in the field of art using composite visual, auditory and other scales have demonstrated that composite perceptions are heavily weighted towards the visual (Porteous, 32).

Gezer states that in order to have an aesthetical judgment about a product in plastic arts, one has to observe as many artifacts as possible. However, he points out that one's aesthetic notion could only be formed and enriched by observing the contentfull and successful products (Personal Interview). Regarding the grammar of sculpture and plastic arts, Sharma relates the state of success to the creatively definition of the attached meaning and to attain of the state of equilibrium of solids, voids, weights, twists, lines and bends (57). The achievement of public's aesthetic awareness is dependent

upon the qualified artifacts around them (Gezer, Personal Interview). In the same way, art and artistic activity and products in the environment enriches and reinforces the man's cognitive abilities and aesthetic assets (Sharma, 176).

In Turkey, as mentioned before, the rapid spread of monuments throughout the country has diminished the quality of the products. Atatürk busts were almost mass-produced, and monuments were built by callow artists for meeting political and municipal demands. Also, Finn connotes the difficulty to have a discussion on the greatness and quality in relation to any work of art (29). In addition, Doğan emphasizes the impossibility of putting forward a commonly accepted aesthetics definition (10).

There is often a split between the artists' intentions and the public perception of his/her work. According to Senie this is largely the result of the absence of art education and the nurturing of visual thinking throughout the public school systems. (4) Regarding the education system, we might have an alteration or an improvement to solve similar problems in Turkey. Thus the difference and also the relation between looking, seeing and perceiving should be stressed in education.

The state of aesthetic evaluation of human is, then, directly related with the artifacts surrounding him and the stages of aesthetic development are levels of increasing ability to interpret the expressiveness of works in this way.

Lighting, as a reinforcer of spatial perceptions, enhancer of environmental atmosphere, definer of moods and behaviors, should not be

bounded within the field of illuminating engineering. “Lighting is an Art as well as a Science” (Erhardt, 14). Lighting is both a psychological and physiological inducer.

Leslie draws an analogy between music and light in defining its artistic peculiarity (8). Like the musical chord, which is a particular combination of tone, duration, intensity and expression, a light chord provides an analogous series of color, intensity, duration, view, direction, contrast etc. to the perceiver. “Only by accepting light as artistically autonomous, as a world of art itself, as plastic stuff to be molded, shaped, and formed as freely as the clay in which sculptors model, could artist hope to find the looked for correspondence between their new scale of experience and their artistic expression of it…” (Leslie, 12).

From the artistic point of view, light can affect one’s moods, reactions and perceptions. It is an element in art that embodies components of use as well as fantasy, and can radically transfer our experience of any space defining our sense of scale and mood. Light can be utilized to alter our perception of the spaces and surfaces around us. (Senie,190)

Lighting design is the process of integrating, in a unique way, the art and science of human perception with the art and science of human technology. The result is a very complex system that varies in time in a way that can be extremely exciting (Jones, 43). It is more than the calculation of illumination levels but rather an enhancer of aesthetic impression. The least important

element of lighting design is illuminance, but unfortunately it happens to be the easiest lighting metric to calculate and measure (Steffy, 1).

The form, unity, solid and void relationship, proportion, scale, volumetric harmonies and contrasts are some characteristics constituting the plastic composition. Lighting has the function of revealing this composite. The encounter of two artistic approach results in the concept of monument lighting. They should have a convenient superimposition in order to achieve a kind of aesthetical understanding regarding the observer.

> Art is not just a series of pretty objects; it is rather a way we have of articulating our interior life. We have a continuing and complex inner response to the exterior world, composed of various needs, emotions, thoughts, both fleeting and long-term. This inner life is not transparent to us, not self-interpreting; if we are to understand it, we must give it some more perceptible shapes, and then examine the shapes. Art is one way of doing this (Parsons, 12).

4. CONCEPTUAL FRAMEWORK

4.1 ARTISTS' AIM IN THE CREATION OF ARTIFACT

CONCEPTUAL FORMATION AND THE END PRODUCT

In the previous chapters, an approach was put forward for understanding the concept of monument as an artifact and its relation to the subject of lighting. Yet, the artistic point of view needs a different discussion. The emphasis on conceptual formation that the artist constructs through the process of molding the artifact was discussed. However there is the debate on artists' idealogy of lighting through production.

Until this point, the problem was examined from the lighting designers' point of view. On the other hand, in each field of art, it is difficult to make a judgment of the work, and to understand the creators' intentions. In literature, as an example, one has to analyze the period, authors' life and idea to understand what lies behind his/her lines of the poetry.

As a general fact it has been observed that lighting projects are mostly proposed after the monument's or the artifact's installation. However, the lighting criteria, as Erhardt points out, should include a limited care to luminance or illuminance factors but rather needs a great attention to the problem of creating the appropriate scenery and atmosphere with respect to the monuments or the artists' concept and aim (35). Consequently to understand the conceptual formation accurately, in order to propose the general lighting

plan, the artist should be consulted beforehand or the artists themselves should propose the lighting plan.

According to Gezer, the conceptual formation and production procedure of the sculptor does not involve the idea of artificial lighting, as the daylight is paramount for the sculptors. He adds that, for night scenery the most practical solutions usually are applied to the project, although the intended scenery, with the appropriate shadow distribution, is not effectively achieved (Personal Interview).

Another argument can be carried upon the relation, in between the conceptual subject and the end product. To achieve the appropriate proportion that would support the monumentality of the artifact, sculptors work on different scales with different layers of detailing. Gezer states that the site and the environment in which the monument is going to be installed should be investigated beforehand (Personal Interview). In spite of this, the end product sometimes does not reflect the ultimate goal of the artist. The change in the scale, and the great discrimination between the working model and the end product diminish the impression of concept. While molding or carving the model, the artist should consider the resultant viewpoint. In the Bilkent Atatürk Monument, examined in this thesis, a similar discussion can be carried out regarding the conceptual formation. It is difficult to distinguish the radial movement above Atatürk's head (which represent the artist's intention, namely, the beams of light representing Atatürk's reforms and his foresightness) when viewing the monument from its immediate environment.

(Fig. 4.1) Located at the entrance roundabout, the monument is generally perceived by the drivers and the vehicle passengers (Fig. 4.2) Therefore an instant and selective perception occurs, as the monument is perceived as a landmark element, a point of reference that is easily distinguishable visually. Unless one is looking for something specific, the first thing to attract the undirected visual attention would be an unusual quality, contrasting with its visual context, or with the environment (Lam, 36). Through the complex structure and procedure of perception, brain dictates the scanning pattern of the eye and interrupts the normal sequence of consciously directed eye movements at a point of distraction (Lam, 37). Lighting, especially at nighttime, appears as the primary cause for taking ones attention. Structuring a hierarchy of the way human vision generally responds to focal accents, Michel also states that brightness, high contrast and vivid color, which stand as the attributes of luminance, are important accents to be considered (62). Thus, light may be utilized to direct the visual attention by revealing the symbolic light beams on the monument.

Furthermore, the lighting system under which the artist works directly influences the work of art. The shades and shadows dramatically change when the object is located at the outdoors. The material characteristics around the monument, the base, environmental conditions rapidly change its facets. Different brushstrokes of light render it in different intervals of time. Gezer works under diffuse light conditions, however his monuments are always standing under direct sunlight, except in cloudy sky conditions. (Fig. 4.3) A semi-open space allowing an appropriate level of sunlight penetration or

provision of direct light to simulate sun, would allow the artist to observe the model under a variety of shadow patterns.

4.2 LIGHT AND MEANING

"It is through symbols that man finds his way out of his particular situation and open himself to the general and the universal. Symbols awaken individual experience and transmute it into a spiritual act, into metaphysical comprehension of the world" (Millet, 135) Light acquires meaning in arts relationally, that is, as part of a sequence of luminous relationships. These relationships in turn set up a series of associations in the inhabitants that transfer meaning from the intentional realm of the artist into the personal realm of the inhabitant. Light is approached in an integrated way, both conceptually and practically. Included are the poetic and the practical, daylight and electric light, intention and realization (Millet, 3).

Through the environment of childhood, the human observes what forms mean, from small toys to large forms like buildings. This process includes the experience of light, the kinds of visual information that it conveys. In relation to this, the patterns of light, which attract human's attention, possess meanings. According to Millet some of these meanings are universal, archetypal images that humanity shares, some cultural, absorbed through rituals and reflecting an attitude of life and some are personal associated with particular events (5).

Light, in revealing plastic arts, simultaneously reveals the meaning of the artifact, sublimate it or diminish its character. The experience of darkness, with the shades and shadows it involves, implicates associations and carries a potential in expressing meanings also.

The appreciation of darkness can lead the product to contemplative light. On the other hand festive light can add a celebrative character to the setting by offering pinpoints of light that disclose the shape of the monument and theatrical light adds drama to the artifact by creating illusions as in theaters. Millet discusses the use of light in metaphorical manner, suggesting scenery of other than physical reality, like expressing an idea or concept that cannot readily be perceived (144). Whereas through the use of symbolic light, the product represents something more immaterial than itself and the light gains meaning through association with that which is symbolized (Millet, 136).

In other words, lighting can be defined as a denotative signifier that conveys the intentional meaning of a form. Weber indicates that in order to craft a convincing theory of the structure of meaning as embodied in an object, one has to move beyond the simple distinction between form and content (88). He defines the key features of meaning properties of an object as follows:

1. Meaning - The abstraction of the object as a meaningful entity of operational knowledge independent of any specific referent. (The status of the object within classes of known objects, its function and, accordingly, its value -practical, ideological, symbolic-, including any

messages to be communicated and/or any utilitarian, ideological, moral or symbolic purposes to be represented)

2. Presentational and Conventional Arrangement (Meaningful Form) - The realization of meaning through signifiers and individual and cultural conventions of arrangement.
3. Form - The totality of the physical and perceptible constituents and their organization. (Physical constituents, factors of complexity and orderliness)

However, the above model must be further qualified to reflect the variances of individuals' meaning aspects. Therefore, the meaning that is given to the light is directly bounded with the observers' or spectators' degree of knowledge acquisition. This value or meaning can have the property related to the concepts of psychology, politics and ideology, or it just bears the aesthetical property. As mentioned before, in the monuments, like artifacts, it is difficult to distinguish this value of aesthetical understanding from the influences of ideological and political property. Moreover, what art enables us to understand is not necessarily what the artist sought consciously to communicate. "Art is capable of layers of interpretation and may reveal aspects of its creators, which they themselves were unaware" (Parsons, 13).

5. LIGHTING CRITERIA

The clarity of characteristics of an object - form, surface texture, color, inherent contrast, etc. - has a great influence on how well we can see at various levels of illumination (Lam, 58).

Artificial lighting outdoors, regarding the reveal of monuments, has several potentials:

- It can reveal form, texture and detail to emphasize features and make them discernible.
- It can conceal certain features restricting the vision using careful arrangement of shadows. Sometimes it can be used to suppress all surface contour and detail, and reveal only the artifact's outline as a silhouette.
- Shadows and light patterns can also be utilized to imply unreal features, by differing our sense and impressions of size and distance. Light gradations can suggest distortions in surface perception (Fig. 5.1, 5.5b). (Shading can make a flat surface appear curved or sloping)
- It can influence the way the observers react to the monument by suggesting symbols and images like mystifying the setting or evoking the sense of excitement. More complex associations can be established by compositional relationships of light in the environment.
- By careful adjustment of color filters it can alter the color values within the scene and imply variety of images associated with color.

(Use of high color temperature may suggest a cool environment and imply weather)

- Can build up several different ambiances by developing variety of atmospheres and mood. It can isolate the monument with a single spotlight, or may create visual continuity by unifying a series of separate elements. (Fig. 5.2)

Illuminating Engineering Society of North America, IESNA, proposes the following design guide for floodlighted monuments (IESNA, 10 Outdoor-1):

DESIGN ISSUES	Appearance of Space	Color Appearance and Color Contrast	Direct Glare	Light Distribution on	Light Pollution Trespass	Modelling of Faces or	Point(s) of Interest	Reflected Glare	Shadows	Source/Task/Eye	Sparkle/Desirable Reflected Highlights	Surface Characteristics	Special Considerations	Illuminance (Vertical)	Category or Value (lux)
Buildings & Monuments (Floodlighted)															
Bright surrounding															
Light surfaces													*		A
Medium light surfaces													*		B
Medium dark surfaces													*		B
Dark surfaces													*		C
Dark surroundings															
Light surfaces													*		A
Medium light surfaces													*		A
Medium dark surfaces													*		A
Dark surfaces													*		A

Table 1 Illumination Design Guide for Monuments

Very Important
Important
Somewhat Important
Not Important

* Lighting must not interfere with visibility for pedestrians, motorists or boaters

Table 2 Illuminance Categories

A	B	C
20-50 lux	50-100 lux	100-200 lux

In the third chapter, the objective of lighting monuments is stated as: Conveying the monuments' social and psychological meanings to the public and revealing their form with the aesthetic assets it involves.

Therefore, rather than proposing a general lighting criteria, it can be stated that utilizing the design guides mentioned above, one should study the monument in terms of its function, historical meaning, symbolic quality, shape, dimensions, color and so forth in order to develop lighting solutions that will form a harmonious composition within the city's or the corresponding district's lighting plan. In line with the techniques to be employed, monument lighting should be consistent with the city's lighting theme and character, and also with the future development strategies within the city. .

As Lynch underlines, each setting in a city is perceived within the environment that it has been set, with the conditions and chains of reasons that leads to its existence (161). Therefore, the lighting plan should encompass a study of monument in relation with its immediate and distant surroundings. Is the monument located within a historic center or a central business area or within public park? In what ways are the different areas linked or connected?

The presence of high-rise buildings might be the main characteristic of a given district, or the local architecture or street patterns.

Floodlight of buildings and the landscape mostly can be visible from a distance; so the overall composition of lighting must be coherent, the brightest and colorful parts must be appropriately chosen with the areas of darker parts. The overall quality of environmental lighting should not flatten the appearance of the monument. The Dikmen 27 Aralık Monument is surrounded with hills each representing a congress that was carried out during the War of Independence (Fig. 5.2). The lighting plan of the setting proposes different focal points by revealing each of the hills and the monument located at the center. Although, different color temperatures are provided with differing lamp types to put an emphasis on center point, so the monument and the setting has limited relation regarding the lighting plan. A projector located in front of the monument, flattens its facets and vanishes the shadows that result in the loss of three-dimensional visual quality (Fig. 5.3).

Accordingly, achievement of the proper appearance related with the concept of monument should be considered. As we are involved with the human form, relationship between shadows and brightness, if not fully considered, lighting can produce a visual effect which may be quite grotesque (CIBSE, 29).

For the perception of three-dimensional objects, the direction of light source is extremely important. Lam points out that the ability to perceive

volumetric form comes not from the contrast inherent in the object itself but from the gradients of light and shadows produced by the illumination which falls on the object (67). The best condition of illumination for most three-dimensional objects corresponds to the condition we encounter outdoors, a combination of directional sunlight, diffuse skylight and reflected ground light, which produces sharp shadows, as well as sufficient light from other directions to fill in detail in the shadows.

5.1 DAYLIGHT AND ARTIFICIAL LIGHTING

Regarding the relation between daylight and electric lighting, the idea of imitating daylight came forward in the early 1900s by providing an illumination pattern to the buildings, artifacts and landscapes that would preserve the sense of three-dimensionality. (Nye, 63)

Gezer opposes the idea of imitating daylight. As sculptures and monuments through the history were mostly displayed on the exterior of buildings, in gardens and squares, sunlight was the most efficient tool in accentuating their three dimensionality. Thus, he proposes that daylight is essential to a monuments' rendering. He stresses the dynamic property of sunlight, and expresses that forms are rendered differently under different sunlight conditions. This is an opportunity that we would never attain with artificial lighting (Personal Interview).

As new inventions on lighting equipment and techniques grow, we see the emergence of different approaches. Designers must take into consideration the fact that most people prefer daylight, and that the contact with changing natural light is physiologically, psychologically and architecturally important (Thomas, 97). So the artificial schemes and daylight should complement each other. But this complementation does not mean that new sources are needed to imitate sunlight. According to Ishii, inventing a source of light similar to solar light or turn night into day, a goal for which many lighting technologists have striven in the past, is something that we should abandon. As Ishii claims, the fundamental idea here is that lighting designers have to distinguish night and day, stress the difference in between and, try to create new lighting environments different from those during daylight (Jankowski, 18).

There are three distinct elements of daylight: Sunlight -the direct beam-, skylight -the diffuse light scattered by the earth's atmosphere acting in concert with clouds- and the reflected light from the ground. The sun's position in the sky can be predicted with great accuracy, but the strength of the solar beam, and whether any direct sunlight reaches to the ground, depends on the weather. Even on cloudless days, the presence of water vapor and pollution affects the relative intensities of sunlight and skylight, so that the daylight comes effectively the subject of random variation (Tregenza and Loe, 31).

Furthermore to use daylight to advantage in the design, effect of the local terrain, landscaping and nearby buildings should be taken into account in addition to the luminance and luminance distribution of clear, partly cloudy

and overcast skies, variations in the amount and direction of incident daylight (IES Lighting Handbook Application Volume 7-1).

While sunlight accompanies these kinds of variations, it still remains firmly the standard by which we judge lighting effects. According to Turner the brain applies a kind of sunlight constant to analyze scenes which would otherwise be under lit (for example at dusk) in much the same way that we can look at and read monochrome images such as films and photographs, without assuming that the TV stars have suddenly got stark white rather than skin-colored faces (Designing with Light, 26).

5.2 DYNAMIC PERCEPTION VERSUS STATIC PERCEPTION

“Perception is not a constant but an accumulative and evolving entity” (Myers, 10). Once a percept is set, it may take a considerable effort to change it. We have the notion that our senses provide us with an accurate picture of the world around us.

According to Veitch and Arkkelin, in their discussion of environmental attitudes and preference, "at a very general level, people prefer and approach environments they evaluate favorably and avoid environments they evaluate negatively". This suggests that there are either factors of environments or factors of persons (or and interaction of the two), which basically determine

where we go and what we prefer (cited in Ungar). “A sculpture exists in a space like a human being, or like a mountain, tree or cloud and needs to be approached as a terrain that must be explored in order to be fully appreciated. It needs a careful observation by walking around it and watching the changes as its been examined from different angles” (Finn, 11).

Thus, it can be stated that the perception process of a sculpture or monument includes the interaction between the object and environmental perception. As Hart and Moore put it: "Our understanding and representation of space results from extensive manipulations of objects and from movement in the physical environment, rather than from any immediate perceptual 'copying' of this environment (cited in Ungar). Hence size and complexity, surrounding, and the purposive connection are the factors considered.

A monument or sculpture, either traditional or abstract in nature, may be intended for viewing either from within a restricted angle or from all sides (CIBSE, 2). They either allow us to perceive from a distance or just walk around to see their details. The setting is mostly related with the environmental conditions, but sometimes the orderly produced ones may propose areas for gathering. The environmental setting is sometimes arranged for ceremonial activities and places around the monument are designed to allow the spectators to place a wreath on. (Fig. 1.3) Conversely, according to the environmental setting sometimes the monument can only be observed from a certain distance.

Besides, monuments placed outdoors have a different quality of perception regarding the daylight, than the ones located indoors, in museums, art galleries. (Fig. 5.4) The indoor quality of lighting, and sometimes the restricted area to stroll around the artifact, just allows a static perception concerning the product. However, monuments outdoors allow perception from different directions and distances with different qualities and quantities of light.

Monuments and the concept of public sculpture have some prerequisites like space and meaning. Regarding the space, a city's streets, squares and open spaces are the stages on which we act and interact with the public and the environment. A culture's attitude toward public spaces is revealed in the prevalence of such spaces and their design. (Senie, 94) For example, in 1926, when the Atatürk Monument placed in Sarayburnu, (Fig. 2.2) a great curiosity was observed. People were coming to see the monument and were walking around it for hours, and staying at the setting to observe the details. From then on, Sarayburnu acquired a different meaning (Gezer, Personal Interview).

This dynamic quality of subject's perception interferes with the dynamic quality of daylight. The apparent path of the sun across the sky varies with time and place, it depends on the time of the day, season of the year and on the latitude of the point on the earth's surface from which the sun is observed. Thus, the illuminance produced on an exterior surface by the sun is influenced by the altitude angle of the sun, the amount of haze and dust in the

atmosphere and incident angle, the angle between the solar ray and the surface on which the sunlight falls.

The monuments and all the three-dimensional surfaces at the exterior are lit with a variety in modeling regarding the daylight, however the artificial lighting can propose a fixed location of installation, which disturbs the general dynamic property. This fact, when interfered with dynamic and changing point of view and perception, points out the importance and care in analyzing the proper luminaire location. The visual attention is automatically directed by the focus selector to elements of the visual field, which will provide the needed information. Regarding monuments the information content and context is enhanced by careful design of artificial light, therefore lighting plays an important role in determining its perceived relevance and importance. The lighting designer should consider that people perceive information and visual relationships, not absolute intensity levels of light.

5.3 PLACEMENT OF THE LIGHTING SOURCE IN RELATION TO THE ARTIFACT

Monuments are artifacts that are created to have a communication, a kind of relation with the public domain. In light of this phenomenon they are situated at the outdoors. In a museum, visitors are subject to the judgment of curators, who arrange the light as they see fit, and there is no way a visitor can change it (Finn, 13). However, there is a contrary faculty of sight at the

outdoors regarding the daylight. As one looks around a sculpture, one can take note of the revelation that comes when the light does something extraordinary to the forms. However along with the darkness, an artificial lighting system replaces daylight's dynamic conditions and the discussion of contradiction of lighting systems starts.

Ernst Cassirer had drawn attention to the contrast between day and night, between light and darkness, which he saw as the true essence of the cultural development of humanity. He declared that the mystical sense of space derives primarily from the contrast between day and night (cited in Zapatka, 28). So the universal significances and interpretations of light had been concentrated into the artistic expression of the phenomenon of electric light.

As indicated before, two dissimilar ideas of lighting is concerned with lighting up the monuments. Attempt to imitate the daylight conditions through the night to achieve a continuous pattern, or the effort in creating an alternative perception setting.

Particular to the first approach, the difficulty comes from the selection of the best perceptional situation of the monument under the dynamic condition of daylight. The selection procedure should include a comprehensive study of solar position through the year with respect to the monument (Fig. 5.6) . The finding, the condition at which the best daylight rendering occurs, would be subjective in nature. Because our perceptions are derived from our biological structure, experience and knowledge (Myers, 9). More than that, the choice is just a specific minute or hour concerning the whole year. Also the

selected interval would comprise only a fixed location of perception, although the monument would grant several locations of observation. Despite of all these contrariness, it is the designer's choice to propose an imitation of daylight. For instance the frontal view, or the face of the monument can be assumed as the center of attention and the daylight calculations could be carried regarding that point of view. The altitude, azimuth and the incident angles can be calculated. The angles will be utilized in locating the poles of luminaries, and predicting their height. The positioning of the poles and luminaries would be limited by the factors of topography, environmental setting, luminaire's light distribution characteristics, and pole height. In addition to that, the lighting designer will be faced with the possible problems of glare when selecting the position. The surrounding buildings, or structures, if any, can be considered for the mounting of lighting devices. If the monument is located at the node or square upon the city the adjacent buildings can be utilized. However, the design and installation of luminaires should not disturb the appearance of building façade and interfere with the setting. Also, the placement and the period that monuments and sculptures belong may constitute some conservation requirements that would limit the positioning of the luminaries (Treganza and Loe, 25).

