THE HOLY LIGHT: A COMPARISON OF NATURAL AND ARTIFICIAL LIGHT IN A SACRED SETTING

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Abstract

The design of sacred settings can attempt to enrich the inner spiritual experience of the Lord being the Light. It provides natural light to connect to the divine and artificial light to highlight the rituals associated with this connection. The paper attempts to compare these light effects in a sacred setting; and to utilize popular commercial graphic software in the analyses of these effects. Specifically, AutoCAD and Forum Z are utilized to investigate these differences in viewing the dome's fresco in the historic Church of St. Themonianos in Lysi, Cyprus and in the Byzantine Fresco Chapel in Houston, Texas. The study includes three parts: recreation of a digitized model of the historic church in Cyprus; analyses of light effects in both churches; and a comparison of light effects along accepted lighting guidelines. The conclusion of this examination is that both sources of light complement each other in their effects in sacred settings.

1. Introduction

One of the most dramatic effects of light as a visual experience is in the sacred setting. Under the nightmare of darkness, man needs to be given a glimpse of the fire/light descending from above showing the presence of God (Arnold, 1975). "They shine through the darkness, a light for the upright; they are glorious, merciful and just." (Psalm 112:4). Numerous studies such as Hayes (1983), Gelfenbien (1986), and Plummer (1987) demonstrate that light provides premonitions and points of departure for spiritual and mystical transcendence, creating a bridge from the profane (the earthly world) to the sacred (a state of pure light). Thus, a premise can be drawn that the “holy” light dramatizes the spiritual state and affects the mood of the user in the sacred space.

For centuries the source for a holy light was the sun, moon and stars. Louis Kahn described natural light as the only light, because it puts us in touch with the eternal. Yet, over the past hundred years, artificial lighting was developed to replace natural light, and visual design became de facto lighting design as well (Lam 1977; Lou 1996; Lechner 2000). The study’s second premise follows this discussion and posits that there is a difference between artificial light and natural light in creating the visual effect of the “holy” light.

Based on these two premises, the objectives of this study are to compare the effects of natural and artificial light in a sacred setting; and to utilize popular commercial graphic software in the analyses of these effects. Specifically, AutoCAD and Forum Z are utilized to investigate these differences in the Church of St. Themonianos in Lysi, Cyprus and the Byzantine Fresco Chapel in Houston, Texas. These two sacred buildings, which were constructed more than 800 years apart, serve the same faith, are similar in size and scale, and have the same religious icons in the interior: two Byzantine frescos, Christ Pantokrator and Angels (the dome fresco), and Virgin and Archangels (the apse fresco). These two frescos were originally housed in the historic Church in Cyprus. In the 1970’s, thieves removed them in pieces. They were rediscovered and restored in the 1980’s by the Menil Family of Houston, Texas, to be installed in the new Byzantine Chapel in Houston. This study focuses on the effects of lighting on the dome’s fresco (Figure 1). Natural light illuminated the frescos in the Church in Cyprus; while in Houston, the major source of light is artificial lighting.
2. The project’s buildings

The Church of St. Themonianos in Lysi, Cyprus was constructed between 1150 and 1300 with limestone and plastered over on the inside. The building is set so the entrance to the chapel is on the south side and the apse toward the east (Carr 1991). The diameter of the dome at the center of the plan is 250.1 cm with a depth of 98.5 cm. It is built on a high drum pierced with small windows, one at each side of the coordinates. These openings are the main source for the illumination of the dome’s fresco. The Church was documented, but there are no interior photographs of the original church with the frescoes still in place. Therefore, we digitally reconstructed the building, and applied the image of the fresco to the original dome.

The Byzantic Fresco Chapel in Houston, Texas, designed by Francois de Menil in 1997, recreates the original chapel in an abstract way using concrete, rough cut stone, wood, and laminated glass. Moreover, it provides “a new architectural context that would restore the frescoes’ spiritual meaning...” (Giovannini 1997). De Menil has simply extended the effect of the murals by “dematerializing the rest of the chapel with darkness and light” (Giovannini 1997). The building is oriented in the same way as the original building in Cyprus with the apse pointing to the east. The outer concrete shell acts as a support structure for an inner freestanding steel and sandblasted laminated glass structure that holds the frescoes and recreates the original chapel through light (Figure 2).

3. Method and analyses

• Recreation of a digitized 3-D model of the historic Church in Cyprus as if the fresco were still there

The AutoCAD model is based on the known dimensions of the church’s plan, dome (including its depth) and apse. In addition, a four layer system was set up to apply different materials to the surfaces of the ground, walls, ceiling, and dome. Due to the rendering limitation of AutoCAD, Form Z’ was used to simulate the original interior of the building by applying the materials and images to the AutoCAD model surfaces. The image of the fresco was assigned to the dome layer and projected upward onto the surface. This allows the image to take the shape of the dome and properly reflect the light that enters the building.

• Analyses of the light effect on visualizing the dome’s fresco in both Churches

The Church in Cyprus relies only on natural light penetrating through the south entrance, the opening to the east in the apse, and the four small openings in the drum. Form Z was used to simulate and render the effect of light on this Church's dome as if the fresco is still
Form Z allows the designer to place a digitized model almost anywhere and to set up the sun in the right location. The program’s data for Cyprus includes the solar information for Nicosia (Cyprus capital). Since Nicosia is relatively close to Lysi, it served as a surrogate city for this study. A simulation and rendering of the natural light effect on the dome were run for the winter and summer solstice and the fall/spring equinox at different times of the day to try and get the most and least amounts of light that the building may experience (7:00 am, 1:00 pm, 7:00 pm). The results of the lighting simulation illustrate that the best quality of light to view the dome fresco with is found during the winter solstice in the evening. The worst quality of light appears to be during the spring/fall equinox in the middle of the day.

