# The Holy Darkness: a Study of Light in Brihadeshvara Hindu Temple, Tanjore, Tamilnadu, India (1010 Ad).

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**The study investigates how religious principles govern the treatment of light/darkness in sacred monuments. Specifically, a digitized daylight simulation was used in the analysis of Brihadeshvara Hindu Temple, built in 1010 AD in Tanjore, Tamilnadu, India. This sacred monument, listed as one of UNESCO's World Heritage Sites, is an intriguing case study since the treatment of the 'holy light' in the temple is actually the treatment of the 'holy darkness'. The simulated values were compared to the Illuminating Engineering Society (IES) standards for 'public places with dark surroundings'. This qualitative comparison corroborated the project's findings. The paper concludes that digitized media such as computerized daylight simulations can examine the significance of light/darkness in sacred monuments as a spiritual experience. Moreover, this quantitative investigation can augment the qualitative studies in the field of historic sacred architecture.**

## Introduction

According to the Rigveda, ancient Hindu scriptures, the God Surya "is the sun of the heaven and his name is derived from the word svar (light)…Surya is the golden ornament of the sky, a flying falcon, and the very countenance and eye of the gods. Traversing heaven and earth in a single day, Surya observes the whole world from on high. It is his work to dispel the dark night of ignorance and to dispense the light of life and health" (Finegan 1989, p. 37).

In spite of the importance given to sun in the Hindu scriptures, natural light was used very sparsely in Hindu temples. According to the Hindu faith, when a worshipper is in the presence of the divine, there should be nothing to distract his/her senses, including vision, and God shall reveal himself to his devotee gradually (Deva 1995). Therefore, the innermost sanctum of the temple is shrouded in total darkness and the progression into the temple is a ritual movement where the devotee goes through the dynamic experience of the darkening spaces before reaching the darkest sacred chamber (Michell 1987). This treatment of light ensures that by the time the pilgrim reaches the innermost chamber (garbhagriha) his/her eyes slowly become accustomed to the darkness and his/her state of mind befitting worship and is no longer plagued by worldly thoughts. During this journey, one passes through many doorways, colonnaded halls and corridors, which are decorated with sacred carvings. These sacred symbols have a profound impact on the mind of the devotee; they simulate the mystery that envelops the universe and the divine spirit that illumines the universe (Deva 1995). Reaching the holy sanctum, the worshipper enters a place for individual self-realization and personal relation with the divine.

This sanctum is not intended for mass prayer or congregational worship (Deva 1995). Thus, a basic premise can be drawn: the design of the Hindu Temple accommodated the faith which requires a procession toward the "holy darkness" and enhanced the spiritual experience. The dictation of the Hindu faith to create this spiritual procession toward the 'holy darkness' is examined in the historic Brihadeshvara Temple. The paper reports a multi method analyses that include a quantitative analysis in the form of computerized lighting simulations, and a qualitative comparison of the simulated values to the Illuminating Engineering Society (IES) standards for 'public places with dark surroundings' which represents the low levels of illuminations.

**The Brihadeshvara Hindu Temple**

The sacred monument of Brihadeshvara Temple of Tanjore, Tamilnadu, south India (1010 AD) is listed on the UNESCO's World Heritage Sites (1987) as part of the three Chola temples of Southern India. They represent an outstanding creative achievement in the architectural conception of the pure form of the Dravida temples. This style, originally known as Dravidadesha style, was practiced during several dynasties only in the state of Tamilnadu in South India. The Brihadeshvara Temple (or Rajarajeshvara) was built in the capital of the Chola dynasty Tanjore by Rajaraja the Great (985-1014 AD) and has been dedicated to Shiva. It was built of granite stone during a span of six years, and reflects the prosperity and opulence of the Chola kingdom.

This monument not only expresses the Chola power but also is considered as one of the finest architectural examples of intricate craftsmanship in stone (Michell 1989) (Figure 1).

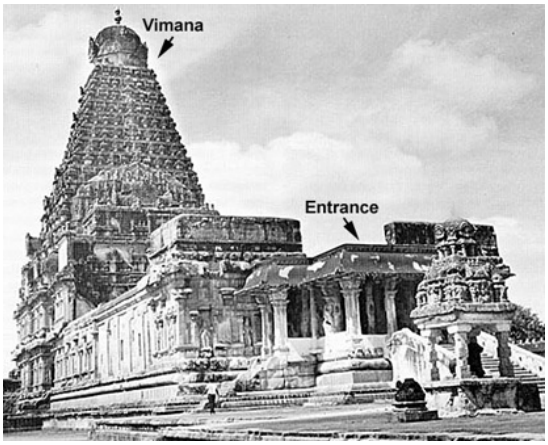
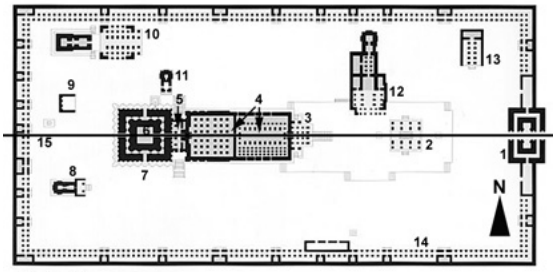