Different monuments demand different solutions; therefore each monument lighting has a unique solution. For example, the Atatürk monument at the Ministry of Finance proposes a dynamic quality of perception. (Fig. 5.1) As the face of Atatürk is molded negatively, the shadows occur within the figure, propose a movement with a change in the viewpoint. The facets

perceived by an observer who is standing in front of the artifact are different than an observer viewing the monument from the sides. Shadows and light patterns could be utilized to imply the differing impressions. However, the lighting, spotted from downwards is insufficient in creating the intended shadows that would imply several views of Atatürk. Similar lighting scheme can be seen in Fig. 5.5a. The model is molded just like the Ministry of Finance Atatürk Monument with a light source placed at the center (Fig. 5.5b). The central placement of light source results in changing shadow patterns. Therefore, from different angles of observation different faces are perceived.

Each proposed scheme should be explored down to basic elements to decide on the best way to treat each of them; and then appropriate products that will provide the best solution should be selected; regarding their intensities, color temperature and color rendering indexes, filters, forms, distribution characteristics etc.

Additionally, the orientation of monument with respect to daylight condition, will effect its daytime perception and nighttime illumination. Most of the time, a south-orientated monument would not have as strong modeling as a monument that is oriented towards east or west.

Rather than the problems with modeling, sometimes the orientation of the monument does not coincide with its conceptual properties. For example, the Atatürk Monument located at the Air Force Headquarters is positioned towards İnönü Boulevard, in the north direction. Spectators' viewing direction

and the monument's relation with the headquarters building formed the bases of its position. Atatürk is figured with the first pilots of Republic, looking towards the sky, and using his hand to shield the beams of the sun. However, through the day the solar beam is coming from the backside of the monument, from the south, contrary to figure formation. (Figures 5.7, 5.8, 5.9)

6. LUMINARIES

"A luminaire is a complete lighting unit consisting of one or more lamps (light sources) together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply" (IES Lighting Handbook, 6-1). The choice of luminaries for a particular project is an integral part of the lighting design itself. Luminaire selection parameters indicated by Belcher and Helms are as follows:

1. Luminous intensity distribution - the distribution influences the amount of light control.

2. Amount of direct glare control - heads-up, luminaire luminance ratios, direct glare zone (distribution).

3. Amount of indirect glare control - heads-down (horizontal tasks), indirect glare zone, heads-up (vertical tasks), direct glare zone.

4. Easy maintenance - availability of light sources and luminaire components.

5. Mechanical construction - strength, metal gage, thickness of lens, alignment, and rigidity.

6. Safety - certification

7. Aesthetics - Appearance, appropriateness, scale, and finishing should be considered, as they are the noticeable part of the urban picture in daylight.

8. Cost - initial vs. life cycle cost; cost of lighting control system.

9. Efficacy and luminaire efficiency.

10. Reliability of manufacturer - backing up the product and reliable delivery of product.

Luminaires are classified according to their source, mounting, construction, application and photometric characteristics in order to help specifiers and manufacturers in describing, organizing, cataloging and retrieving luminaire information.

The principle types of luminaires at the outdoors are classified by the manner in which they are mounted, by the intensity distribution they exhibit, by the degree to which they provide cutoff, and if floodlights, by their beam patterns (IESNA Lighting Handbook, 21-6).

Luminaries for floodlighting can often be screened from normal directions of view, hidden within planting, sunk into the ground or concealed with street furniture. When fitted to building façades, or installed on poles the placing must fit to the overall architectural and urban design.

6.1 LIGHT DISTRIBUTION

Luminaires can produce patterns of light that are interesting and important to the appearance of the space being lighted. Hence, the photometry or optical performance of a luminaire is quite critical to the success of a lighting system.

> The best condition of illumination for most three-dimensional objects corresponds to the condition we encounter outdoors: a combination of directional sunlight and diffuse skylight, which produces consistent, sharp shadows, all from the same angle, as well as sufficient light from other directions to fill in detail in the shadows (Lam, 68).

Mainly because there is no diffuse light from the sky, it is often difficult to achieve coherent modeling outdoors at night, regarding the monuments that need to be seen from all sides (CIBSE, 29). Illumination should have a dominant direction (vector) neither coinciding with the viewing direction (i.e., from behind the observer, which produces minimum modeling), nor perpendicular to the viewing direction (which produces maximum modeling).

For a luminous environment to be visually comfortable, the occupants must not be subjected to excessive glare.

Therefore, both the light distribution characteristics and the positioning of the luminaire should be devised concerning the binocular visual field of human. The binocular visual field extends vertically 130° and horizontally more than 120° when both eyes are focused on a fixed object (Egan, 8). (Fig 6.1)

Design and prediction of the pole height, if the monument is to be lit from above, is dependent upon the angle above the line of sight, 60°. So the offset distance should be defined in deciding the mounting height. The Tarımcı Atatürk monument is lit from above, by three pole-mounted luminaires. However, the pole heights are insufficient to hide the light source and louvers are not utilized to prevent glare (Fig. 6.2). Both direct and reflected glare types with different color temperature sources can be observed. (Fig. 6.3) Glare is an important problem for the drivers as well as the pedestrians. The Atatürk monument located at Mithatpaşa Boulevard was intended to be illuminated

from upwards, and the adjacent building façade was utilized for installing the luminaire (Fig. 6.4). However, the height of installation is not adequate from the point that it interferes with the visual field of drivers. As shielding devices were not used and the light source is angled towards the boulevard, drivers are faced with disability glare, their eyes are dazzled and the potential of nighttime accident occurrence increases. Also, the high intensity backlight makes the front face unperceivable in the setting.

Consequently, in order to minimize glare, for a small, low artifact, the luminaries should be steeply angled, limiting the risk of glare for the observer on the opposite side. When the object is tall, some light may go past the display and cause glare for viewers on the far side looking upward at it. Solutions to this problem include:

- Angling the luminaires sharply down and relieving shadows with a high-reflectance pedestal
- Keeping light beams entirely within the mass of the display
- Illuminating objects from below as long as appearances are not distorted
- Using overall soft lighting (fill light) in the display space so that all object can be readily seen, while focusing a narrow beam (key light) on the important parts of object
- Lighting the background behind the artifact

6.2 QUALITY AND QUANTITY OF LIGHTING

The design of lighting for monuments and statues aims at the achievement of a natural lighted appearance. The relationship of shadows and brightness is of utmost importance. This is particularly true where the human form is concerned. The lighting of the object or scene, as defined by CIE, increases considerably its illuminance relative to its surroundings (Aldworth, 445). When obelisk-type structures are lighted, depth can be maintained by adjusting the brightness of each face so that there will be a contrast between each face in the field of view of an observer at any one time (IES Application, 12-6). Thus, light projected mainly from one direction may produce a pleasing effect when the monument is viewed from a particular position but when the viewing position is changed the shadows may confuse or distort the appearance.

Modeling can be defined as the ability of light to reveal the texture and three-dimensional form of an object by creating patterns of light and shadow *(Lighting Manual*, 146). Studies for quantifying and defining the best modeling appearance experimented the vector-scalar ratio (ratio of maximum difference of illumination that can be measured on diametrically opposed surface elements of an infinitesimally small sphere at a point/ratio of mean illuminance on the surface of an infinisimally small sphere placed at that point). For different angles of azimuth and altitude the best ratio was searched to measure the directional strength of lighting at a point (Heintjes and Fletcher, 122).

Monuments and other sculptures intended for viewing primarily from in front, can be lit within the forward hemisphere using symmetrical beam floodlights located some distance away and at a height rather greater than that of the monument (CIBSE, 29). This key light position, the three-quarter front key 45° to the sides, is the favorable location for the modeling techniques upon theaters and film making in revealing human form and gesture (Viera, 19) (Figures. 6.5, 6.6). A natural modeling effect will be created, if this key light is balanced with fill light, of about one tenth the intensity of the main beam, directed from 45° to the other side to soften the shadows unless harsh and strong shadows and contrasts are intended.

Backlight, in addition to key and fill light appears to be an important treatment and is used to reveal edge contours and solidity while separating the object from its background (Fig. 6.6).

> It can be very effective to provide a high backlight at a similar intensity as the key light. This method should be used with care so that overshoot glare is avoided. If the statue is to be observed at close quarters, then the spill light must be such that it does not shine into people's eyes. The shape of light beams can be matched closely to the outline of the statue and irregular patterns of light can be protected by profile spotlights. The light can be kept of the background so the statue will stand out in dramatic isolation. Irregular dot or breakup patterns are used to simulate the effect of sunlight through trees (CIBSE, 30).

Also, the characteristics of fill (soft) light should be considered taking possible limitations, related with distance and setting, into account. The intensity would fall off with the increase in distance and it is possible to spread over the nearby scene. Particular effect for each monument would require the

careful adjustment of the relative intensities of these directions, and it is the intensity and distribution, which helps to shape the shadow composition.

As referred to previously, lighting from below can be used to constitute an effect opposite to natural light. This can create some stunning effects but care should be taken that the effect is not grotesque. It is recommended to position the luminaries to supply a beam with an incident angle of 45° to 60° (CIBSE, 30). (Fig. 6.7) To avoid glare in the observers' eyes it is possible to bury the luminaires into the ground or use louvers across the lens.

It may also be possible to mount small discreet luminaries on the plinth or elsewhere on the structure, with carefully balanced intensities to highlight particular features of the artifact. But the intensity should not be decreased by brushes or interrupted by other structures. Such problems can be observed at the Atatürk Monument in Gazi University. The figures cannot be distinguished from the background, as the intense backlight is not balanced with the key light that has been shielded by shrubs. (Figures 6.8, 6.9)

Actually, there is no simple one to one relationship between measured luminance levels and apparent brightness of objects, as they are perceived by the viewer.

> One cannot derive any simple quantitative formula to predict either the meaning which will be given to a particular stimulus or the emotional and evaluative responses which it will trigger. …The higher the strength, quality and information content of desirable visual stimuli the better we can see… People perceive information and visual relationships, not absolute intensity levels of light. The final

impression, which will be lodged in the brain, is principally determined by whether the stimulus is meaningful or meaningless, clear or ambiguous, relevant or irrelevant, expected or unexpected. These are the real questions, which must be decided in the course of lighting design (Lam, 70).

6.2.1 LIGHT AND THE MATERIAL OF MONUMENT

Emphasis on materials is grounded in the interaction between light and material. Highlights arise from glossy materials reflecting discrete points of light, and definition of surface texture comes from the appropriate use of key light from the sides. Light can also be utilized in muting materials, hence making dissimilar materials appear similar, or make the intensity seem unchanged (Millet, 72).

The surface reflectance characteristics depending on the material of the monument will give an idea to the lighting designer about the distance of the luminaire and the intensity of the light beam. Material reflectance property of the base and the surrounding is also crucial from the point of reflected glare. The reflectance percents of a perpendicular light beam on outside surface materials are given by IES Lighting Handbook: Reference Volume as shown in Table 3.

Table 3 Typical Material Reflectance Characteristics

Material	Reflectance percent
Bluestone, sandstone	18
Brick_light buff	48

Cement	27
Concrete	40
Marble	30-70
Paint (white) old / new	55 / 75
Glass clear / reflective / tinted	7 / 20-30 / 7
Asphalt (free from dirt)	7
Earth (moist cultivated)	7
Granolite pavement	17
Grass	6
Gravel	13

Table 3 (cont`d)

Light from a bright source, a floodlight, reflected by a glossy or semi-matte surface into the eyes of an observer can produce feelings ranging from mild distraction to considerable discomfort and preclude the proper perception of the monument. (Figures 5.3, 6.3) In other words, it is the designers' aspire to utilize the veiling reflections as highlighted features, similar to the use of sparkling effects with spotlights in jeweler shops.

It is a general principle that the more distant a lamp is from the surface it illuminates, the more uniform the illuminance across the surface. In addition, the angle of incidence determines the extend to which texture is enhanced. As Tregenza and Loe point out, when light falls perpendicular onto a surface, irregularities are masked (105). So the closer to a monument any lighting luminaires are placed, the greater the diversity will be across the surface, the more dramatic will the appearance be, because the contrast range is greater, and the more the textural qualities of the material will be emphasized.

Lighting bronzes is an exacting business. Too much light and the surface detail disappear into sparkle and reflection, too little and the visual

qualities of even the best works are deadened (Turner, Designing with Light, 111).

Works in light colored materials are normally revealed best when brighter than the background, but darkness is often presented most effectively in silhouette (CIBSE, 29).

The lighter the color of the surface of the object, the less light is required for a particular level of brightness. Very dark surfaces can demand uneconomically high illuminances. Low surface brightness can, however, often be alleviated by accent lighting, to avoid an excessive energy cost (Outdoor Lighting Catalogue, 120) Figure 6.10 indicates the effects of brightness difference on the artifact and its surrounding. Recommended surface illuminances indicated by Philips are as follows:

Table 4 Recommended Surface Illuminance Values

Reflectance of Material	Luminance of surroundings		
	Low	Medium	High
High (0.60)	20 lux	30 lux	60 lux
Medium (0.30)	40 lux	60 lux	120 lux
Low (0.15)	80 lux	120 lux	240 lux

6.2.2 INFLUENCE OF COLOR PROPERTIES OF LIGHT ON PERCEPTION OF MONUMENT

Just as the pattern of light and dark on a floodlit monument is usually different from its daytime appearance, with a far greater contrast range, so nighttime color can be different in achieving dramatic images. The color appearance of the light source or reflected light can evoke a warm or cool atmosphere (CIBSE, 4).

Associating color with human psychology and emotional responses needs great care, as human preferences for colors are exceptionally liable. Over two hundred studies imply that it is difficult to propose a hard-wired linkage between environmental colors and particular judgmental or emotional states (Clearwater, 110). Clearwater indicates that colors should be specified in terms of what they are to do instead of what they are to define color-behavior and color-emotion linkages (115).

Lamps of low correlated color temperature are seen as warm, those of high correlated color temperature as cool. Attractive images are sometimes achieved by using light of different colors at different times of the year. For instance, metal halide lamps can be used in winter their bluish-white light suggesting the cold season; in summer, high pressure sodium lamps can be used to give an appropriate impression of warmth. Also, tungsten halogen or high-pressure sodium lamps can be suggested to sunlit areas, whereas metal

halide or mercury lamps can be utilized to produce deeper shadows (Aldworth, 474).

The color-rendering index, which determines the way in which surface colors are perceived when illuminated by a light source, is usually related to the appearance under daylight. The conscious use of colored lamps may suggest dramatic images; on the contrary, the diminished quality of color rendering may cause great dissatisfaction (CIBSE, 4). Along with the rapid advancement in lighting technology a variety of light sources are available with different color temperature and color rendering indexes. So, the use of color at exteriors, on monuments is a largely matter of image property, artifact concept and meaning.

Early work that touched upon the relationship between light levels and color temperature was conducted by Kruithof (Lam, 52). Though there is not a consensus on it, he developed a chart, which defined a region of high and low levels of illumination for a range of color temperatures, which were considered "pleasing" to a number of observers. (Fig. 6.11) So we expect low color temperatures when illuminance levels are low.

However, the color temperature utilization outdoors, regarding the monument lighting, is directly related with the design of intended atmosphere rather than preference study. Also color appearance is more noticeable in combination than when seen in isolation. (Fig. 6.12)

Specular reflections from glossy surfaces may increase the chroma and saturation at one angle and obscure color at other angles, whereas a matte finish reflects light diffusely and appears more or less the same from any viewing angle (IESNA Lighting Handbook, 18-3).

Color of the surface material of the monument can be accentuated by choosing a lamp of similar color, or using a lamp having a spectral property that would emphasize the material color. As pointed out by CIBSE, filters can be utilized in converting the white light, like from a tungsten halogen, to attain the necessitate color scheme (48). If such a source is utilized, the illuminance of the source should be increased, in accordance with the selected filter. The multiples of illuminance required with color filters are given by CIBSE as follows:

Table 5 Illuminance Multiplication Factors for Color Filters

Filter Color	Illuminance Multiplier Factor
Amber	1,5
Red	2,0
Green	4,0
Blue	6,0

Investigation on modeling by Heintjes and Fletcher, suggested that there is a possible relation between glare and color temperature as their experimental results suggested that for the higher color temperature, a lower angle of incidence from the directional light can be tolerated before the glare is experienced (129).

6.3 EFFICACY AND ENERGY CONSUMPTION CRITERIA

From the economic point of view, Jankowski states that energy crises caused the outdoors to go in dark in the 1950s but in the 1990s we have seen an increase in exterior lighting applications (10). As the consumption rate increases, more houses are built, cities slowly expand and people buy and install more powerful lamps. (Bunge, 44).

Energy management has become increasingly important since he early 1970s, stimulated by the escalation of energy costs, the depletion of certain energy sources, and the concern for protection of our environment (IESNA, 26-1).

After illumination levels are determined, there are trade-offs to be weighed when selecting luminaries. They include economic considerations, suitability of installation, efficiency and lighting effectiveness (Jones, 41)

The extending possibilities of lamp and luminaire choice with different color temperatures and color rendering indexes suggests the designer a variety of selection opportunities. The efficiency of a luminaire is affected by the performance of its individual components, including lamps, ballasts, sockets, wiring and optical media such as reflectors, louvers and lenses. For outdoors, luminaire cleaning and maintenance is much important and should be assured for the intended lighting quality and quantity. Lamp selection should provide the maximum efficacy in accordance with the lighting necessity. The

appropriate lumen output and the correspondent watts will affect the consumed energy. A better optical control of beam and distribution angle will add to efficacy and energy conservation, reducing the disturbing and wasted spill light. The systems should be inspected for defective or broken components and periodical cleaning should be provided. Group relamping can also reduce the cost of operating a lighting system while keeping illuminance levels close to the design value. The calculation of average hours of use per day and total hours of use per year give useful data in comparing the alternative lamp combinations, and the data can be utilized in designing automatic switching devices to operate luminaires only when they are needed. Characteristics of electric light sources are specified by IESNA in Fig. 6.13.

Properly maintained equipment results in a functional lighting system that suffers little from wasted energy, misaligned luminaires and lamp burnouts. When outdoor lighting equipment is operating as designed, it suggests civic pride and a continuing concern about public safety and security.

6.4 LIGHT POLLUTION and TRESPASS

Alongside the positive benefits of nighttime exterior lighting, architects and designers must take on board a range of potential and actual problems. Poorly designed exterior lighting can cause annoyance or discomfort. Inaccurately placed lighting can be glaring to pedestrians, motorists and people who live in the vicinity. Principal amongst these is light spillage or light pollution and light tresspass (Gardner and Hannaford, 177).

According to Smith, nighttime sky glow caused by inefficient and excessive man made light sources is called light pollution (43). Dust, water vapor and other particles reflect and scatter light that is emitted into the atmosphere. The result is the sky glow found over all urban areas called, light pollution, the haze of nighttime brightness. It is a serious nuisance for astronomers, creating a veiling luminance over the night sky, however some is unavoidable if there is to be any exterior lighting, because a fraction of all light falling on the ground is reflected upwards (Tregenza and Loe, 100). No stars can be discerned through the brilliant glow of city light around the entire perimeter of the sky as a result of an unshielded roadway lighting, poorly designed security lighting, uplighting of building facades, stray uplighting for signs and poorly designed landscape lighting. The installation of misaligned luminaries or those with inappropriate photometric characteristics not only causes nuisance but wasteful of energy. IESNA defines the methods to control the light pollution as follows:

- Limit flux above horizontal by designing systems minimizing or eliminating upward flux emission. A full cut off luminaire does not emit light above the horizontal plane.
- Minimize non-target illumination. Lighting systems should be designed to light the intended area especially in upward lighting conditions.
- Turning the lighting off during determined times of low use.

The topic of light trespass is somewhat subjective, because it often relates to immeasurable and indefinable factors (IESNA Lighting Handbook, 21-5). It falls into two categories as unwanted light received in adjacent properties (high illuminance levels), and excessive brightness in the normal field of vision (nuisance glare). To help control light trespass:

- The designer should inspect adjacent areas to identify and consider potential problems.
- Luminaires with tightly controlled intensity distributions, cutoff reflector and refractors should be selected and each should be designed to aim the angles and the entire beam within the intended area. (IESNA Lighting Handbook, 21-6)

It makes good sense that if we use luminaries that distribute the light efficiently only where that light is wanted or needed, we ought to be able to use a lower wattage source, provided internal losses within the luminaire are not significant (Oesper, 39).

Because of the fundamental role exterior lighting plays in the environment, its interrelationships with architecture and arts, and the growing problem of light pollution, exterior lighting has to be brought under formal planning control (Gardner and Hannaford, 205).

7. CASE STUDIES

The researches, studies, arguments and expressions on artificial lighting practice has put forward a variety of facets comprising a wide range from abstract, emotional and psychological expressions to more technical, physical and quantitative approaches. As the present study tries to focus on the problem from both the viewpoint of lighting designers and sculptors, it would be inadequate to form the bases of the research on some arguments related with just conceptual, contextual or physical facts.

The intent of this thesis is to deal with artificial lighting from the point of its essence of art and to focus on the outcome of its relation with the art of sculpting by questioning the place of sculptor in lighting practice. To attain this intention, sculptor Hüseyin Gezer was contacted and two study models of his monuments were obtained (1/20 and 1/10 scale carvings of Bilkent University Atatürk Monument and Hacettepe University Bayraklaşan Atatürk Monument respectively) with the purpose of exploring the relation between human perception, response and preference with the subject of monument lighting. Various artificial lighting arrangements were set up and applied on these models, in addition to the investigation of effects of daylight modeling on their surfaces. It is believed that utilizing the models, opinions and arguments will become more tangible and constructive, rather than making criticisms on personal impressions.

In the introduction, it has been mentioned that the quest for finding out ways for appropriate monument lighting formed the bases of the research. This can be achieved by a convenient integration among functional, psychological and aesthetical factors as mentioned. The studies on cases are supported with a survey procedure to collect further, representative and eligible data, to be used in discussing the subject of interaction and integration and sets of evidence that define the causal relationships. The questions in the survey are prepared to find out the perceptional preference tendencies of the sample group among different lighting settings of the models.

7.1 BİLKENT UNIVERSITY ATATÜRK MONUMENT

The Bilkent University Atatürk Monument was made by Hüseyin Gezer in October 2000. It is located in the middle of the roundabout at the entrance of main campus gate. The roundabout was renovated after the artifact's installation and a small area around was proposed for ceremonial activities. (Fig. 4.2)

The monument is made of bronze and its base is emphasized with contrasting color marble. It is about 5,50 meters in height. The slight slope in topography changes the eye level when we walk around and to the backside of the monument.

The artifact is constituted of figurative representation of Atatürk on the front side, with two young persons located on the backside. The forms are structured in back-to-back position, with Atatürk facing towards the entrance gate and the youths towards the campus. For achieving the total unity and defining the theme, forms are embraced and connected with a radial movement.

Gezer explains the theme of monument and his conceptual approach as being his aspiration to emphasize Atatürk's ideas and desires upon the Turkish Youth. In many of his speeches, Atatürk addressed the duties of youth focusing on the matter of independence, freedom, science, and ethics. These directives points out his reliance and confidence on youth. Since the monument will be located at the entrance of a university, Gezer tried to seize this idealized association. The radial movement around Atatürk symbolizes, the spread of beams of ideas from a center point where Atatürk's figure is located. Along with the radial movement, those rays coincide with youth. The torchere, held by the young girl, captures the light beams forming its flames. The girl, holding the torchere, symbolizes the significance of science, knowledge and education and the boy holding the flag, emphasizes independence. Again we observe that the flag intersects with the beams at a point and balances the total unity. The forms of the boy and the girl were designed to balance and to create harmony within their linearly intersecting V-shape. (Fig. 7.1)

From the lighting point of view, according to Gezer, the essential light for sculptures and monuments is daylight. Hence, he has not proposed artificial

lighting at the design phase. On the other hand, he states that the emphasis should be given to the radial movement of beams around Atatürk's head, if an artificial lighting system will be used. Directing our attention to the incident angle that would cover the mentioned area; he claims that a lighting system with a single pole should be utilized (Fig. 7.2). In the words of Gezer, the best impression concerning a monument or sculpture can be achieved by proposing spotlighting from above, having about 30° to 45° incidence angle with the normal of the horizontal plane.