Once the building was digitally constructed, the fresco applied, and the light simulation pictures rendered, the pictures were compared to a documented photograph of the underside of the church’s dome to verify the accurate level of the shadows/lighting as representation of what the real church experiences. Through a comparative analysis of each rendering to this photograph, it appears that the renderings are an accurate representation for this study.

The Chapel in Houston uses artificial light as its major source to illuminate the frescoes and to provide a sense of layering and dematerialization. The interior structure of glass panels, which holds the frescoes, glows with a stunning intensity through this light (Slessor 1998). The black walls, columns, ceiling and the charcoal-grey slate floor provide additional contrast to the lit focal point of the Chapel. Natural light is used to augment the artificial light. It falls into the space between the outer concrete walls and the black interior plates, which are set 60cm back from the external walls. The lowest quarter of the black walls is removed, allowing light from the above narrow skylight to gently wash down the concrete and infuse the chapel with a subtle radiance that highlights the perimeter of the chapel. This acts as a framing element and enhances the sacred space for viewing the frescoes.

The view of the original dome’s fresco in the Church in Cyprus was influenced by season changes and time of day. Due to the small openings and the location of the fresco, part of the image was always in shadow and there was in fact no full vision of the whole fresco. Yet, these effects aid to alter the psyche, and create the direct connection between earth and heaven. This in turn symbolizes the "holy" light since the sky provides the connection to divine light (Eliade 1968).

The Chapel in Houston uses electrical light to be diffused through the glass that holds the fresco. This illumination provides a constant even light that helps to view the whole fresco at any time of the year in its full majestic image. The perimeter effect of the natural light frames the vision onto the focal point, the fresco. The chapel's dark background enhances the "holy" light by contrasting and dramatizing the effect of light, which elevates the spirit toward God.

Lighting design guidelines such as the IES Lighting Handbook (1987), and Lechner (2000) focus on four major functional and spiritual guidelines for Houses of Worship: Task lighting (function); Accent lighting (spiritual); Architectural lighting (function and spiritual); and Celebration light (spiritual). These guidelines include recommendations for both quantitative illumination in Lux and/or footcandles, and for appropriate quality components of lighting, such as brightness, glare, reflection, and diffused or direct light.

The analysis of the Church in Cyprus along these criteria determines that the first three are partially fulfilled, while the fourth one is not applicable for evaluation. The interior of the church is dark most of the time and its ambient illumination is based on the 'mystery' of time creating constantly changing effects of shade and shadows. One can therefore interpret that the frescoes were not the focal point of the church but rather served as decoration icons. Since there is no documentation regarding the actual use of the church by its worshippers, the criterion of celebration light cannot be evaluated.

The analyses of the Chapel in Houston along these accepted criteria reveal that the stable architectural light in the interior of the chapel fully fulfills these guidelines.
The task light is clearly defined focusing on the frescoes; the accent spiritual lighting is always present in the same way; the architectural lighting enhances the sense of mystery and numinous by which the frescoes could be seen afresh. The celebration lighting was not evaluated for consistency with the examination of the historic church. Still, the main recommendation for contemporary houses of worship -- to use daylight as the major light source and then to augment it with electric lighting -- is not fulfilled since the Chapel uses electric light as its major source and supports it with natural light as a secondary source.

4. Discussion and Conclusion

Because the two buildings were constructed 800 years apart, criteria and standards should be limited to those that can only be applied to both buildings. It should also be limited to those issues that affect the dome fresco. Therefore, the discussion focuses only on the criterion of architectural lighting.

The analysis of the Church in Cyprus along the recommended ambient lighting indicates that not enough natural light penetrates the building to view the fresco, and it is always viewed in partial shadow. The "holy" light in this church is created by the transcendence in time and the direct relationship to the sky, and not necessarily by the importance given to the fresco. The analysis of the Chapel in Houston along this criterion illustrates that electric light can provide a complete and steady viewing experience of the fresco. The glass panels evoke the numinous, instilling the ancient frescoes with renewed spiritual significance and power (Slessor 1998). The manipulation of the architectural components that influence the senses of light and darkness creates the "holy" light while focusing on the fresco.

In conclusion, the first objective of the study to compare the natural and electric lighting in a sacred setting shows that natural light enhances the general spiritual effect using the relation to time and nature; electrical lighting provides a controlled environment that can create a drama of light and darkness around a sacred icon. This illumination enhances the viewing of a focal point as part of the spiritual experience.

Still, the scriptures tell us that the spiritual experience is not influenced by the exterior elements of light, but is rather based on faith that the Lord is the Light (Revelation 22:5; Isaiah 60:19). The design of sacred settings can attempt to enrich this inner spiritual experience by providing natural light to connect to the divine and artificial light to highlight the rituals associated with this connection. Therefore, it can be concluded that both sources of light complement each other in their effects in sacred settings.

The paper fulfilled its second objective to demonstrate the utility of digital methodology to analyze the effect of light in sacred buildings. AutoCAD and Forum Z were used to reconstruct a quite accurate 3-D model of a historic church. In addition, these commercial applications were utilized to simulate and render the effects of natural light on the dome's fresco and test the sacred phenomenon of the "holy" light.

References


Khemlani, L. 2002a. Modeling in Form Z. AEC Tech News September # 82

Khemlani, L. 2002b. Comparison of lighting capabilities AEC
Tech News October # 85


Endnotes

1 Form Z was reported to be more accurate than other programs in its ability to model with a higher degree of dimensional correctness (Khemlani 2002a).

2 The validity of such rendering is further supported by Khemlani (2002b) report that Form Z’s natural day lighting simulation is “adequate to produce a realistic daytime rendering”.

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