*Figure 1: Brihadeshvara Hindu Temple (1010 AD), Tanjore, Tamilnadu, India: view from the east (based on Harle 1986).*

Figure 2 shows the linear arrangement of the Brihadeshwara temple that is located in the middle of a large rectangular walled courtyard, and centrally aligned with the Nandi pavilion (six meters long monolithic representation of Shiva's bull) and the gopuras (pyramidal gateways at the entrance to the courtyard). The entrance porch of the Brihadeshvara Temple leads into two adjoining mandapas. Art historians (Pichard 1995) believe that they were either built subsequent to the collapse of an original structure, or they had remained incomplete and were finished several centuries later. The mandapa adjoins the antarala (vestibule) and the garbhagriha (innermost cell). The antarala is a triple story structure with openings on the north and south sides, which can be accessed by a monumental set of stairs. The square garbhagriha (8 meters side x 3.66 meters height) is raised on a high plinth and surrounded by a narrow pradakshinapath (surrounding ambulatory passageway) with four cardinal openings that are inaccessible from the courtyard and serve as windows. The Vimana (inner-most shrine) located at the end of the linear procession (Figures 1, 2) was built as a pyramidal stone spire, which rises to a height of approximately 66 meters above the garbhagriha. Thirteen diminishing stories, each with pilastered walls, an eave and parapet, ascend towards an octagonal dome-like roof with a gold plated copper kalash (stupi) at the apex (Michell 1989, Deva 1995).




**LEGEND**

1. Gopuras (Gateways)
2. Nandi Pavilion
3. Entrance Porch
4. Two Adjoining Mandapas (Prayer Halls)
5. Antarala (Vestibule)
6. Garbhagriha (Innermost Sanctum)
7. Pradakshinapath (Ambulatory Passage)
8. Ganapati Shrine
09. Karuvur Devar Shrine
10. Subrahmanya Shrine
11. Chandeshvara Shrine
12. Amman Shrine
13. Natraja Mandapa (Prayer Hall)
14. Enclosure Wall with Colonnade
15. East-West Axis

*Figure 2: Plan of Brihadeshvara Temple Complex (based on Stierlin 1998).*

**Method, Analyses and Results**

The analyses of the treatment of light/darkness in Brihadeshvara Temple were performed in two stages: (a) running a digital daylight simulation software -- Lightscape; and (b) comparing the simulations values to the IES standards for 'public places with dark surroundings'.

• *Quantitative analysis of the treatment of light in Brihadeshvara Temple*

Lightscape is an advanced lighting and visualization application founded on a physically based simulation of the propagation of light through the environment. Based on a description of light arriving at a surface, local illumination algorithms portrait how individual surfaces reflect or transmit light and can predict the intensity, spectral character (color), and distribution of the light leaving that surface. To achieve more accurate images, the program's global illumination algorithms use a combination of radiosity and ray traced images, to render the transfer of light between surfaces in the model. The combination of local and global illuminations enables the simulation results to portray highly realistic renderings with accurate measurements of the distribution of light within the scene.

To run the program, a 3-D CAD model of the temple was created based on the documentation drawings by Pierre Pichard (1995). An interior model was constructed as 3D surfaces, instead of solid walls, to optimize the model for radiosity processing. As described earlier, a vital aspect of Hindu worship is the actual progression from the outermost spaces (well lit) to the innermost sacred spaces (completely dark) of a temple. Hence, a series of horizontal and vertical surfaces along the sequence of the procession in the Brihadeshvara Temple were analyzed. The floors of each of the successive four spaces were coded for the horizontal surfaces, while, the four main walls that would directly face a person while walking towards the innermost part, were selected as the vertical surfaces (Figure 3).

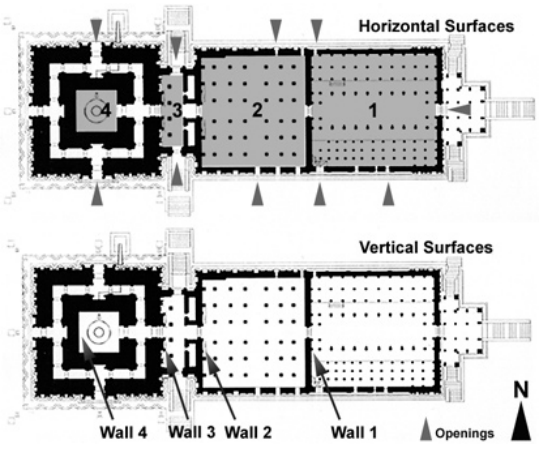



*Figure 3: Brihadeshvara Hindu Temple (1010 AD), Tanjore, Tamilnadu, India: plans with openings and a sequence of horizontal and vertical surfaces.*

The model was imported into Lightscape as an input file. The surfaces and openings of the model were assigned their texture and physical parameters. In addition, the lighting systems were defined according to the geographical location, date, time, and sky conditions. The simulation targeted three time frames on March 21st (the equinox): sunrise and sunset which are spiritually important in the Hindu Faith; and the high noon for maximum light. The location of Tanjore, India (10˚ North Latitude, 79˚ East Longitude) was used for light conditions. The Lightscape simulations used the process of radiosity to generate single frame daylight renderings along with light analysis of each surface.