7.2 HACETTEPE UNIVERSITY BAYRAKLAŞAN ATATÜRK MONUMENT

This monument has been completed by Hüseyin Gezer in 1969. It is located on the Main Campus of Hacettepe University. In contrast to the Bilkent Monument, it is positioned in a square, surrounded by University buildings. The setting around proposes different viewpoints with little elevation changes. (Fig. 7.3)

The monument is made of bronze, and its base is made of concrete. It is about 5,40 meters in height. The base stands at eye level and including the base the total height exceeds 6,50 m.

Similar to the Bilkent Monument, three figurative forms shape up the artifact. The placement of the figures are also similar, Atatürk at the front and the youth at the backside.

The monument stands out with its massive structure. The figures are more abstractly defined than the Bilkent Monument. One's eyes are attracted with the sudden exposition of the faces, recessions and curves. The flag that is held by the boy at the backside embraces all the figures and constitutes the main theme, which is independence. Gezer explains that using the flag as the symbol of independence, he tried to define Atatürk's magnificence. The name of the monument, "Bayraklaşan Atatürk", implies this theme as well. The girl holding the torchere is attributed to the progressive ideology and carved as if trying to run out of the monument to carry this symbol of science, knowledge and education to the public.

7.3 SURVEY

During the preliminary stages, the research was handled by the observation and site analysis of about 50 Atatürk monuments in Ankara. As an outcome of the observations, they can be categorized as follows: Non-lighted monuments, the monuments illuminated by the utilization of nearby luminaires (like roadway, security and landscape lighting) and the ones that are lit purposely. From those lighted ones some significant monuments were photographed for further discussions.

Through the discussions that have been held in previous chapters, several variables affecting the physical and psychological ties between human and monuments were introduced. Several factors such as, effects of daylight and artificial light modeling on monuments, influence of color properties of light, luminaire positioning and its affects on perceiving the artifacts, dynamic and static property of light sources, environmental setting considerations were discussed in revealing the meaning that was attached. The discussions exposed some questions, concerning the relation between daylighting and artificial lighting effects on monuments. Although it has been mentioned that sunlight cannot be imitated by an artificial lighting system (considering its dynamic quality, spectrum and intensity), which can only propose a fixed location of installation (diminishing the quality of modeling), is it possible to propose an artificial lighting scheme that is installed in order to imitate the modeling of sunlight at a specific time in a specific day through the year? Regarding the orientation of a monument, is it possible to imitate the daylight conditions (having direct, diffuse and reflected components of light) by proposing beams from similar direction? What would be the preference tendencies of human, among different lighting schemes with different modeling qualities (proposing schemes that are similar to daytime conditions or creating a setting as if the monument is lit from opposite directions)? Through the case study and survey procedure answers were sought to these questions, by examining the effects of different lighting treatments on models.

For the Bilkent Atatürk Monument, the Construction and Maintenance Department of Bilkent University has proposed an artificial lighting system. As can be seen in figures 7.4 and 7.5, four pole locations (indicated with capital letters) are suggested. Pole installation locations were limited by topographical, environmental and technical restrictions. However, it can be argued that the chosen locations are quite successful from the point that they propose multiple directions of light (Section 6.2-modelling, Fig 7.5).

Ankara is located at 40° northern latitude. As the monument is east-oriented, and as the sun follows a south inclined path from east to west, the monument is always modeled from the southern side. The bearing angles vary from 51° to 107° with the north-south axis in both east and west directions in accordance with the seasons and time of day (Figures 7.6, 7.7). Therefore, as indicated in figures 5.6 and 7.5 the solar path draws a slight curvature, passing over the pole locations –B and C- that are positioned at the south direction. In line with this fact, is it possible to imitate the daytime modeling conditions by directing the artificial light beams mainly from poles B and C? The distance from the monument to the pole locations A and D (the north side oriented poles) is less than the distance to B and C (From M to A 24,5m, M to B 30m, M to C 36,5m and M to D 26,5m) (Fig. 7.5). In accordance with distance calculations, if the monument is going to be lit from south direction and if we try to obtain the same level of illumination (mainly from poles B and C to imitate sunlight) the energy consumption would be relatively higher comparing to a scheme in which the light is coming from the opposite direction, from north, regarding poles A and D. As stated by the inverse square law, the

illumination (E) at a point on a surface varies directly with the luminous intensity (I) of the source, and inversely with the square of the distance (d) between the source and the point. To investigate and discuss the effects of lighting the Bilkent monument from the mentioned directions, lighting models and treatments were prepared in laboratory conditions. The setting is defined in 1/20 scale, similar to the actual conditions and suggested pole locations (A, B, C and D). Then the model is lit from different directions with different intensities. As an example, for imitating the daylight condition the lamps located at points B and C (at the south side of the actual monument) is projected to the model with full intensity whereas the ones positioned at A and D were dimmed for balancing the setting (used like fill light).

During the research, the monument was photographed hourly in 21st March under clear sky daylight conditions, starting from 6.00 am to 6.00 pm to observe the variance in modeling throughout the day (Fig. 7.10). To carry on the similar observations on two solstices (on 21st June and 21st December), utilizing a sundial, the model of the monument was photographed similarly (Fig. 7.8). The photographs are utilized in the survey to find out whether there exists a particular time in the day when the monument is best revealed. As the research is concerned with the meaning as well, the matter of conceptual formation and discussing sculptors' intentions is another point that was focused on during the survey.

In chapters 5 and 6, attention was drawn to the importance of placement of luminaires with respect to the artifact, in order to achieve an effective

projection on the intended portions, with minimized glare problems (Figures 6.2, 6.7). Accordingly, the importance in choosing the appropriate pole heights (if the monument is intended to be lit downwards) was emphasized taking the dynamic property of perception and the cone of vision into account. In the study, the effects of different incidents of light were examined on the model. The sculptor's suggestion of lighting the monument with 30° incident angle was also tested. Feasibility in pole installation was another parameter that has been counted in deciding the pole heights. The poles for different incidents were prepared in laboratory conditions as well, and the schemes were photographed again.

Hacettepe University Bayraklaşan Atatürk Monument, was included in the survey in order to discuss the importance of orientation of a monument in achieving an effective daylight modeling. As the monument is south-oriented its modeling through the day is extremely different compared to other directions of orientation (Fig. 7.9). To discuss the differences in modeling and investigate human preference tendencies, the model of the monument was photographed similarly with the Bilkent Monument. Utilizing a sundial, the hourly differences on solstices and equinoxes was set up and captured with the camera.

In line with the factors stated above, a questionnaire was prepared to discuss effective lighting system and human preference among the photographed lighting schemes of Bilkent and Hacettepe University Atatürk Monuments.

7.3.1 EXPERIMENTAL SETUP

The study was conducted at two universities in Ankara. One of them was the Interior Architecture and Environmental Design Department at Faculty of Fine Arts, in Bilkent University and the other one was at the Interior Architecture Department of Engineering and Architecture Faculty in Çankaya University.

The model of Bilkent Atatürk Monument was 1/20 scale and Bayraklaşan Atatürk Monument was 1/10 scale. Both of them were gypsum plaster cast with a cover dye representing their application material's color, that is bronze.

For the artificial lighting experiments, slide projectors with 100-watt tungsten halogen lamps, and 12 volt 35 watt halogen lamps with 8° parabolic reflectors were utilized as light sources. While selecting the light sources, their intensity distribution characteristics were considered. By adjusting the focal distance of the lens in slide projectors, the intended beam angle could be attained. For adjusting the lamp intensities, manual dimmers were used. The degree of dimming was carried out with an illuminance meter. The lighting treatments were prepared in room FC-112, at Department of Interior Architecture and Environmental Design, at Bilkent University.

The daylight photographs of the models were taken under clear sky conditions. A sundial, that has been prepared for Ankara, according to 40°

northern latitude, was used in taking the photographs of four periods of year: On the vernal and autumnal equinoxes on 21st March and 21st September, and on two solstices, on 21 June when the longest daytime is observed and at 21 December when the shortest daytime is observed. (Fig. 7.8)

The photographs that formed the question contents were taken with a digital photo camera under different exposure and aperture settings. To decrease the subjective influence while photographing, the photos that were taken with different adjustments of exposure were compared to the ones taken with the camera's automatic settings.

A photo enhancer program, Adobe Photoshop 5.0, was utilized for photographic correction and background preparation and the organized picture schemes were displayed with a picture viewer program ACDSee v3.1. The background grading of daytime photos was prepared in order to be consistent with the actual daylight conditions. Since the horizon is 12 times brighter than the zenith under clear sky conditions, the grading was prepared gradually decreasing from top to the bottom. A light blue hue was selected for the background gradient with the color picker feature of the program. (Blue – red:92, green:128, blue:190 saturation:52, brightness:75) For the nighttime lighting, dark blue background color was prepared including the same ratio of brightness and saturation. (Dark Blue – red:38, green:37, blue:49)

During the survey, a personal computer with a 19" monitor was used. The brightness and contrast settings of the monitor were adjusted to the default

values and color temperature was calibrated to 5000K. The resolution was set to 1280 by 1024 and the 32-bit true color scheme was selected for appropriate screen size and accurate color rendering for the best match with the photographic properties.

7.3.2 METHOD

Interviewees

The participants of the study were the undergraduate students of Bilkent University, Department of Interior Architecture and Environmental Design and Çankaya University Interior Architecture Department. Non-probability sampling method was chosen because of the convenience in selecting and using the available student group in both of the universities. 113 students were selected from both departments, discounting their classes. Among the students 64 were male and 49 were female. Regarding their personal data, the name, age, sex and department were collected. Each experiment session lasted for approximately 6 minutes. The interviews were conducted by two pollsters.

Procedure

The interview procedure was as follows:

1. The subjects entered the room one by one.
2. To each one, 27 photo groups were shown pertaining to 9 questions.

3. During the questionnaire there was no time limitation for the selection procedure. They were allowed to examine the photos for as long as they needed.
4. They were not allowed to see the previous schemes again.
5. The answers were filled by the pollsters.
6. Pollsters noted down the unexpected comments.

7.3.3 RESULTS AND DISCUSSION ON FINDINGS

The questionnaire consisted of nine questions about the lighting schemes (See Appendix A). Only the ninth question comprised the Hacettepe Monument. The rest were related with Bilkent Atatürk Monument.

Except the second and eight questions the inquiry was the same:
"In which of the photographs do you perceive the monument in the best way?"

The best perception was regarded as, the state at which the appropriate modeling, balanced shades and shadows with an accurate color combination would occur.

For the first question 2 groups of photographs were presented to the interviewees (Figures 7.10, 7.11). They consisted of the front and backside daytime views of the Bilkent Atatürk Monument. As mentioned before, the photographs were taken on 21st of March at each hour, starting from 6 o'clock early in the morning till 18 o'clock in the evening. The camera was located at

the front and backside of the monument for each time interval and the scenery is captured with (+)(-) 1-minute deviation. The photographs were ordered from 6 am to 6 pm.

Firstly the front view group was shown and the question was asked. The pollster noted the answer down. Then the second group, consisting of backside scenes was shown, repeating the same question again. The selection again noted down.

The first question was asked to find out, whether there exists a time interval at which the observers perceive the monument best. If a tendency towards a specific hour were detected, this particular time interval would be discussed as a parameter in proposing a pole location and an angle of incidence, utilizing the solar azimuth and altitude at the selected hour. As the monument is east-oriented the modeling drastically changes through the day. The details on the monument's front view disappear in the afternoon, while the light beams wash the backside face of the monument. Therefore, the change in backside scene was also presented to the interviewees.

To observe and examine the distribution of preferences in each question, and represent the findings of the study graphically, percentile charts are prepared for each data set.

The distribution of the results for the first question is shown below in figures 7.12 and 7.13.

Question 1 – Distribution of preferences among front views

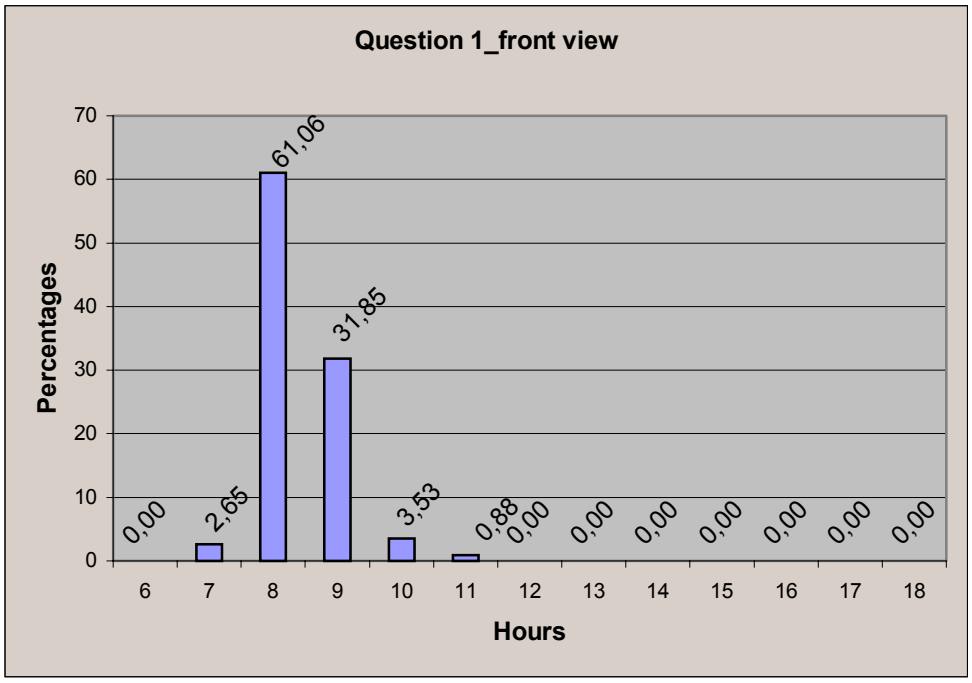

Fig. 7.12

In the first question, interviewees were asked to make their selection among the photographs depicting the monument on 21st March. Among the front view group, the preferences are distributed significantly on two hours. 61% of the subjects have selected 8.00 o'clock and approximately %32 referred to 9.00 o'clock. As the monument is east-oriented, and as the sun follows a south inclined path from east to west, the monument is always modeled from the southern side. Starting with the noontime, the front side of the monument is left under shade. Hence, none of the interviewees have selected the photographs depicting the afternoon appearance (Fig. 7.13).

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. Therefore, the data above, indicating the solar time (8.00 and 9.00 o'clock) can

be considered as an indicator for the placement of luminaires. However, the luminaire locations were already indicated in the lighting proposal by the Construction and Maintenance Department, considering the topographical and environmental factors (Figures 7.4, 7.5). The environmental setting of the Bilkent University entrance limits discussing any other alternative locations. (Fig. 7.14) Thus, for imitating the daylight modeling at 8.00 or 9.00 o'clock, one of the indicated pole locations must be selected. Pole C, which makes 37° of angle with south, on the north-south axis, seems to be the most convenient. To calculate the altitude of sun at 21st March when the azimuth angle is 37°, a sun angle calculator (sun path diagram) was used. The calculation indicates that on 21st March when the azimuth is 37°, sun's altitude is 44° and the corresponding solar time is 10.20 in the morning. At this particular time the sun is located just above the pole C. This can indicate that point C can be utilized for imitating the sunlight situation with two hours variation from the subjects' preference. However, only 3,5% of the interviewees selected the photograph taken at 10.00 o'clock. In spite of this fact, pole C is the only location that could be utilized for the daylight imitation purpose.

In accordance with the discussion above, the model was illuminated under a single artificial light source, imitating the solar location on 21st March at 10.20 (utilizing the same solar angle). From the three-photo group in Fig. 7.15, the illustration on the right side represents the result of this illumination. The outcome can be compared with the photograph, indicating the 21st March 10.00 o'clock view of the monument on the left side and with the 21st March 10.00 o'clock sundial photograph of the model placed in the middle. The

similarity among the photographs regarding the shadow distributions can be easily observed.

The lighting designer should remember that this selection of pole location (pointed out in 5.1.2) is just an imitation of a specific time through the year.

The sun reveals the backside of the monument in the afternoon. In contrast with the front view, the backside is left under shadow in the morning. Therefore the selection of the interviews is mainly distributed on 13.00 and 14.00 o'clock when the front side is under shadow (Fig. 7.13).

Question 1 – Distribution of preferences among front and backside views

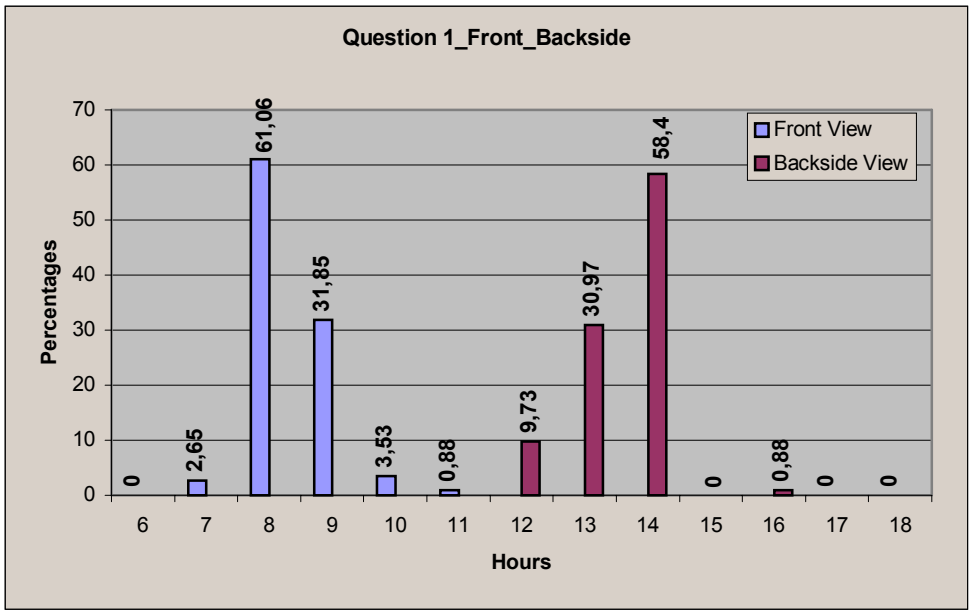

Fig. 7.13

The second question was related to the concept of the monument. Firstly the subjects were informed about the artist's focal point at the artifact, and then they were asked to choose the appropriate one regarding the query.

"Concerning the monument it is important to reveal/emphasize the beams of half radial shape located above Atatürk's head"

"In this manner, in which of the photographs this reveal/emphasis is best seized?"

As the half radial shape, indicating the concept, can only be seen from the front side of the monument, only the front view group, consisting of 21st March daylight conditions, was shown to interviews (Fig. 7.10). Similar to first question the aim was to discover a specific daytime, if any, at which the radial shaped beams are best revealed. The results would be utilized in finding a solution for revealing the meaning as well as the overall structure.

For the second question the responds are distributed among the hours, as follows:

Question 2 – Distribution of preferences among front views

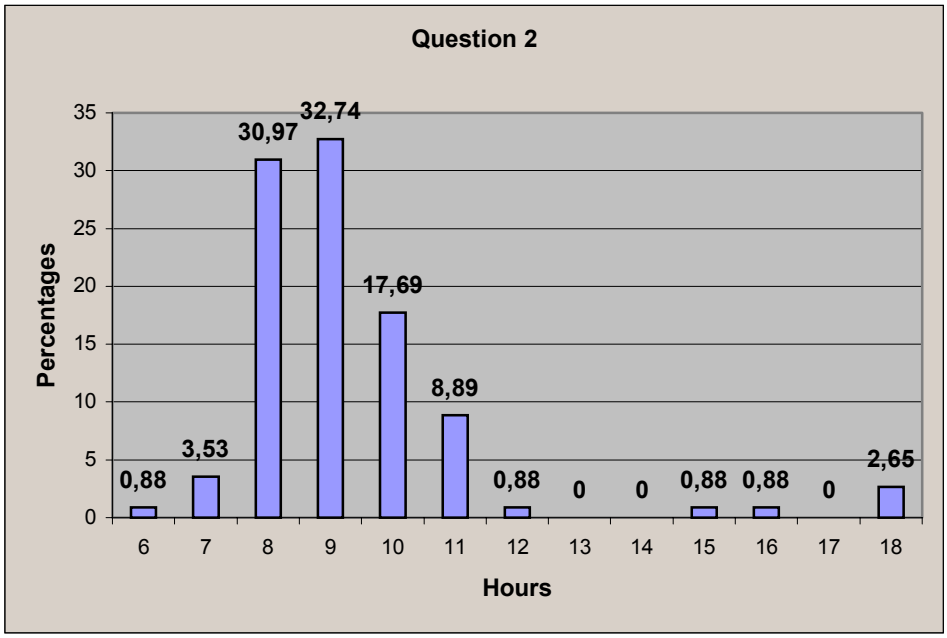

Fig. 7.16

Approximately 64% of the subjects indicated that at 8:00 and 9:00 am they could effectively perceive the emphasis on the beams. (Fig. 7.16) The results designate the change in the daylight conditions again. The best reveal is observed between eight and eleven o'clock when the solar altitude angle strolls around 40°-50° on 21st March. Again the contrast between dynamic quality of daylight and static aspect of electric light makes it impossible to propose the best location for luminaries. At this time the sculptor's proposal should be discussed.

While describing the concept of monument, Gezer sketched this idea that would reveal the beams including Atatürk's head (personal inteview). He wants the monument to be light with spotlighting from above, having about

30° of incident angle. However in order to achieve a beam with an angle of 30°, the correspondent pole height should exceed 45 meters. The pole heights for the proposed points with respect to angles of incidences are listed below:

Table 6 Required pole heights for 30° – 60° angles of incidence

	A	B	C	D
30 Degrees	46,4 m	56,9 m	67,2 m	49,8 m
45 Degrees	28,5 m	34 m	40,5 m	30,5 m
60 Degrees	18,2 m	21,3 m	25 m	19,3 m

As the topography, environmental setting and light distribution characteristics of luminaries limit the positioning, it is not feasible to apply the sculptor's proposal.

Third, fourth and fifth questions were prepared to discuss the possibility of sunlight imitation (The word imitation stands for imitation of modeling, regarding direction and incident angle) regarding the proposed lighting plan and suggested pole locations (Figures 7.4, 7.5). It was impossible to test the directional changes of light regarding the proposed lighting scheme, as the pole installation locations are restricted. Therefore, the questions are arranged in order to compare the effects of change in the intensity and incident angle of artificial light and their influence on human perception and preference. As mentioned before, solar path was used as a reference for suggesting two different lighting directions, resulting in two different lighting schemes.

The daylight imitation scheme was achieved by illuminating the model from the pole locations B and C, which are located on southwest and southeast directions respectively. They were used as key lights, providing the main subject light, creating principal shadows and revealing the surface, texture and form. At the pole positions A and D, in the northwest and northeast directions, lower intensity light sources were used like fill lights, to reduce the overall contrast, and soften the harsh shadows (Fig. 7.5) For adjusting the intensities, as indicated before, manual dimmers were used and the intensity change is calculated with an illuminance meter. The ratio of the brightness of dimmed sources to the full intensity ones was approximately adjusted to ¼. As Millerson states no hard or fast rule can be stated regarding the intensity ratios in modeling (76). The experimental setup showed that, for this case the mentioned ratio is suitable for the appropriate reveal of light on the monument.

The lighting treatments for daylight contrary scheme were prepared as follows: Opposite to the previous setting, the pole locations on the north direction, A and D were used for providing the main beam. Consequently, light sources located at B and C, on the south side, was employed as fill lights to balance the overall scenery.

As designated before, on the word of Gezer, the best impression among a monument can be achieved by illuminating it downwards, providing an angle of incidence 30 to 45 degrees (Personal Interview). In order to keep the light beams entirely on the artifact, luminaires with correct beam spreads and shields can be utilized. However, narrowing the beam light or decreasing the

incident angle generally requires luminaires that are highly positioned with respect to the artifact (Table 6).

For luminaires used at outdoor lighting systems, the general available column and pole heights are 5, 6, 8, 10, 12, 16 and 20m. For applications extending this range, masts are offered. However they are mostly designed to be used extensively in large areas like lorry parks (CIBSE, 66). In this respect, designing a lighting system to provide 30° incidences is not feasible for this situation. Hence, the lighting treatments to be used and compared in questions 3, 4 and 5 were set up according to angles of 45° and 60°.

In the third question the interviewees were presented two photos for each side of the monument (Figures 7.17 and 7.18). Like the first question they were asked to select the one that they perceive the monument in the best way. The lighting setting was prepared to compare the perceptual preference tendencies among lighting the monument from south (daylight imitating condition) and north (contrary situation) directions with 45° angle of incidence. For the front view group, the photograph on the left side of the screen indicated daylight imitation condition, and the one on the right side indicated the opposing situation (Fig. 7.17). The photographs presenting the backside views were similarly arranged, daylight imitation on the left side and the other on the right side of the screen (Fig. 7.18)

The findings for the third question are as follows:

Question 3 – Distribution of preferences among front views

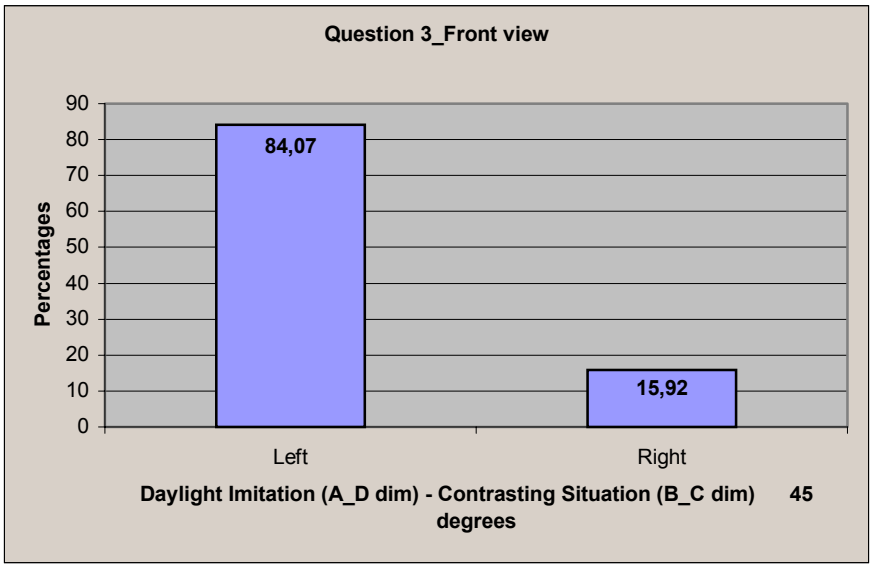

Fig. 7.19

The preferences designate that for 45 degrees of incident angle, when the monument is illuminated mainly from south (the daylight imitation situation) it is perceived better. (Fig. 7.19)

Question 3 – Distribution of preferences among backside views

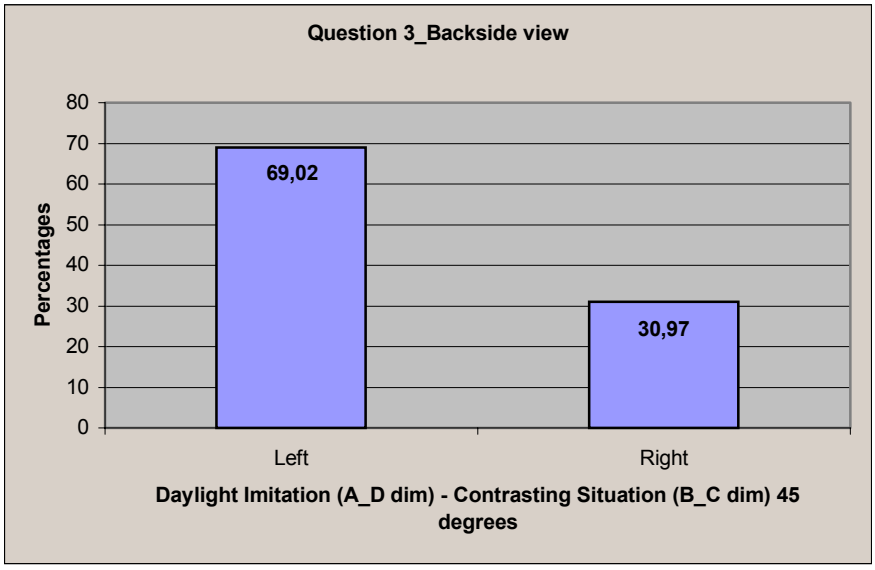

Fig. 7.20

A similar distribution can be observed when we examine responses regarding the backside (Fig. 7.20). The increase in the percentage of right side selection, depicting the north side illumination scheme, might be the result of two lurking variables:

When we dimmed the light to decrease the intensity, the color temperature also decreased. According to the Kruithof there exists a relationship between light levels and color temperature. He developed a chart, which defined a region of high and low levels of illumination for a range of color temperatures that were considered "pleasing" to a number of observers (McGuire). Lower illumination levels with warm color temperatures are more acceptable for humans. The relationship can be observed in the amenity curve for light. (Fig. 6.11) Hence the slight change in the color temperature may have effected the selection of the subjects. As Lam highlights, “perception is a complicated and sophisticated process, involving a range of variables” (31).

The other variable that might effect the perception is the distance difference between the poles and the monument. Although same intensity lamps were used at the laboratory experiments, in the application project the illumination levels should be proposed regarding the distances. The distance from the monument to the pole locations A and D (the north side oriented poles) is less than the distance to B and C (From M to A 24,5m, M to B 30m, M to C 36,5m and M to D 26,5m) (Fig. 7.5). Therefore, higher intensity light sources would be needed for points B and C if the daylight illumination pattern were going to be applied. However, if the poles A and D will be chosen for the

high intensity sources to propose the contrasting scheme to daylight, the energy consumption would decrease and a different lighting atmosphere could be achieved.

The only difference between the third and fourth question was the incidence angle, denoting a change in the pole heights. **The fourth question** constituted of the lighting setting photos in which the model is revealed by 60° incident angle instead of 45°, by reducing the pole heights. (The increase in the incident angle causes the decrease in the corresponding pole height) The placement of the photos was same with the previous question (Figures 7.21, 7.22).

For the fourth question, the distribution of preferences can be observed below:

Question 4 – Distribution of preferences among front views

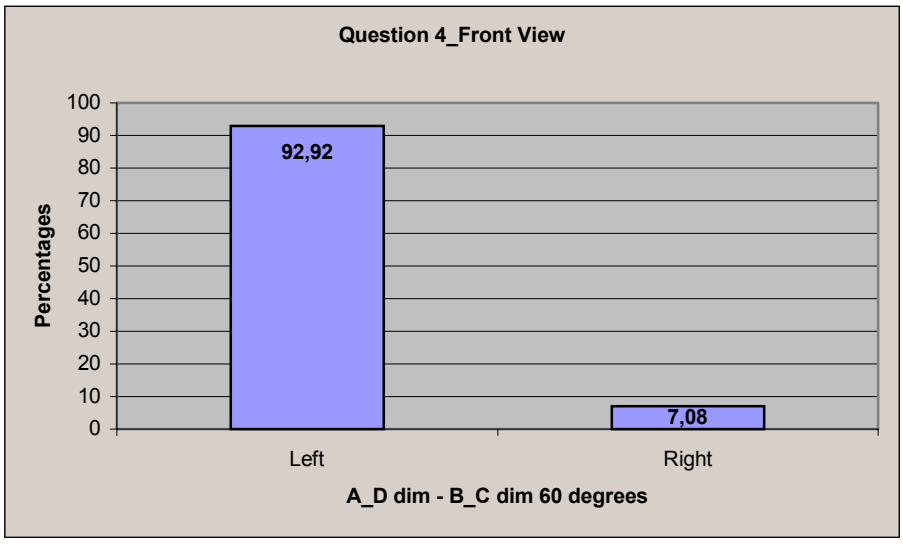

Fig. 7.23

Question 4 – Distribution of preferences among backside views

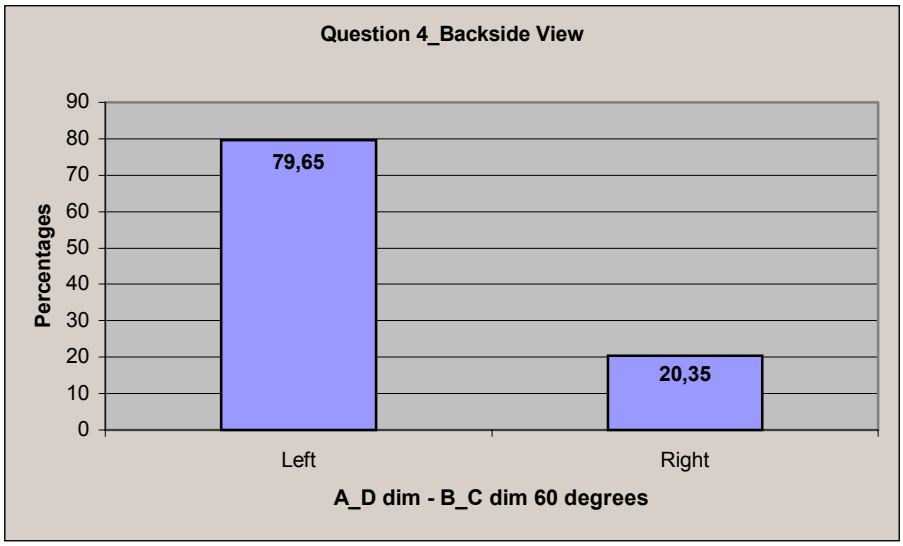

Fig. 7.24

When the findings are compared with the third question, it can be observed that the number of interviewees that favored the daylight scheme has increased regarding both the front and backside views (Figures 7.23, 7.24). It can be stated that for both 45° and 60° daylight imitation pattern was mainly preferred. The pole heights required for 60° illumination pattern are lower than the ones required for 45°. The decrease in the height of luminaire installation would require an adjustment in light source regarding its photometry and intensity. When compared with the models in the third question, the ones in the fourth are brighter. In the fourth question's setting the light sources are closer to the monument than the ones in the third, therefore it can be stated that the brightness difference between the models is the result of the change in preference. (see Inverse square law pg. 73)

The fifth question involved four pairs of photographs. The aim was to examine the preference tendencies between two incident angles, 45 and 60 degrees, on the same lighting scheme.

The first and the second pairs represented daylight imitation situation, placing them on the screen with 45° on the left side and 60° on the right side (Figures 7.25, 7.26). The third and fourth pairs were prepared according to lighting the monument from northern side, contrary to daylight scenery. The lighting situation illustrating the front views in the third photo pair was arranged by placing 60° on the left and 45° on the right side of the screen to prevent the subjects from becoming familiar to the placements (Fig. 7.27). For the backside views the placement was shifted again with the one having 45° incidence placed on the left and the other with 60° on the right side. (Fig. 7.28)

The findings for the fifth question are below:

Question 5 – Distribution of preferences among daylight imitation (45° - 60° front views

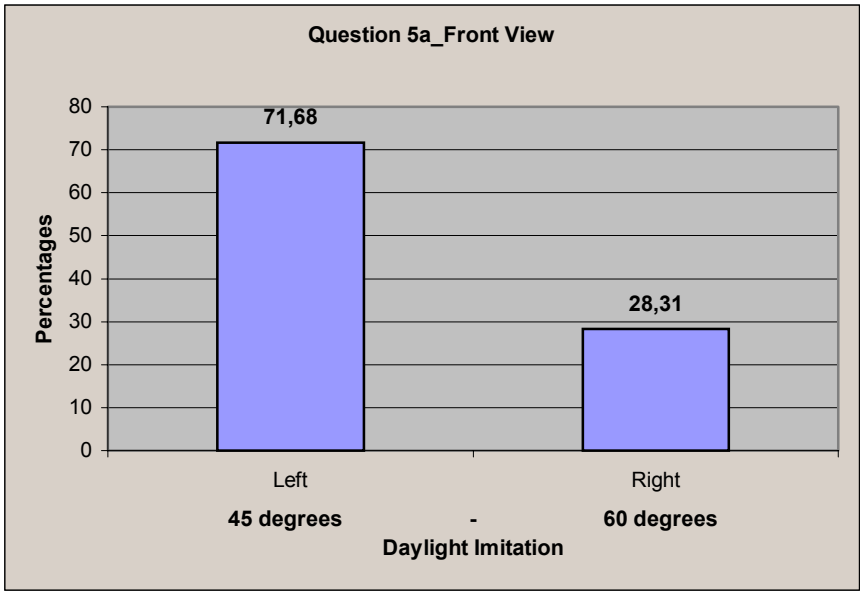

Fig. 7.29

Question 5 – Distribution of preferences among daylight imitation (45° - 60° backside views)

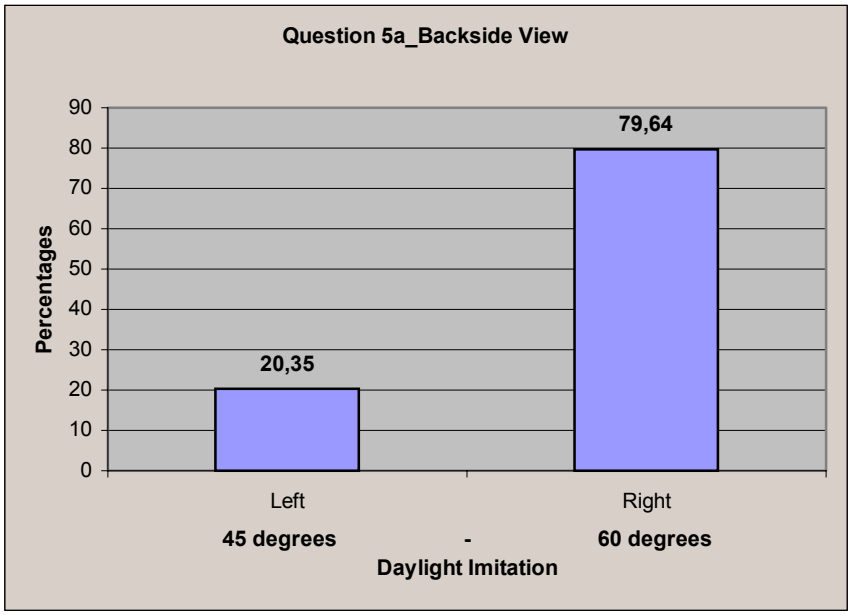

Fig. 7.30

Question 5 – Distribution of preferences among contrary schemes (60° - 45° front views)

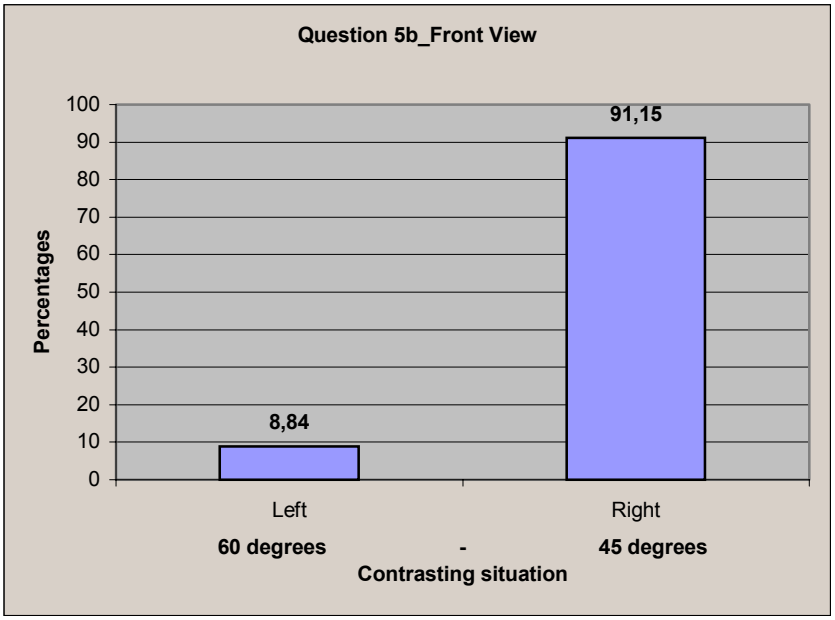

Fig. 7.31

Question 5 – Distribution of preferences among contrary schemes (45° - 60° backside views)

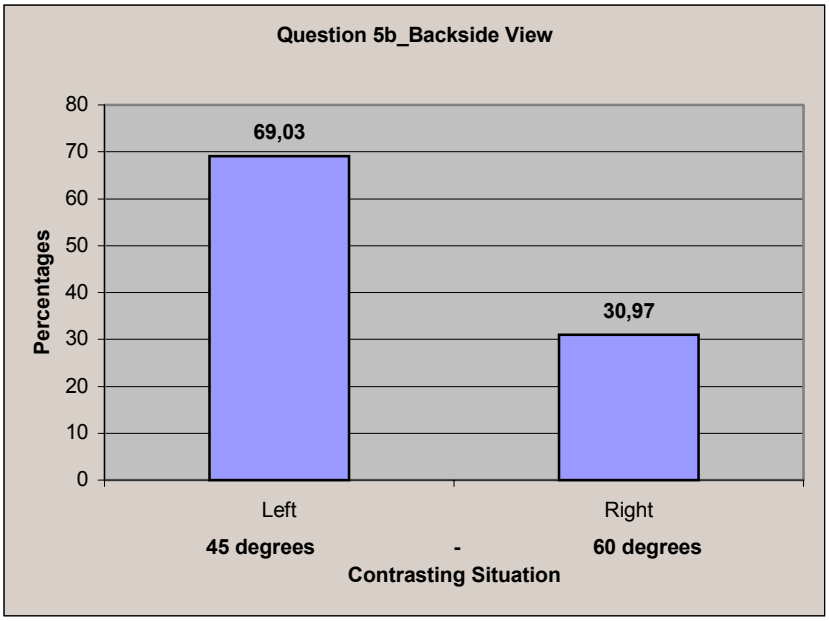

Fig. 7.32

The results indicate that the schemes with 45° of incidence angle were preferred among the subjects when the situation proposes a contrasting atmosphere to the daylight situation (Figures 7.31, 7.32). Same statement is true for the distribution of preferences between 45° and 60° regarding the daylight imitation scheme on the front side (Fig. 7.29). About 72% of the interviewees indicated that under 45° incident angle, the monument is perceived better when observed from the front side. However, considering the backside view of the similar scheme, 60° were favored by %80 of the interviewees. There is no significant evidence for explaining this unexpected scheme of distribution. The result may indicate a photographical distortion, which would affect the preference scheme.

In this research two incident angles were utilized, they were 45° and 60°. In the lighting treatments, all the pole heights were adjusted concerning either of these angles. The effects of a lighting treatment, in which the monument is illuminated from north direction with 60° and from south with 45° (or vice versa), would probably be different than the current findings. A further study is needed to analyze the results of such occasions.

Luminaire location and installation height with respect to the monument was discussed in the previous sections and it was stated that the light source should not coincide with the binocular vision field. The lighting treatments in the study were set up according to angles of 45° and 60° considering the installation feasibility of poles. However, a wide-angled luminaire installed in accordance with either of these angles, will cause glare to the observers in the field unless precautions like reflectors or louvers are considered.

Three roads surround the Bilkent Monument, being located at the entrance roundabout of Bilkent University. One of them heads towards Music Faculty and the other towards the main campus. Third one connects the University to Bilkent Center and Eskişehir Highway. All these roads have different slopes; therefore consideration of glare becomes more important concerning the pole heights. The slope of the Music Faculty road, affects the drivers' line of sight and direction of view (Fig. 7.33). The light columns that will be located at points A and D would probably cause direct glare to the drivers approaching from Music Faculty unless the projector is shielded with an appropriate louver. The same problem should be considered for the drivers

approaching from campus area. Moreover, the type of the projector should have the appropriate distribution characteristics. For this case, Philips SVF 607 type was proposed in accordance with its appropriate photometrical data. (Fig. 7.34) The narrow beam reflector projects the light on the monument and prevents the excessive spill to environment. In addition to glare cut off properties, the devices shown in Fig. 7.35 assist the direction of light that directed towards the monument

Examining the daylight modeling on the monument, and collecting data at the equinoxes and solstices, would entail a whole year time. In addition, clear sky conditions (with no clouds and dust) would be required on these particular days to have appropriate illumination on monument and to capture the scenery properly. The investigation could be conducted on 21st March, but for analyzing and photographing the modeling regarding the other periods, the model was utilized.

Sixth question was composed of daylight modeling illustrations of the model on 21st March, 21st June and 21st December (Figures 7.36, 7.37, 7.38, 7.39, 7.40, 7.41). Parallel to the first question, the aim was to detect and analyze the preference tendencies on the given schemes. The subjects were asked to choose the best perceived one among seven photographs from each group. The question was constituted of six groups of photographs denoting differences of modeling on solstices and on equinoxes. Thus, dynamic quality of daylight through different seasons could also be observed. As can be seen in figures, dissimilar to the first question, there are seven photographs for each

group representing the time interval from 9 am to 3 pm. The interval was selected in accordance with the shortest daytime occurrence on 21st December (Fig. 7.6). The days in the other months are longer; but the month having shortest daytimes was selected for standardization of the selection procedure.

The preferences regarding the sixth question indicate the changes in perception of the monument with respect to different seasons, time intervals of the year. (Figures 7.42, 7.43, 7.44, 7.45, 7.46) In all situations, the backside details cannot be perceived in the mornings and in the afternoons the front side details become unperceivable. As a result of sun's dynamic quality, its affects on monument's surfaces differs at each moment through the year. The variance of solar azimuth and altitude angles can be examined in fig. 7.6. Especially in figures 7.45 and 7.46, the diversity of selections among different seasons as a result of dynamic quality of daylight can clearly be observed. For instance, in June, the altitude angle of sun is greater than the condition in March and December, which results in shorter shadows. Consequently, it is difficult to decide upon the nighttime lighting pattern using daytime observations. As mentioned before, detailed analyzes should be conducted by comprising all the months through the year.