Three types of the simulation output were used for analysis and presentation: single images, walk-through images, and lighting analysis. The results of the simulations show the illumination values in lux for each of the horizontal and vertical surfaces in the monument within a specific time frame. A lighting animation was produced in Quick Time to illustrate the dynamic of the light drama that supports the ritual and spiritual movement from the lit outside toward the dark inner spaces.

The findings of this analysis demonstrate that the average illumination values for the specific surfaces along the procession sequence correspond to the Hindu faith expectation, i.e., a progressively decreased luminance towards the dark innermost chamber. This can be seen in the values of Floor 1 (119 lux) through Floor 4 (0.40 lux) and Wall 1 (38 lux) through Wall 4 (0.43 lux). Due to major openings on either side of the vestibule (antarala) space, Floor 3 (313 lux) and Wall 3 (169 lux) show a deviation from the general pattern. According to historians the presence of a pair of grand stairs and entrances on either side of the vestibule is unusual in ancient Hindu temple architecture and is a distinct feature of the Brihadeshvara temple (Stierlin 1998).

*•Qualitative analysis of the treatment of light in Brihadeshvara Temple*

The second part of the analyses is the comparison of the average illumination values of each of the temple's surfaces to the IES standards, which recommend ranges of luminance for specific visual tasks and areas for 'public places with dark surroundings'.

This comparison demonstrates that the average illumination values inside the temple were lower (i.e. darker) than the standard IES illumination level required for these spaces (30 lux); and were decreasing progressively as one moved towards the innermost sanctum. As described before, due to the major openings on either side of the vestibule the average illumination values of Floor 3 (313 lux) and Wall 3 (169 lux) are higher than the IES standards. In addition, the entrance opening located in the east enables a strong focused light to hit Floor 1 and Wall 1 at sunrise (Figure 4).

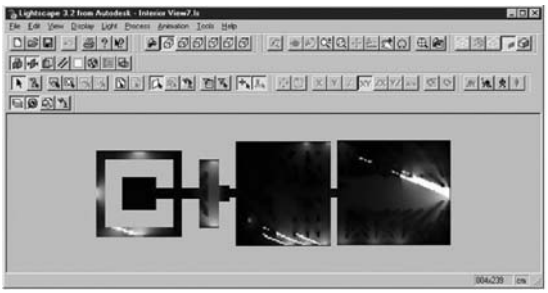


*Figure 4: Sample of Lightscape simulation: the effect of light from the main entrance at sunrise.*

Therefore, the average illumination values of Floor 1 (119 lux) and Wall 1 (38 lux) are higher then the standard illumination levels. These results demonstrate the importance of the first rays of sunlight, which symbolize the Sun God. According to the Hindu faith, the rising sun is worshipped before beginning the rituals for the residing deity of the temple. From these observations it can be concluded that strong religious light requirements dictated the quality of light inside the Hindu temples and thus overruled any other considerations.

**Discussion and Conclusion**

The multi-method investigation of the relationship of light and darkness, light and objects, and the designated light quality in the Brihadeshvara Temple demonstrates the strong influence of the specific dictum of Hinduism on the light/darkness treatment in the temple. Furthermore, the findings of this examination support the basic premise of the paper and illustrate the ritual procession toward the "holy darkness", and how light/darkness can dramatize the spiritual experience in the sacred spaces of the temple.

The temple interiors were designed to be dark so the human eye is not distracted by the material world to let the mind enter the spiritual world of God. As seen in the Brihadeshvara Temple, natural light is introduced in a progressive light quality from brightness to darkness accommodating the ritual movement of the worshiper. It is interesting to note that the reduction level of light quality in the temple also contributes to the thermal comfort in the building. Thick walls, small windows, and reduced light maintain cool and dry conditions for better thermal comfort in the hot humid climate of Tamilnadu. Thus, the Hindu worshippers are not distracted visually or thermally enabling to focus one's mind on God. The results that deviated from the expected simulation patterns trigger an interesting question to be further investigated about the impact of non-original elements of the historic building on the treatment of light. Moreover, these findings highlight the multi dimensionality of religious dicta.

Finally, the analyses suggest that digitized media such as computerized daylight simulations can examine the significance of light/darkness in sacred monuments as a spiritual experience. This quantitative investigation can augment the qualitative studies of light and spiritual conditions in the field of historic sacred architecture.

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