Question 6 – Distribution of preferences among 21st March (front and backside views

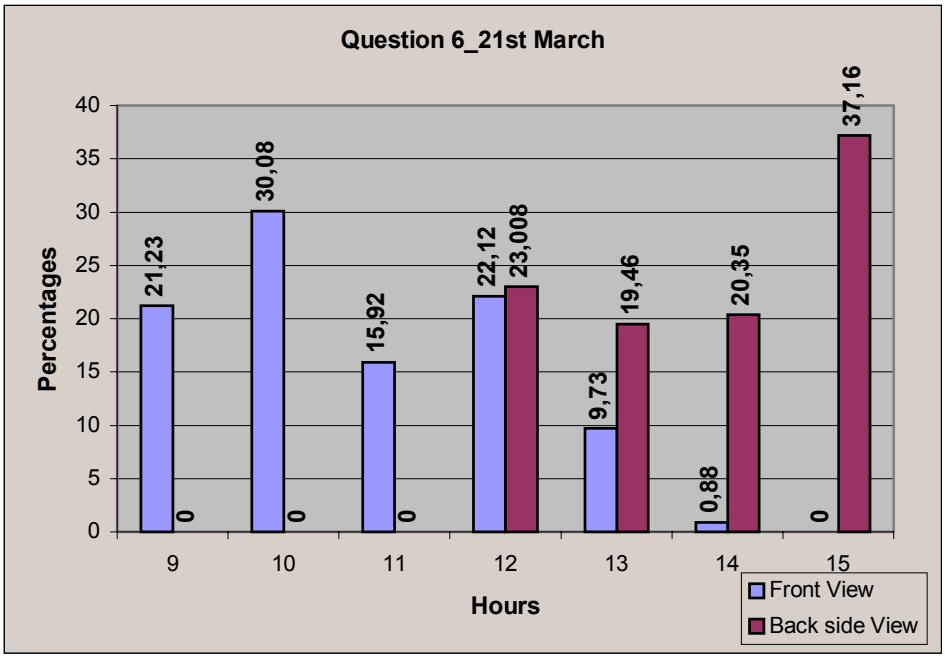

Fig. 7.42

Question 6 – Distribution of preferences among 21st June (front and backside views)

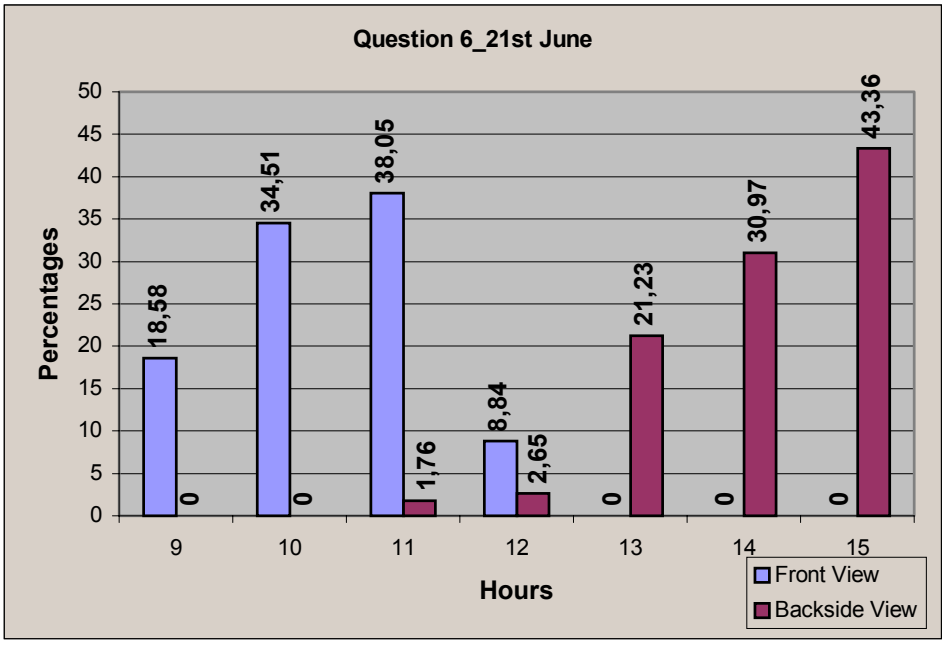

Fig. 7.43

Question 6 – Distribution of preferences among 21st December (front and backside views

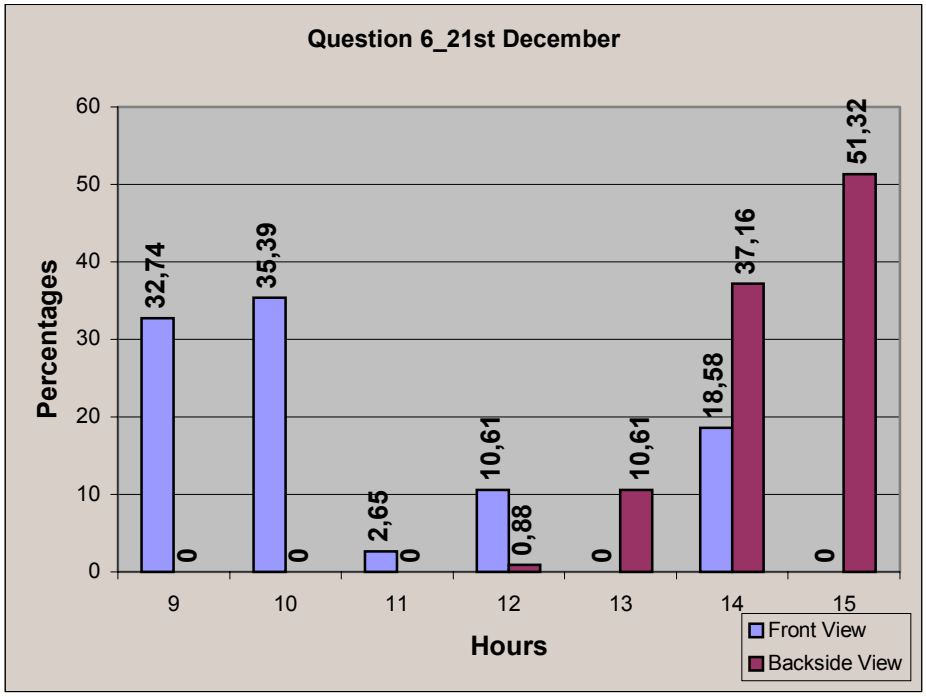

Fig. 7.44

Question 6 – Distribution of preferences among front views

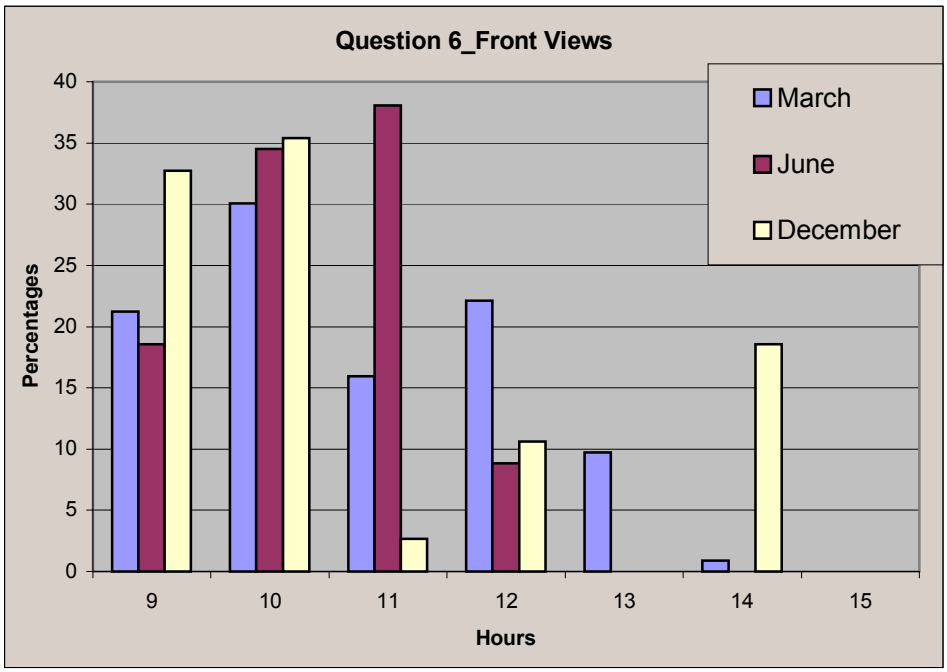

Fig. 7.45

Question 6 – Distribution of preferences among backside views

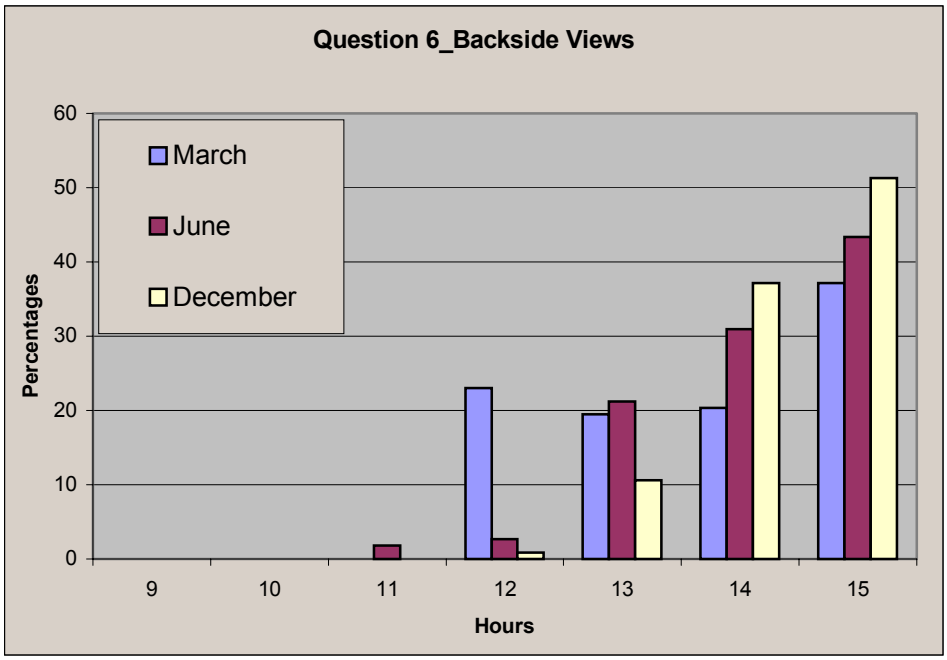

Fig. 7.46

In outdoor lighting design projects, choosing the proper directions of light is usually appear as the most important concern. In chapters 5 and 6 the attention was tried to be taken on this subject, by making arguments on problems related with human perception, quality and quantity of light. It was stated that in order to create stunning effects, spotlighting the artifact from below can be considered; but with a slight change in viewing position the result may be grotesque. The designer should analyze and identify the problem properly to define the boundaries and select the suitable luminaires.

Along with these discussions, **in the seventh question** the interviewees were asked to make a selection between lighting the monument from upwards and lighting it from downwards (Figures 7.47, 7.48). Using a single light source the model was illuminated at an incident angle of 45° regarding both of

the positions (CIBSE suggests that the incident angle, for spotlighting from below, should be 45° - 60°). Two pairs were prepared for the front and backside views. For the front view pair, the model that demonstrates lighting from downwards is positioned on the left side of the screen and on the right side model that is lit from upwards is located. To avoid familiarity, the placement was shifted for the backside views.

The distribution of preferences for the seventh question is as follows:

Question 7 - Distribution of front view preferences

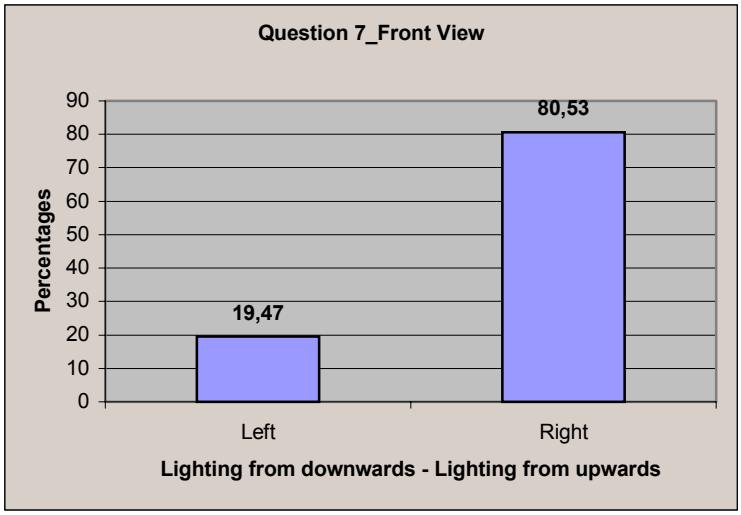

Fig. 7.49

Question 7 - Distribution of backside view preferences

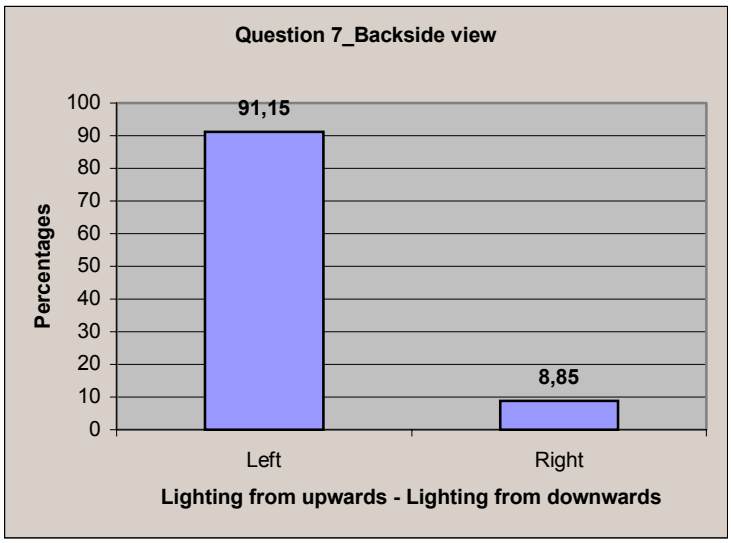

Fig. 7.50

80% of the subjects favored lighting from above for the effective perception of the monument. The rate increased to 91% for the backside view. Although the results significantly indicate that lighting from upwards is preferred by the interviewees, most of the monuments in Ankara are lit by spotlighting from below (Figures 7.51, 7.52) resulting in unpleasant schemes.

The eighth question, like the second one, was concerned with finding an accurate lighting direction that would properly reveal the intended meaning. The second question contained the daylight appearance of the model on 21st March. Whereas the eighth one employed artificial lighting treatments, in which the model was illuminated from upwards and downwards similar to pairs in seventh question. The conceptual approach of the artist was reminded to the interviewees and they were asked to choose the lighting direction that is revealing the intention appropriately (Fig. 7.53).

The results are indicated below:

Question 8 – Distribution of preferences

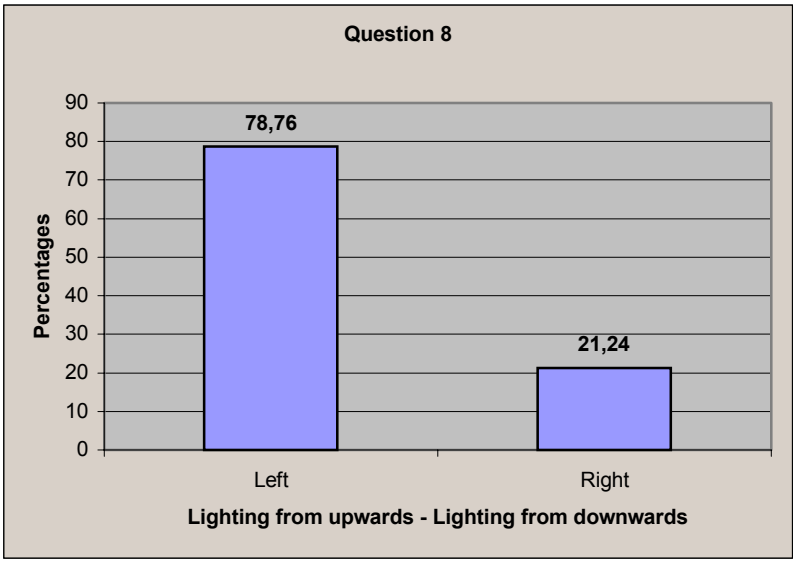

Fig. 7.54

The half radial shape, indicating the concept, is located on the top of the monument and can be clearly perceived from the front side (east direction). To illuminate this portion effectively, it should be lighted from upward direction. The results pointed out a distribution pattern parallel to this statement; 79% of the interviewees selected lighting from upwards (Fig. 7.54). When compared with the seventh question, an increase is observed in the number of interviewees selecting the scheme with downward lighting. As mentioned beforehand, perception is a complicated and sophisticated process, involving a range of variables (pg. 90). Therefore the increase can be explained by the diversity of aesthetical evaluations and psychological concerns of the interviewees.

The last question, comprised the Hacettepe University Monument. The monument is oriented towards south direction. Therefore, the daylight modeling conditions are very different when compared with the Bilkent Monument. To discuss the affects of orientation on daylight modeling, the model of the monument was photographed from 10 to 14 o'clock on the solstices and equinoxes using the sundial. Similar to the sixth question, they were grouped according to the front and backside views (Figures 7.55, 7.56, 7.57, 7.58, 7.59, 7.60). Again the interviewees selected one photograph from each group denoting the condition under which the monument is best perceived.

The answers to the ninth question indicated that the modeling on the south oriented monument does not change drastically and the photographs

indicate that the modeling on the front side (south oriented) is always effective. The distribution of the preferences among front views draws out no significance on 21st March and on 21st December. However, 55% of the subjects had chosen 10:00 o'clock in June, which could be the outcome of photographic difference in the ninth question. As the sunlight was directed towards the camera's lens, the setting could not be captured effectively which may affected the preference pattern.

Therefore, the distribution could be similar to the other months' profile. As a solution to this problem, a wide-range observation from sunrise to sunset should be carried out.

Question 9 – Distribution of front view preferences

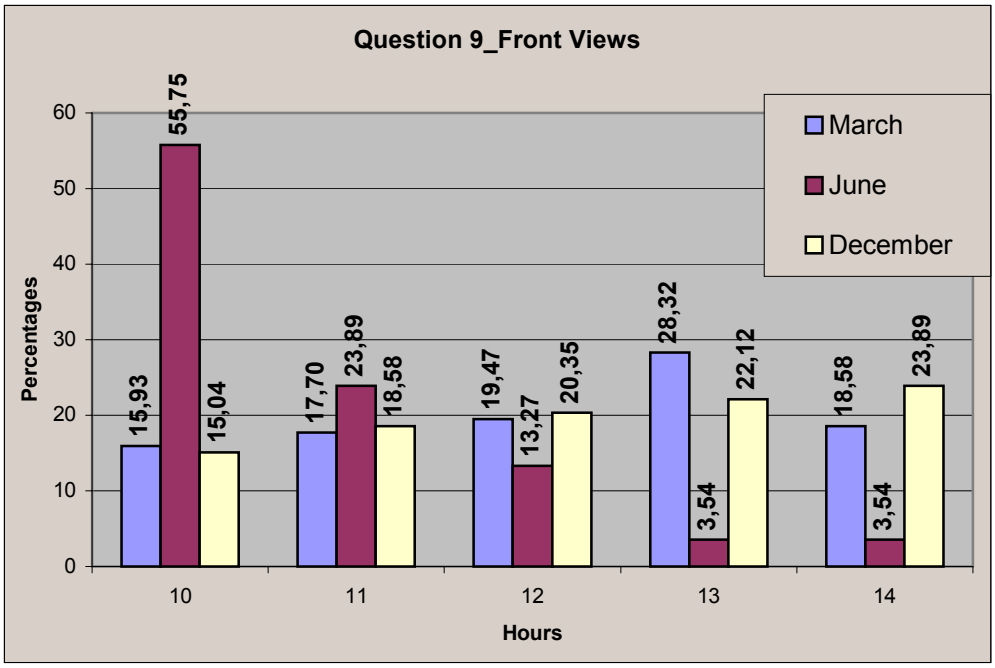

Fig. 7.61

When the subjects were asked to prefer amongst the backside views they indicated that it was difficult to perceive the monument and was not

possible to distinguish the details. Since the light is coming towards the front face of the monument all the day, the backside contrast level is higher than the limit (40:1 should not exceeded anywhere within normal field of view), resulting in a decrease in the visual performance (Egan, 23). Hence, the preference results are affected from the lens flare, brightness differences, and contrast ratios, rather than the shadow distribution and modeling. Especially in June and December, the facets could not be distinguished and the backside was left in dark. Thus, in December 52%, and in June 54% of interviewees selected 10:00 o'clock which seemed more brighter than the rest. The slight difference can be observed in the results for 21st March. 10:00 o'clock was regarded as the brightest one and at 13:00 o'clock the backside figures could moderately be perceived.

Question 9 – Distribution of backside view preferences

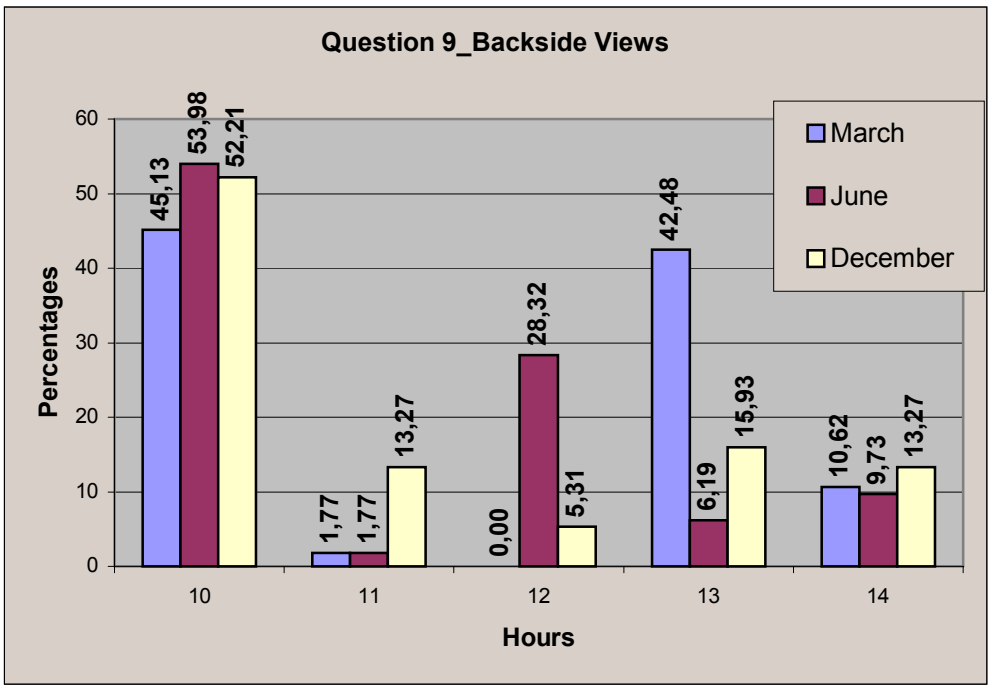

Fig. 7.62

In contrast to the Bilkent Monument, the Hacettepe Monument is illuminated at night. (Fig. 7.3) However, the reflectors illuminating the monument from downwards, generate glare as they are located in the visual field. To examine the lighting condition from upwards, the model is lit from four diagonal points providing 60° of incidence angle. As seen in figure 7.63 when illuminated from upwards the monument is seen more effectively and it is easier to perceive its details.

8. CONCLUSION

This thesis is related with the concept of monument lighting. It focuses on the interaction between two elements of art, light and the monument, and the interaction between human and monument regarding the psychological, physical, and sociological factors.

Monument lighting is more than the calculation of lumens and choosing luminaries, but it rather deals with the proper reveal of meaning. The influence of aesthetics, perception, environmental psychology, and sociology into the field, requires the extensive examination of each artifact within the surrounding it belongs, the context it was produced and information it conveys to public.

The concept of sculpture and monument in Turkish culture is strongly attached to Atatürk and his principles. Conveying the profound events of republic, reflecting the ideologies of Atatürk, and representing his heroic character they appear as important elements in the environment. Therefore, the thesis focused on Atatürk Monuments in Ankara.

The research and case studies aimed to find out and discuss the methods and approaches for effectively illuminating these artifacts. Through the study it has been perceived that monument lighting in Ankara has not been considered as an important factor. Although the environment is rich in monuments, nearly none can even be seen properly. The lighted ones present discouraging

schemes for the new projects. The material and the choice of light source do not reflect a reasonable state and mostly the sources are placed at the bottom of the monuments, resulting in grotesque faces, and unperceivable shapes. Yet, they cannot give the appropriate impression through the daytime as a result of orientation problems. The solar information including the sun's rotation is mostly disregarded, resulting in unperceivable dark surfaces through the day.

Furthermore, sculptors do not consider the nighttime vision for their artifacts. The lighting projects should be carried out with the artist at the production stage. In addition to the outlook, an intensive study on the relation with the surrounding elements and the observers would help to achieve a better result.

To improve the current situations, the socio-psychological role of monument lighting might be utilized to inform the public to evoke awareness. The aesthetic and artistic development can be influenced by means of visualizing artifacts that represent a high level of artistic quality.

It is important to draw the public's attention to the importance of outdoor lighting. So lighting designers and sculptors have to be concerned about, bridging the gap between public and monuments. It is also important to enlighten both the sculptures and lighting designers on the subject of monument lighting.

As a result of the case studies, it was found that illuminating the monument from upwards is preferable to lighting it from downwards. The attempt to illuminate the monument at night by utilizing a specific daytime condition needs an intensive study on sunlight and solar position with respect to site location and artifact's setting. Moreover, the chosen situation, such as choosing the solar position for 21st June at 11.20 am, gives the accurate solar azimuth and altitude angles to be utilized in calculating the pole location and luminaire installation height. However, this particular time reflects just a specific minute or hour concerning the whole year. Also the selected interval would limit the positions of perception, although the monument would grant several locations of observation. Despite of all these contrariness, it is the designer's choice to propose an imitation of daylight. For instance the frontal view, or the face of the monument can be assumed as the center of attention and the daylight calculations could be carried regarding that point of view. Moreover, the case studies has put forward that the orientation scheme of a monument should entail an intensive observation on solar path.

Consequently, different monuments demand different solutions; therefore each monument has its unique solution. Each proposed scheme should be explored down to basic elements to decide on the best way to treat each of them; and then appropriate products that will provide the best solution should be selected; regarding their intensities, color temperature and color rendering indexes, filters, forms, distribution characteristics etc.

For the Bilkent Atatürk Monument, possibilities of dramatization effects should be discussed. An appropriate color temperature or a filter selection would add a symbolic meaning to the Monument and to the entrance of the University. It is difficult to perceive the monument from a distance, because of the flagpoles and main gate structure. Therefore, the setting should be redesigned. The color change would accentuate the artifact from a distance and would attach a strong character. Besides, the colors can be utilized to emphasize the seasonal changes. Moreover, on special occasions and events, son et lumiére performances can be utilized, sequencing the sound and light patterns to re-create the historical stories.

For the Hacettepe Monument the lighting pattern should be reconsidered to illuminate the artifact from a certain height. As the monument is located between the university buildings, its lighting should be considered as a complementary pattern with the building floodlights.

The current study is limited with two cases. Another further step may be to work on this subject utilizing several monuments in order to make discussions on various approaches.

In this study, the lighting models were limited in the lamp type. Neither color filters, nor different color temperatures could be utilized. As a further study, the lighting treatments would be prepared with more variables and using detailed models of the monuments. As the scale of model decreases, the details diminish, resulting in the difficulty to resemble the outcome with the real

situation. Different light sources, especially fiber optic ones, would give a chance to approach to the problem more extensively. The increase in the variables would suggest making evaluations on the perception types of the respondents. For instance by the representation of dramatic conditions to subjects by using color differences, it would be possible to detect different dynamics in their perceptional patterns.

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APPENDIX A

QUESTIONNAIRE

AD ve SOYAD:

EĞİTİM:

YAŞ: CİNSİYET: E K

1. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

Ön: 6 7 8 9
10 11 12 13
14 15 16 17
18

Arka: 6 7 8 9
10 11 12 13
14 15 16 17
18

2. Anıtta Atatürk'ün başının üzerindeki yarı dairesel şekildeki ışınların vurgulanması önemlidir.
Bu doğrultuda sizce ekrandaki fotoğraflardan hangisinde bu vurgu en iyi şekilde yakalanmıştır?

Ön: 6 7 8 9
10 11 12 13
14 15 16 17
18

3. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

Ön: ☐ ☐

Arka: ☐ ☐

4. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

Ön: ☐ ☐

Arka: ☐ ☐

5. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

Ön: ☐ ☐

Arka: ☐ ☐

Ön: ☐ ☐

Arka: ☐ ☐

6. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

M	H	A
Ön: 9 10 11 12 13 14 15	Ön: 9 10 11 12 13 14 15	Ön: 9 10 11 12 13 14 15
Arka: 9 10 11 12 13 14 15	Arka: 9 10 11 12 13 14 15	Arka: 9 10 11 12 13 14 15

7. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

Ön: ☐ ☐

Arka: ☐ ☐

8. Anıtta Atatürk'ün başının üzerindeki yarı dairesel şekildeki ışınların vurgulanması önemlidir.

Bu doğrultuda sizce ekrandaki fotoğraflardan hangisinde bu vurgu en iyi şekilde yakalanmıştır?

Ön: ☐ ☐

Arka: ☐ ☐

9. Ekranda görülen fotoğraflardan hangisinde anıtı en iyi şekilde algılıyorsunuz?

Ön:	10	11	12		Ön:	10	11	12		Ön:	10	11	12
	13	14				13	14				13	14	
Arka:	10	11	12		Arka:	10	11	12		Arka:	10	11	12
	13	14				13	14				13	14	
		M						H				A	

APPENDIX B

FIGURES

The Batıkent Atatürk Monument

Figure 1.1

The Ulus Atlı Atatürk Monument

Figure 1.2

The Zafer Monument

Figure 1.3

The Atatürk Monument – Bakanlıklar

Figure 1.4

The Abdülaziz Monument

Figure 2.1

The Sarayburnu Atatürk Monument

Figure 2.2

Laocoön's expressions under changing illumination

Laocoön's many expressions brought out by changing illumination, 1913.

Figure 2.3

The Lincoln Memorial

Figure 2.4

The Samsun Atlı Atatürk Monument

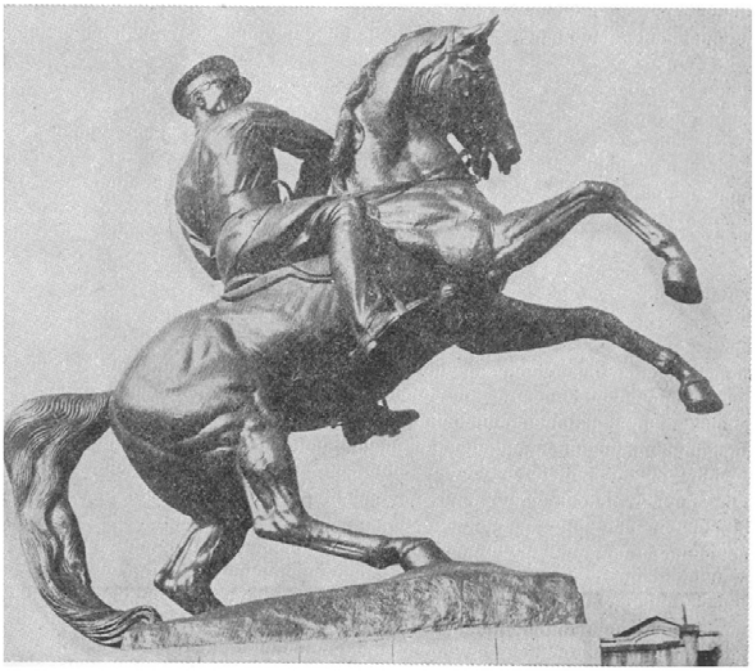


Figure 3.1

The Ministry of Education Atatürk Monument

Figure 3.2

The Bilkent Atatürk Monument – Front View

Figure 4.1

The Bilkent Atatürk Monument – View from roundabout

Figure 4.2

Prof. Dr. Hüseyin Gezer's workshop lighting conditions

Figure 4.3

The Ministry of Finance Atatürk Monument

Figure 5.1

The Dikmen 27 Aralık Monument - Setting

Figure 5.2

The Dikmen 27 Aralık Monument – Front View

Figure 5.3

Michelangelo's David

Figure 5.4

Gypsum model of Atatürk with negative molding pattern

Figure 5.5a

Gypsum model - changing expressions from different viewpoints

Figure 5.5b

Movement of the sun with respect to the Bilkent Monument

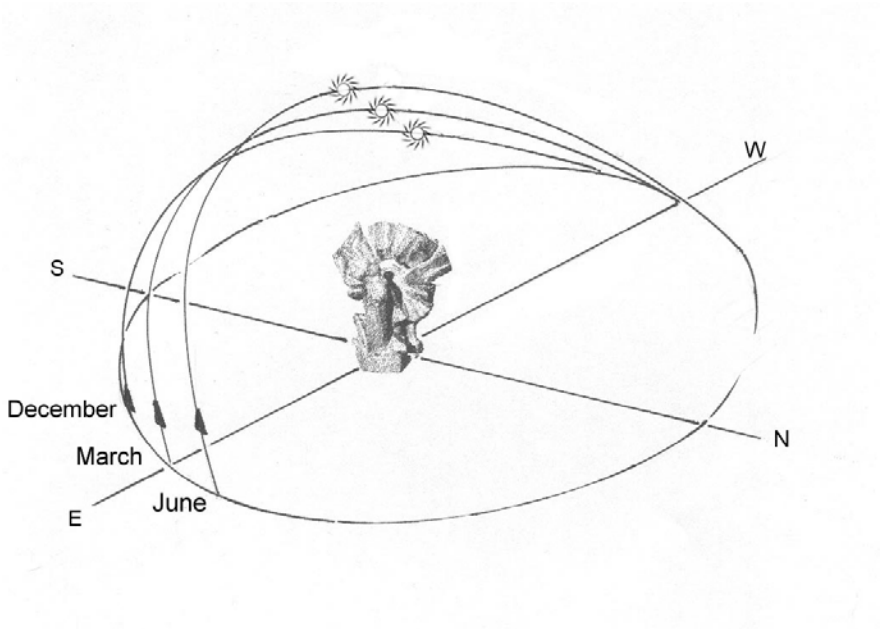


Figure 5.6

The Air Force Headquarters Atatürk Monument – view a

Figure 5.7

The Air Force Headquarters Atatürk Monument – view b

Figure 5.8

The Air Force Headquarters Atatürk Monument – view c

Figure 5.9

Binocular visual field

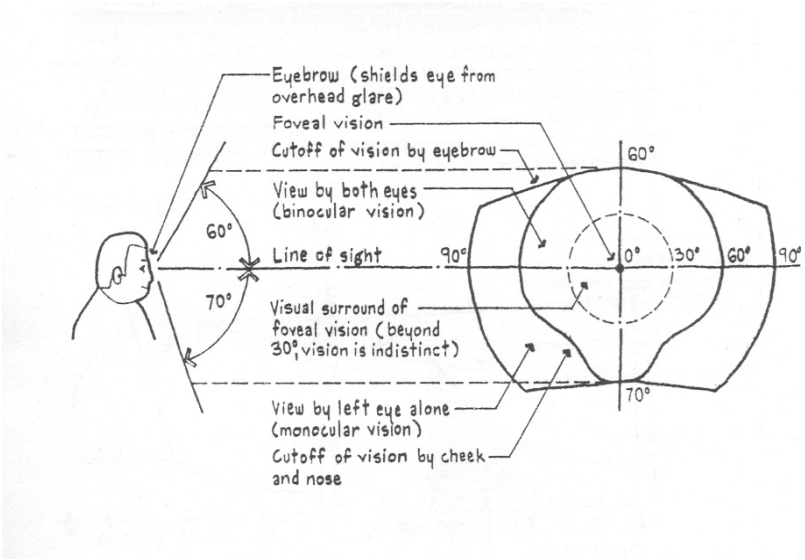


Figure 6.1

Illustration of direct glare occurrence

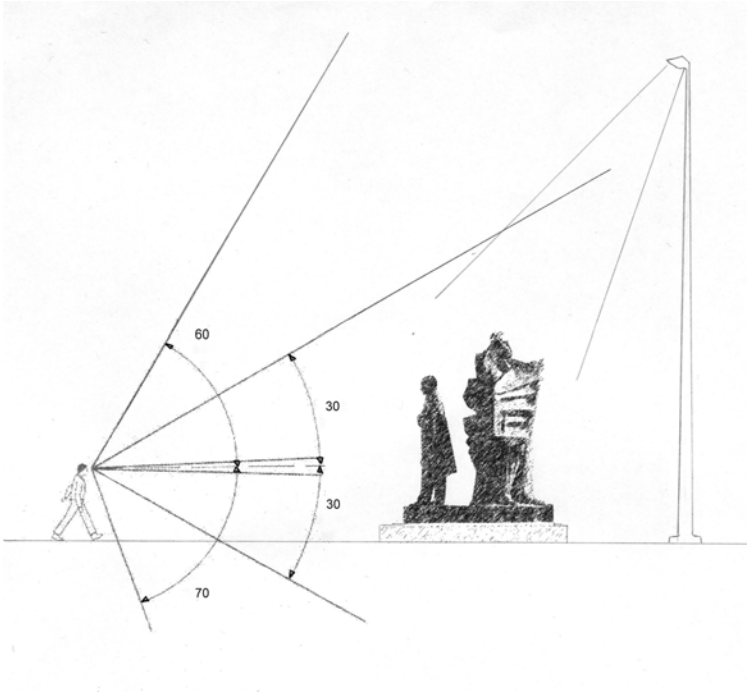


Figure 6.2

The Tarımcı Atatürk Monument

Figure 6.3

The Atatürk Monument – Mithatpaşa Boulevard

Figure 6.4

Modeling techniques in revealing human form

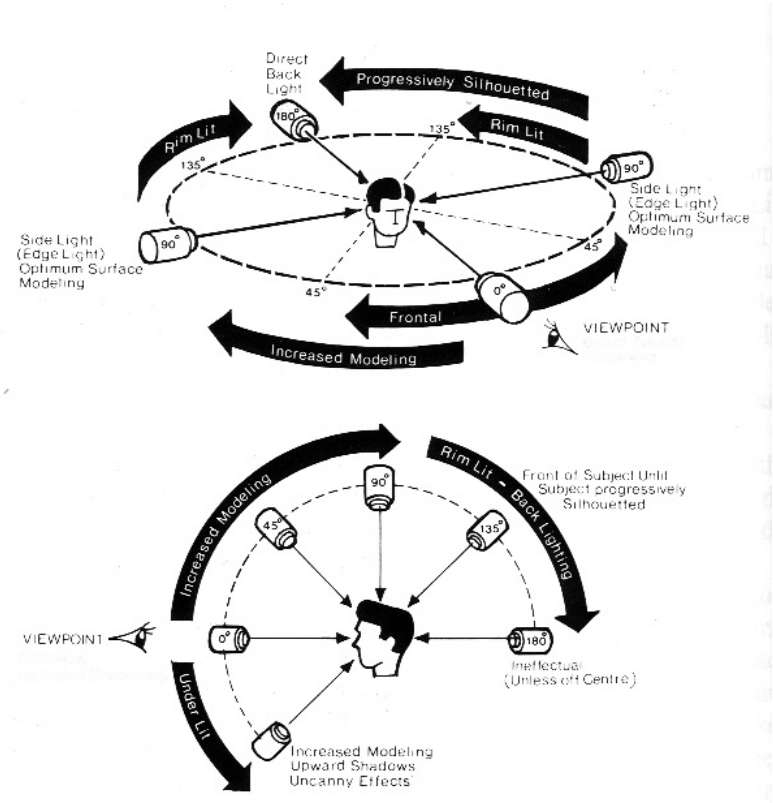
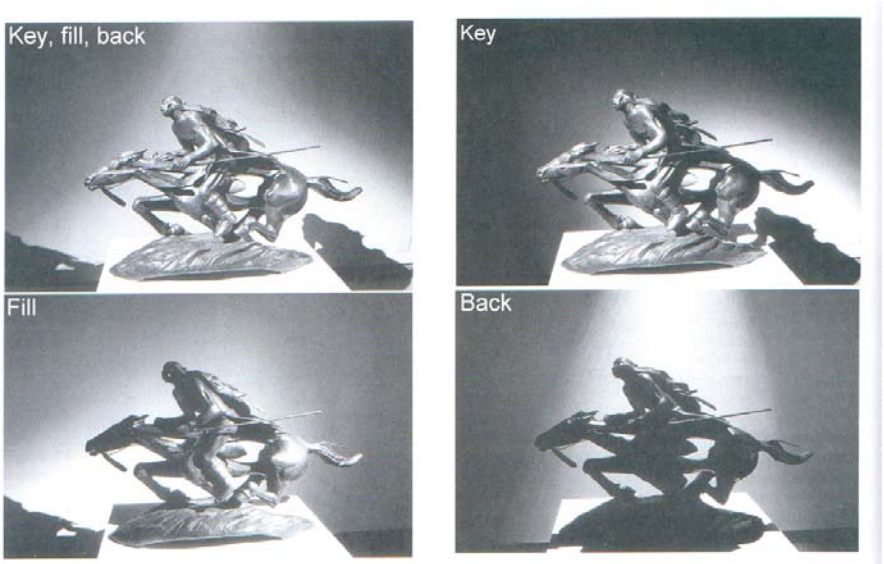


Figure 6.5

Effects of key, fill and back light



Sculpture lighting: Alan Houser's Apache Warrior. Los Angeles County Museum of Natural History, 1982. (a) Key, fill and back light. (b) Key light only. (c) Fill light only. (d) Back light only.

Figure 6.6

Recommended incident angles

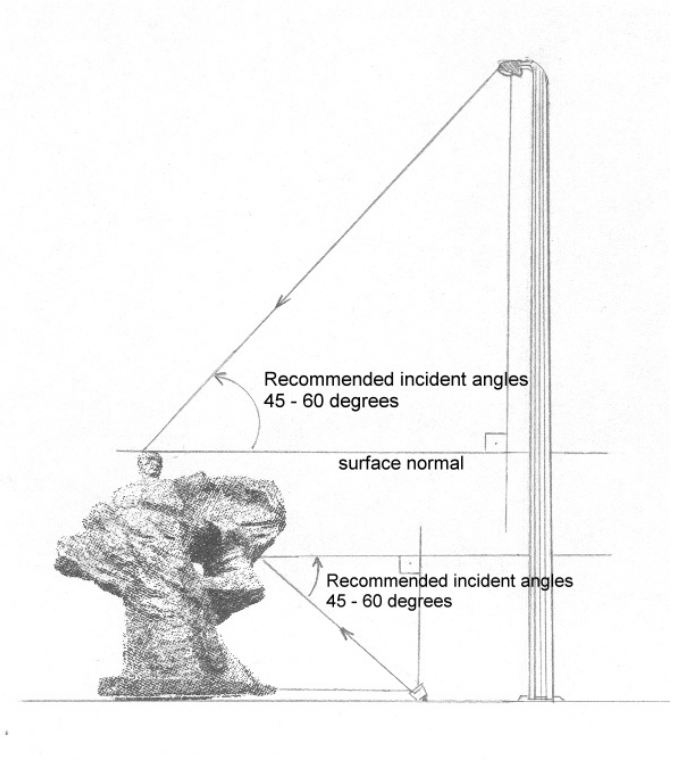


Figure 6.7

The Gazi University Atatürk Monument – view a

Figure 6.8

The Gazi University Atatürk Monument – view b

Figure 6.9

Effects of brightness differences

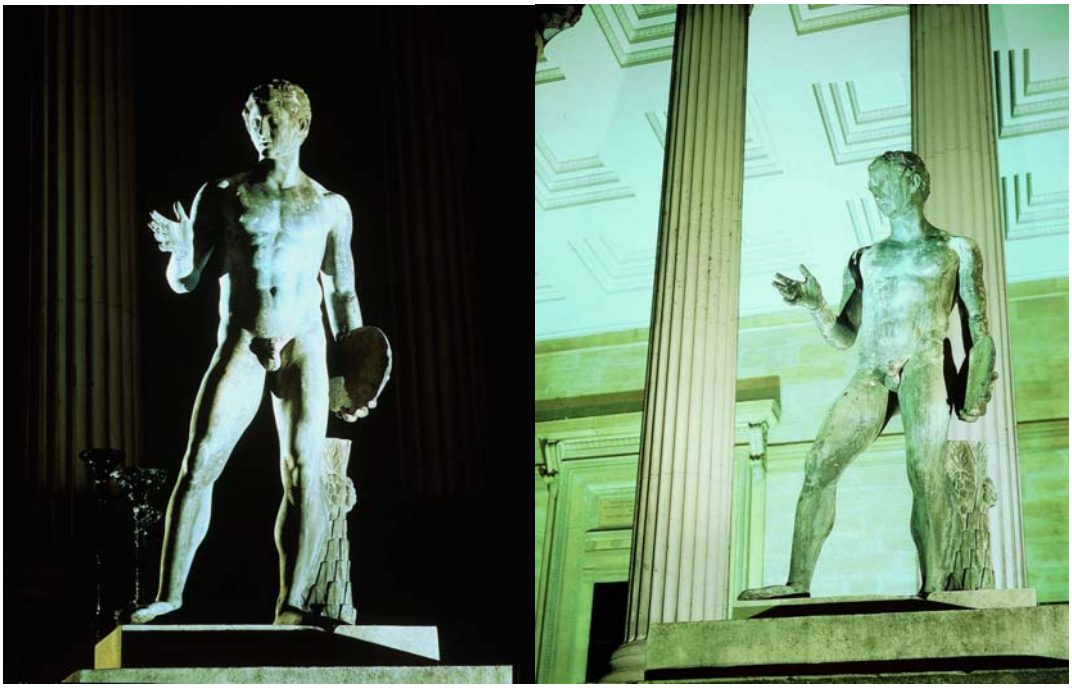


Figure 6.10

Kruithof Curve

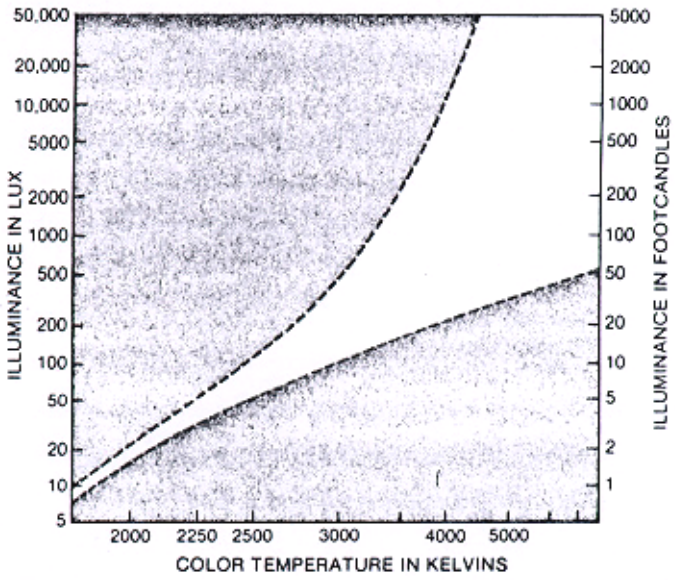


Figure 6.11

Color appearance in combination

Figure 6.12

General characteristics of commonly used light sources

Figure 6-3. General Characteristics of Commonly Used Light Sources*
(This table is intended to show the wide range of parameters available for lamp products. A specific example has been chosen for each source type.)

Source Type and Correlated Color Temperature	Lamp Watts	Initial Lumens	Efficacy (LPW)[1]	Lumen Maintenance[2]	Life (Hours)	CRI	Starting and Warmup Time[3] (Minutes)	Dimming Range (Percent Light Output)
Standard incandescent filament, 2700 K	100	1690	17	85	750	100	0	100–0
Tungsten-halogen (linear), 2950 K	300	6000	20	95	2000	100	0	100–0
Tungsten-halogen (reflector), 2850 K	90	1280[5]	14	95	2500	100	0	100–0
Tungsten-halogen (low voltage reflector), 3000 K–3200 K	50	900[5]	18	95	4000	100	0	100–0
Fluorescent T-5 4 ft,[7] 3000 K–4100 K	28	2900[8]	104	95	20,000	85	0	100–1
High output fluorescent T-5 4 ft,[7] 3000 K–4000 K	54	5000[8]	93	95	20,000	85	0	100–1
Fluorescent T-8 4 ft, 3000 K–4100 K	32	2800	88	85	20,000	75	0	100–1
Reduced wattage T-12 4 ft, 3500 K	34	2800	82	85	20,000	73	0	N/A[9]
Slimline reduced wattage 8 ft, 3000 K–5000 K	60	6900	96	80	12,000	85	0	N/A[9]
High output reduced wattage 8 ft, 4100 K	95	8000	84	75	12,000	62	0	100–1
Compact fluorescent (long twin), 3000 K–4100 K	38	3300	87	85	20,000	82	1	100–5
Compact fluorescent (double), 2700 K–4100 K	26	1800	70	85	10,000	82	1	100–5[4]
Mercury vapor, 6800 K	175	7900	45	60	24,000	20	< 10	100-10
Metal halide, low wattage, 3200 K	100	8075	81	85	10,000	70	< 5	100–50[6]
Metal halide, high wattage, 4000 K	400	36,000	90	80	20,000	65	< 10	100–50[6]
HPS, low wattage, 2100 K	70	6300	90	90	24,000	21	< 5	100–50[6]
HPS, high wattage (diffuse), 2100 K	250	26,000	104	90	24,000	21	< 5	100–50[6]

* See manufacturers' catalogs for specific data.
1. Efficacy for lamp is shown. Ballasting is required for all lamps except standard incandescent and tungsten-halogen.
2. Percent of initial lumens for illuminance calculations.
3. Time interval to reach usable light output.
4. Four-pin lamp required.
5. The important performance parameters for reflector lamps are beam angle and maximum center beam intensity.
6. Dimming below the lower value results in significant color shift.
7. Exact lamp length is 1149 mm.
8. Lumen output measured at 35°C (96°F) ambient.
9. Dimming ballasts are currently not available for this lamp.

Figure 6.13

The Bilkent Atatürk Monument – Backside V-shaped view

Figure 7.1

Prof. Dr. Hüseyin Gezer's lighting proposal sketch

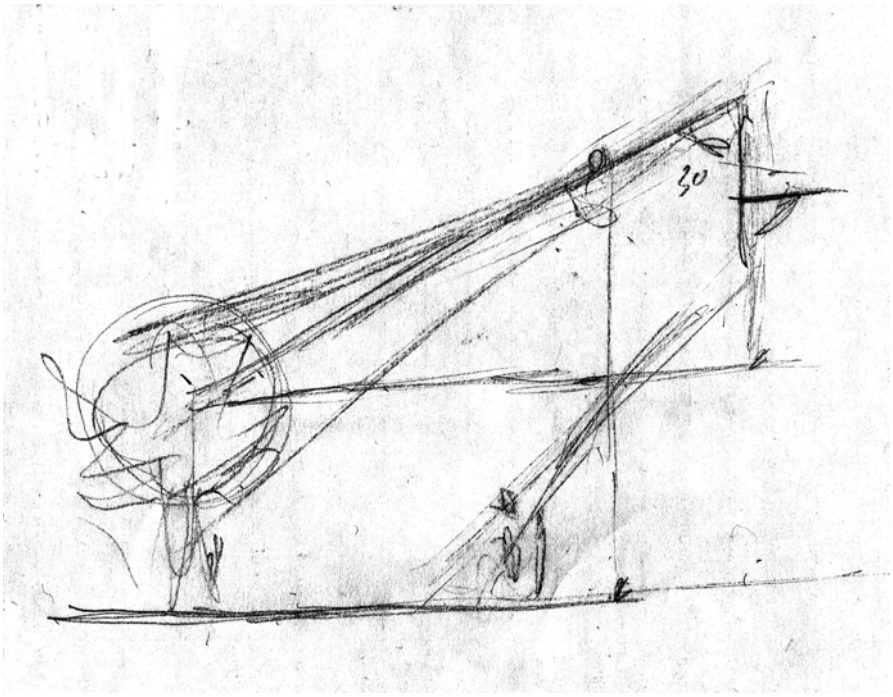


Figure 7.2

The Hacettepe Bayraklaşan Atatürk Monument – environmental setting

Figure 7.3

Lighting proposal for Bilkent Atatürk Monument and site plan

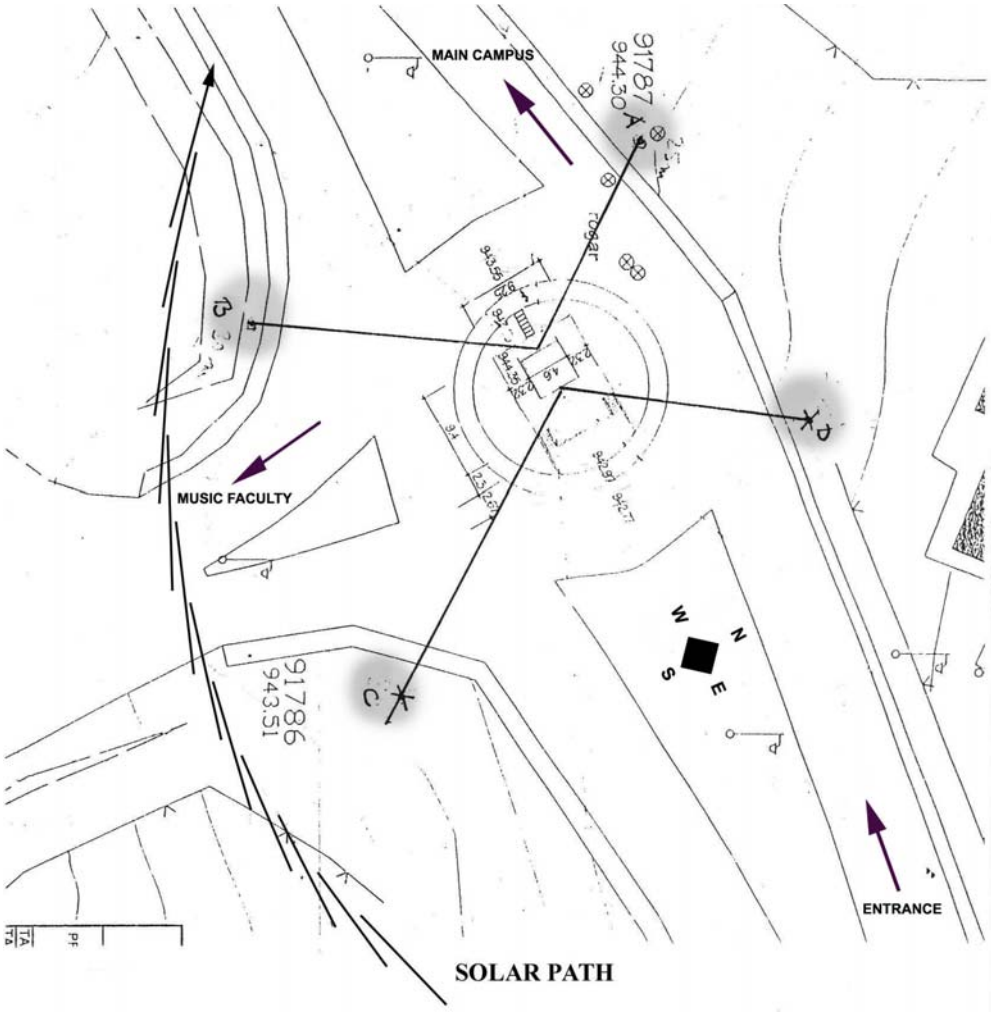


Figure 7.4

Illustration of proposed pole locations with respect to monument

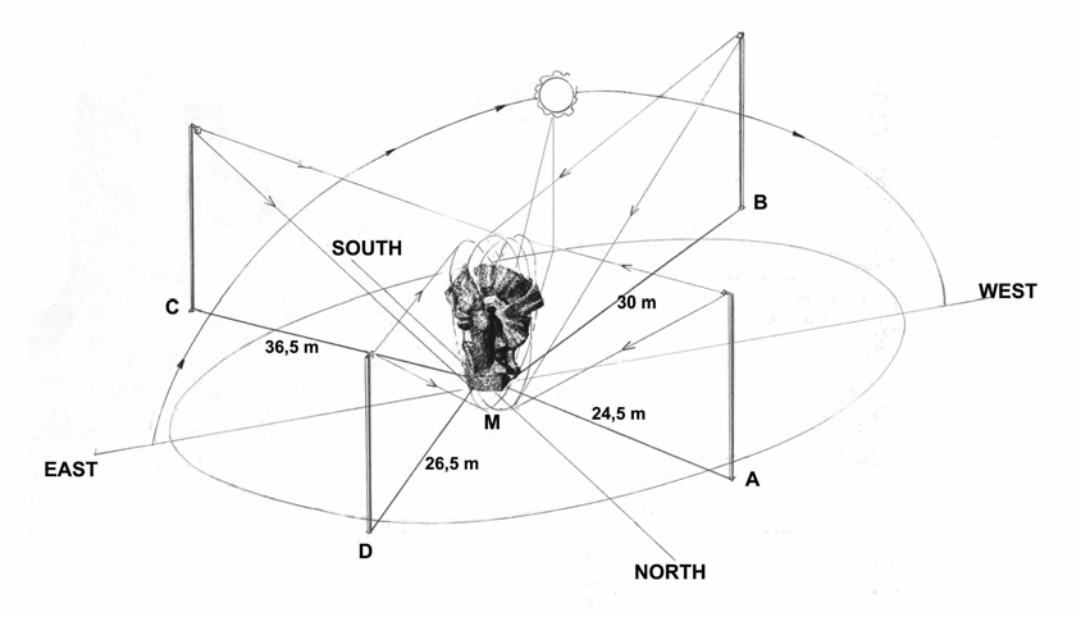
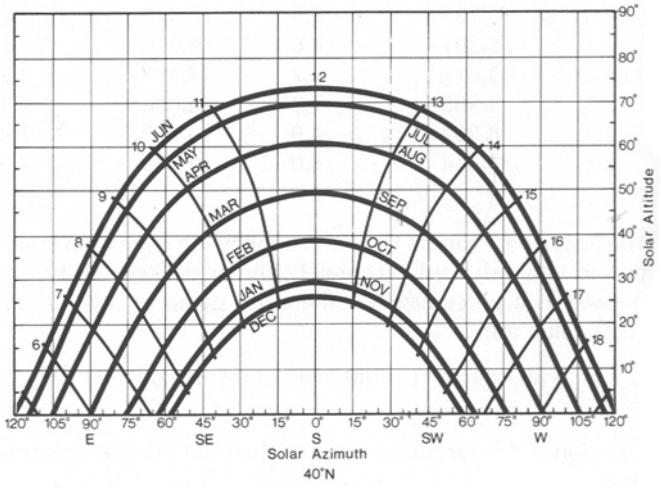


Figure 7.5

Sun path diagram for 40° northern latitude



Sun path diagram: 40° latitude, north.

Figure 7.6

Altitude and bearing angles for 30°- 46° northern latitude

North latitude	Solar angle (degrees)	Winter solstice (21 Dec.) 6 a.m. 6 p.m.	8 a.m. 4 p.m.	10 a.m. 2 p.m.	Noon	Spring equinox (21 Mar.) Fall equinox (21 Sep.) 6 a.m. 6 p.m.	8 a.m. 4 p.m.	10 a.m. 2 p.m.	Noon	Summer solstice (21 June) 6 a.m. 6 p.m.	8 a.m. 4 p.m.	10 a.m. 2 p.m.	Noon
46°	altitude (α)	–	2	15	21	–	20	37	44	17	37	57	67
	bearing (β)	–	52	28	0	90	67	39	0	107	88	58	0
42°	altitude (α)	–	4	19	25	–	22	40	48	16	38	60	71
	bearing (β)	–	53	29	0	90	69	41	0	108	89	63	0
38°	altitude (α)	–	7	23	28	–	23	43	52	14	37	61	75
	bearing (β)	–	54	30	0	90	71	43	0	109	90	70	0
34°	altitude (α)	–	9	26	33	–	25	46	56	13	37	62	79
	bearing (β)	–	54	30	0	90	72	46	0	110	95	78	0
30°	altitude (α)	–	12	29	37	–	26	49	60	12	37	63	83
	bearing (β)	–	54	32	0	90	74	49	0	111	99	84	0

Figure 7.7

Sundial

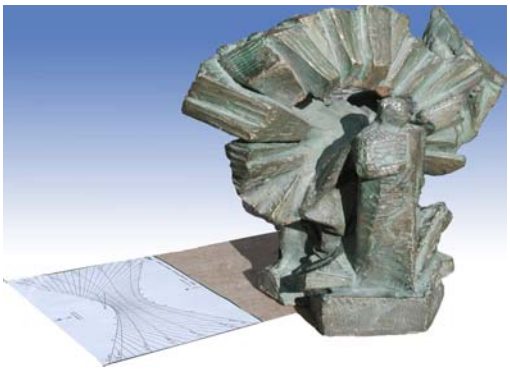


Figure 7.8

Movement of the sun with respect to the Hacettepe Monument

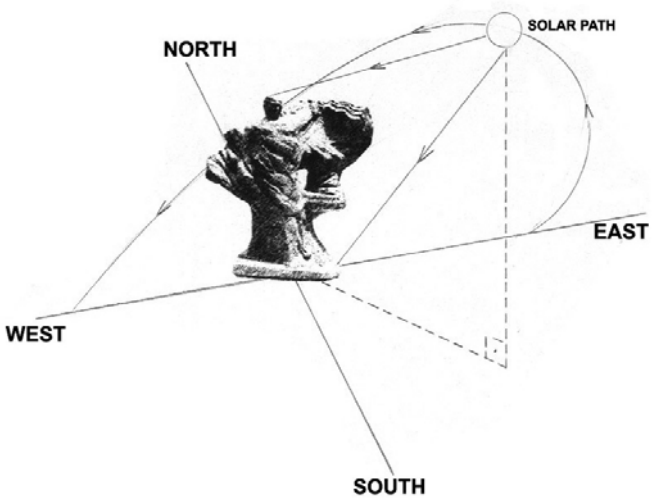


Figure 7.9

Question 1 - Front views

Figure 7.10

Question 1 – Backside views

Figure 7.11

The Bilkent Monument – environmental setting

Figure 7.14

Three representations of 21st March 10:00 am (daylight, sundial, artificial lighting)

Figure 7.15

Question 3 – Front views

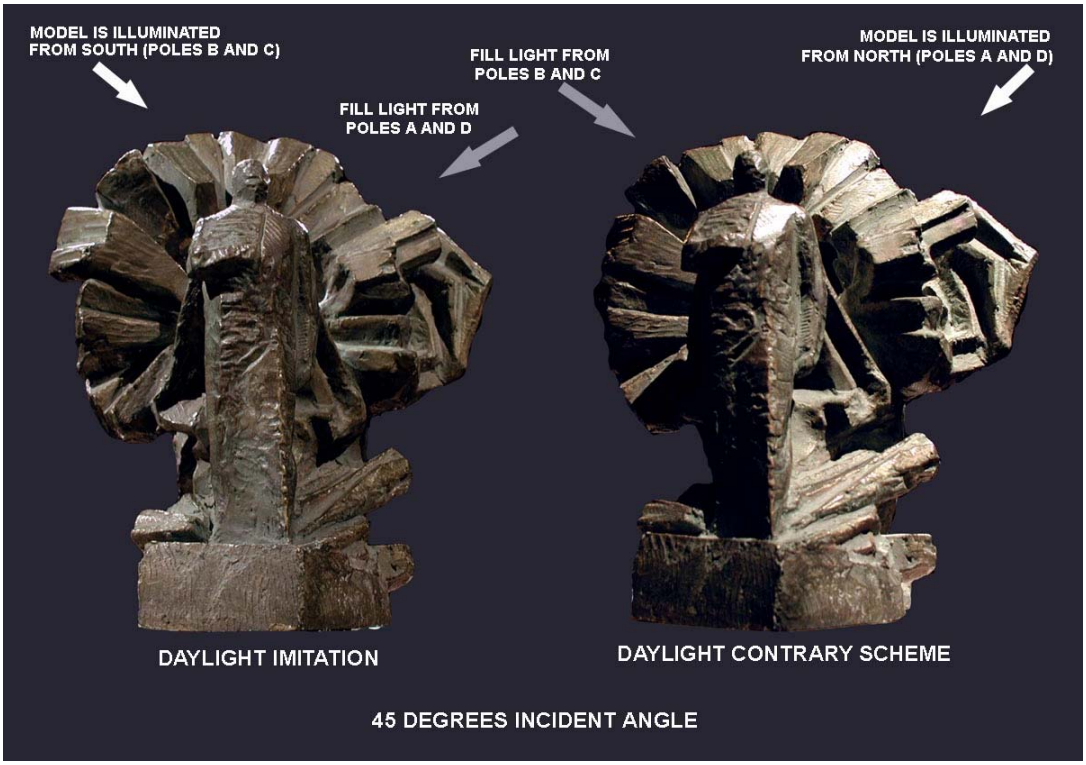


Figure 7.17

Question 3 – Backside views

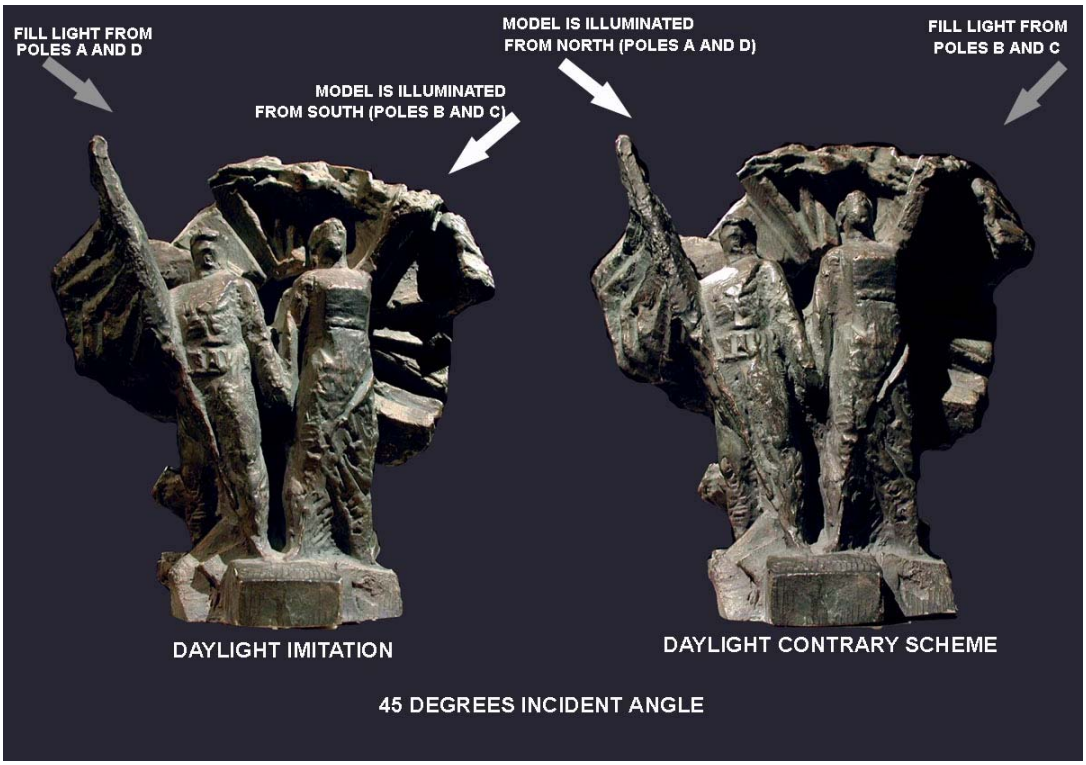


Figure 7.18

Question 4 – Front views

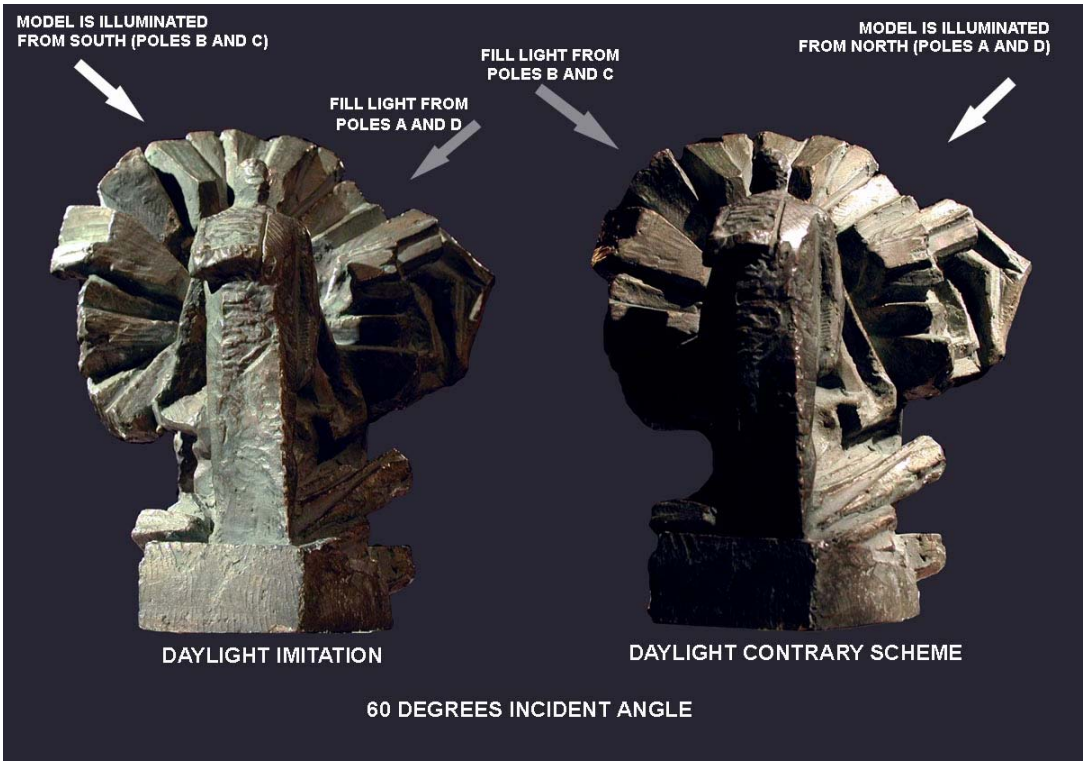


Figure 7.21

Question 4 – Backside views

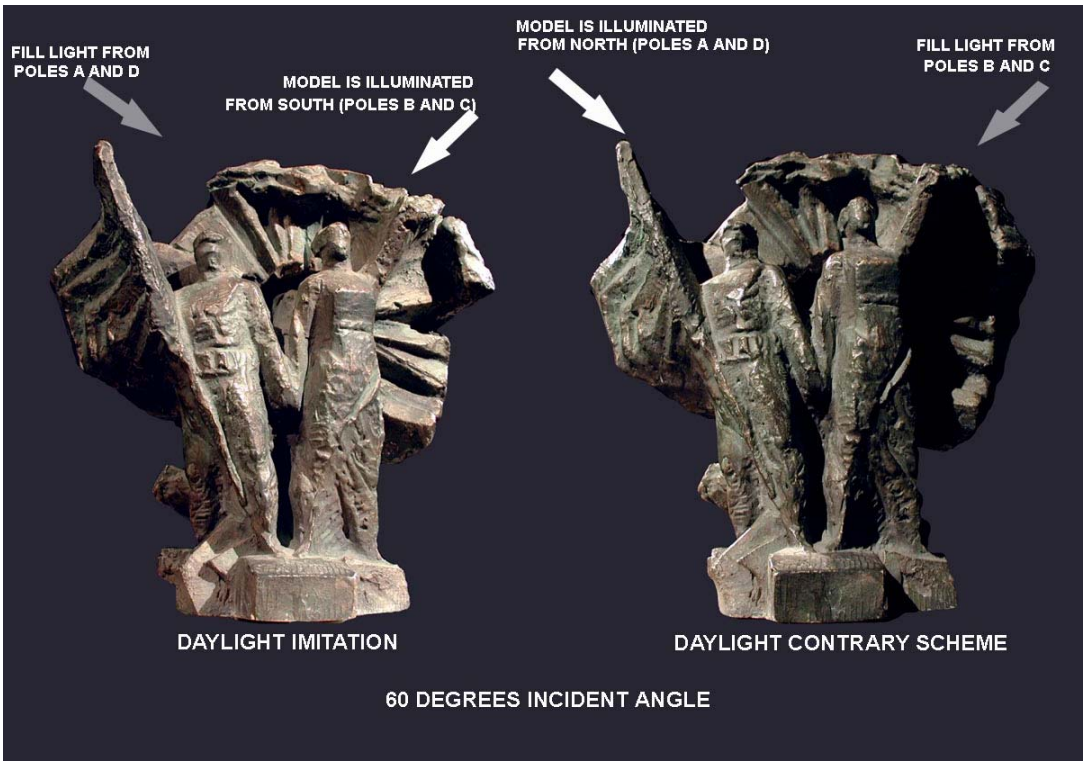


Figure 7.22

Question 5 – Daylight imitation comparison (45° - 60° front views)

Figure 7.25

Question 5 – Daylight imitation comparison (45° - 60° backside views)

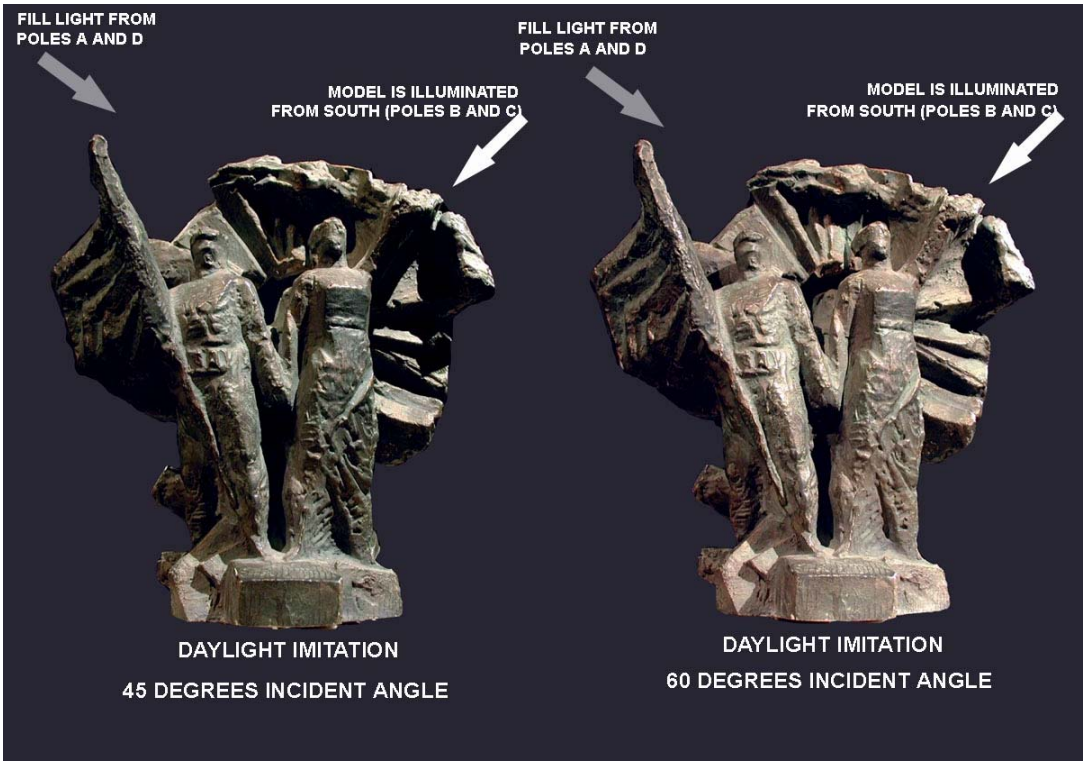


Figure 7.26

Question 5 – Comparison between contrary schemes (60° - 45° front views)

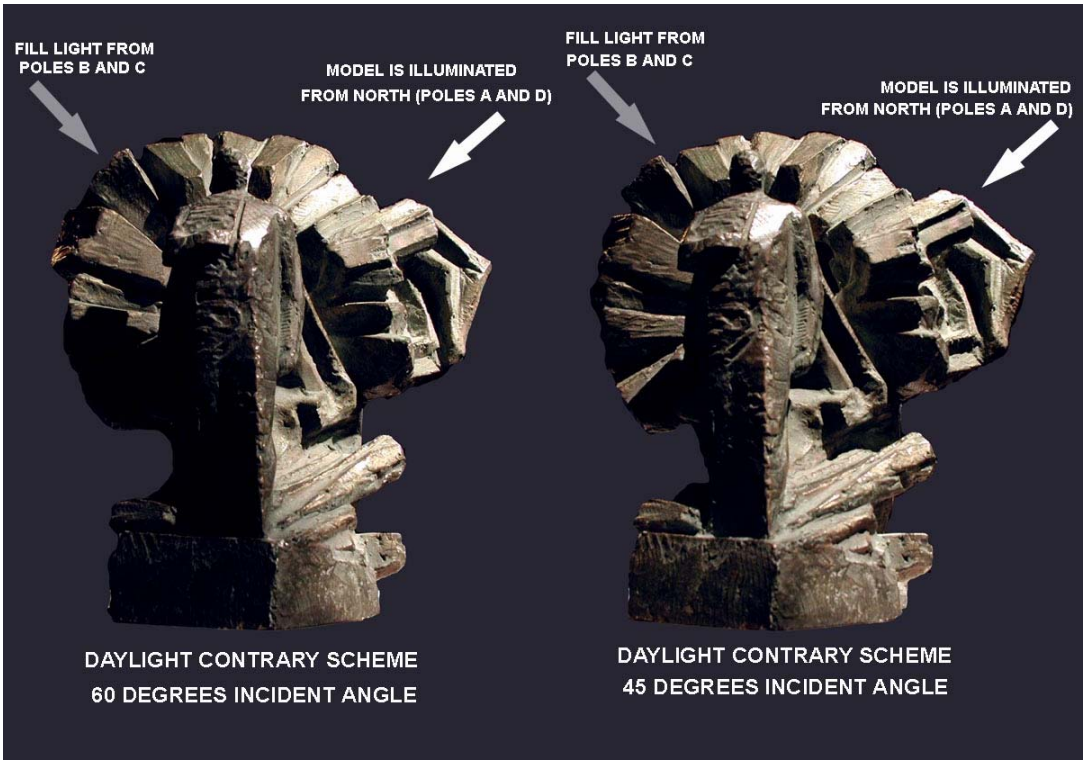


Figure 7.27

Question 5 – Comparison between contrary schemes (45° - 60° backside views)

Figure 7.28

Roundabout view

Figure 7.33

Reflector proposal - Philips SVF 607

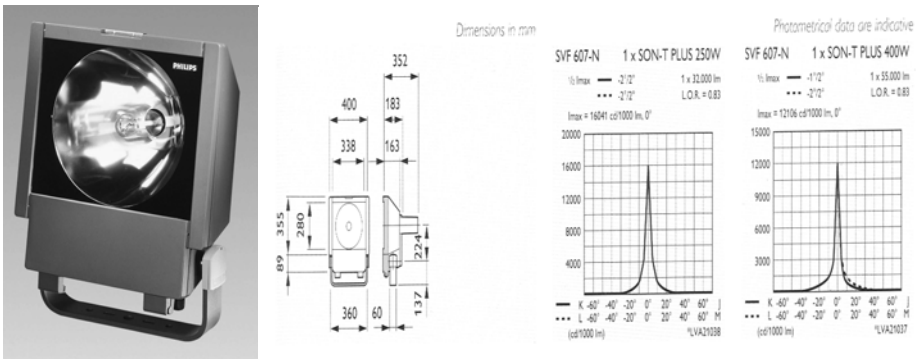


Figure 7.34

Louvers

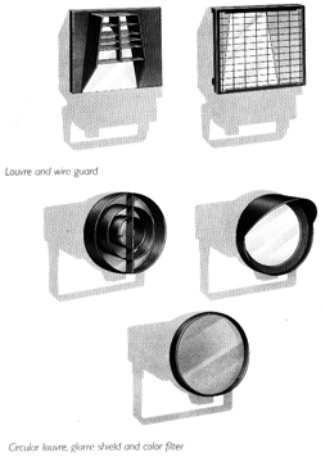


Figure 7.35

Question 6 – 21st March sundial photos (front views)

Figure 7.36

Question 6 – 21st March sundial photos (backside views)

Figure 7.37

Question 6 – 21st June sundial photos (front views)

Figure 7.38

Question 6 – 21st June sundial photos (backside views)

Figure 7.39

Question 6 – 21st December sundial photos (front views)

Figure 7.40

Question 6 – 21st December sundial photos (backside views)

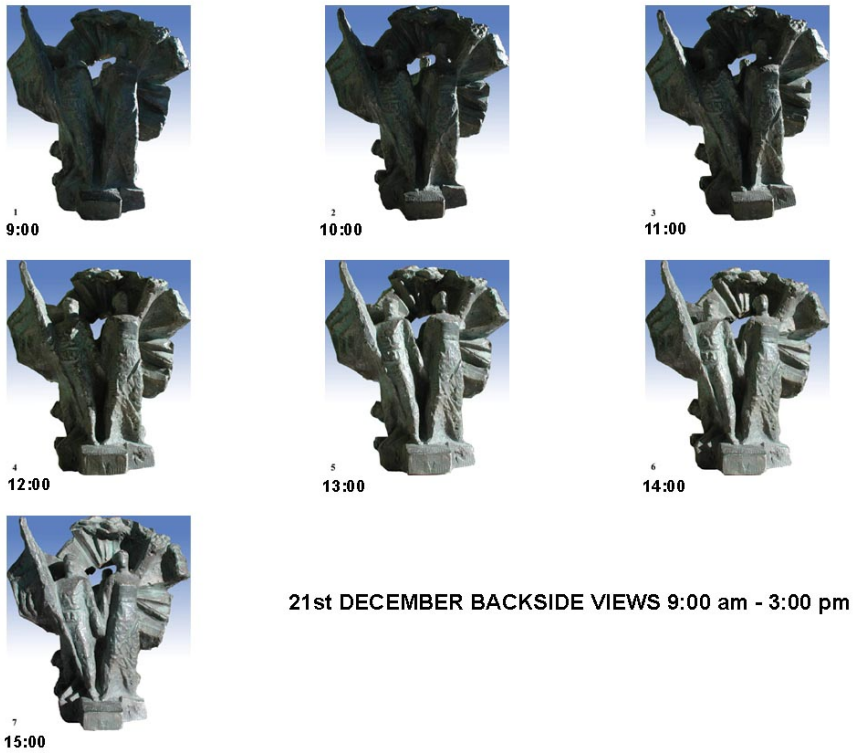


Figure 7.41

Question 7 – Lighting from upwards and downwards (front views)

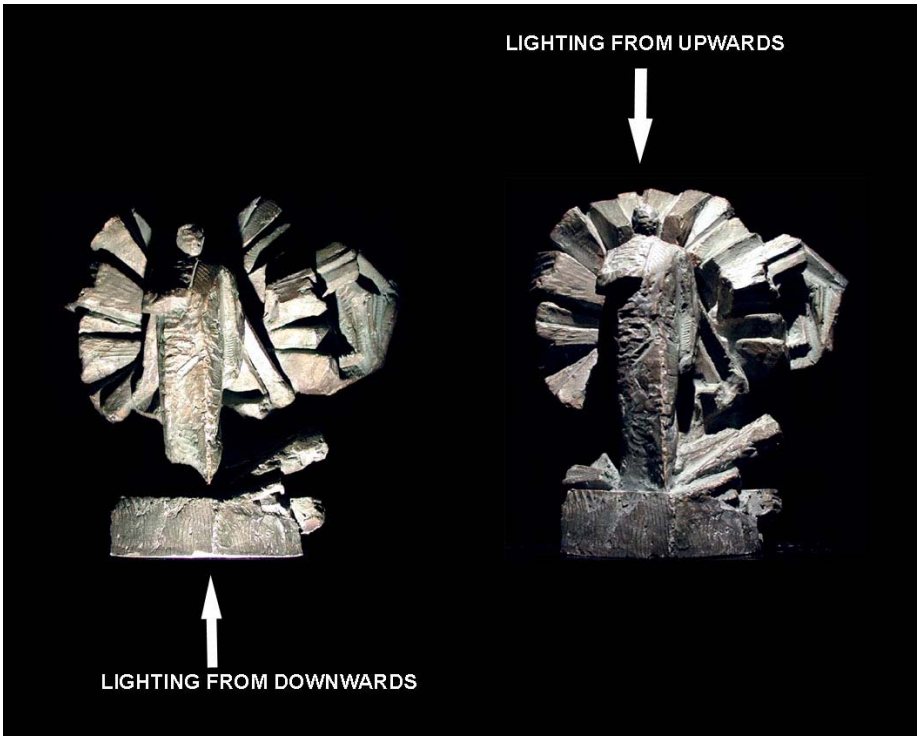


Figure 7.47

Question 7 – Lighting from upwards and downwards (backside views)

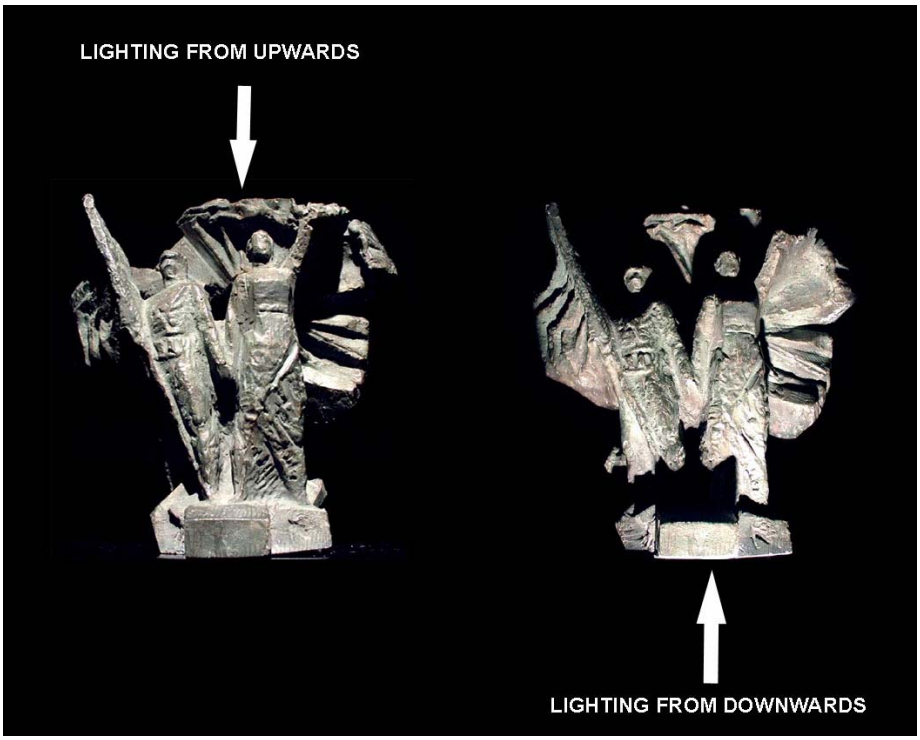


Figure 7.48

The Atatürk Monument - Çankaya

Figure 7.51

The Yenimahalle Municipality Atatürk Monument

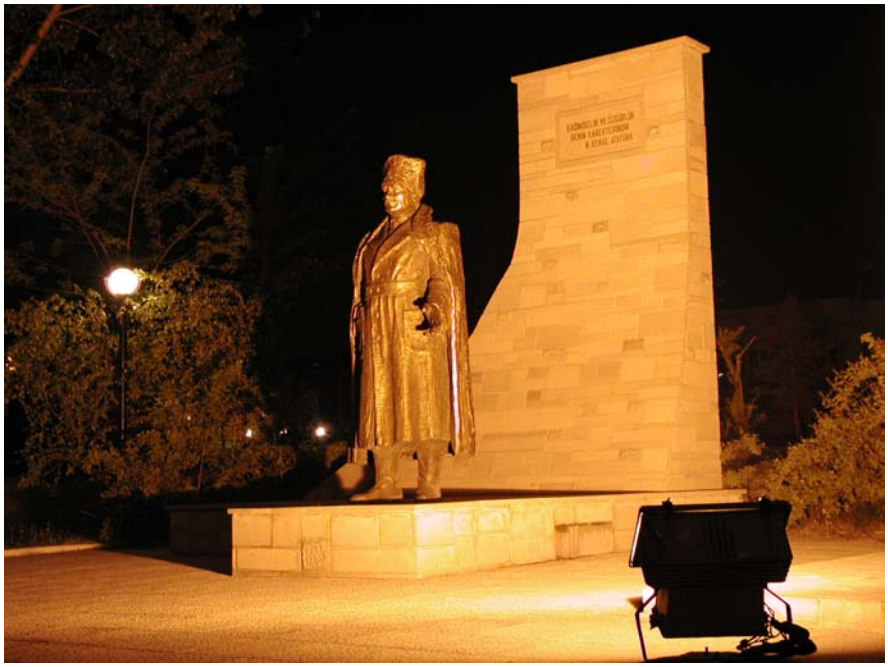


Figure 7.52

Question 8

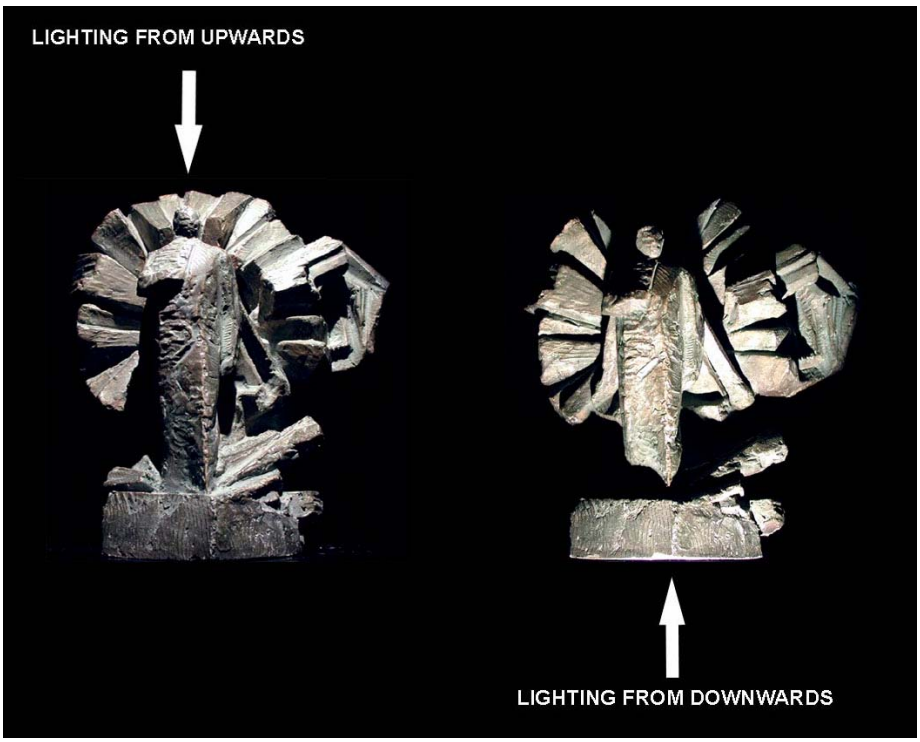


Figure 7.53

Question 9 – Hacettepe Monument 21st March front views

Figure 7.55

Question 9 – Hacettepe Monument 21st March backside views

Figure 7.56

Question 9 – Hacettepe Monument 21st June front views

Figure 7.57

Question 9 – Hacettepe Monument 21st June backside views

Figure 7.58

Question 9 – Hacettepe Monument 21st December front views

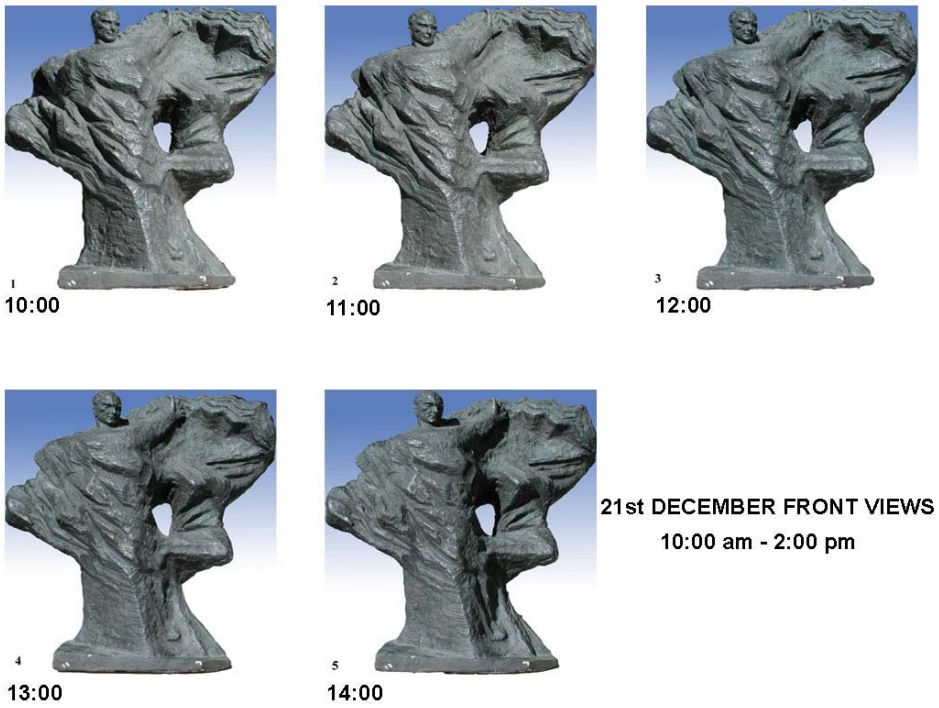


Figure 7.59

Question 9 – Hacettepe Monument 21st December backside views

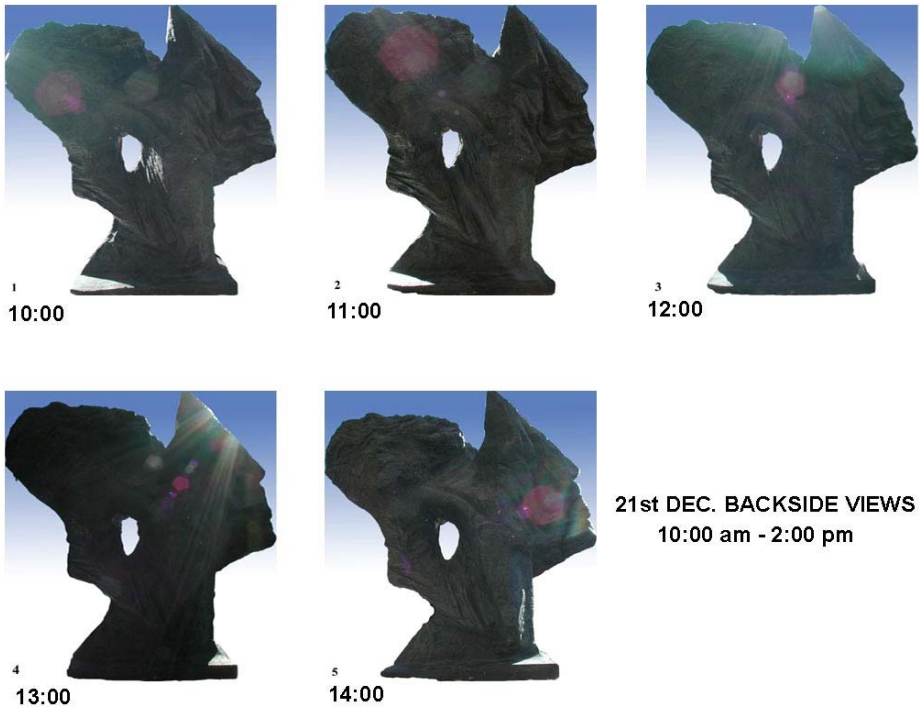


Figure 7.60

Hacettepe Monument – Illuminated from upwards

Figure 7.63