

# The Effect of Visual Composition Created by Mosque Envelope in Generating Solemnity

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## Abstract

The architecture of the mosque building is one of the most developed building typologies in Indonesia, and it has a high variation of form. This study evaluates how the mosque envelope affects its primary function as a prayer hall. Religious worship that requires solemnity is influenced by a spiritual atmosphere where lighting is important. This study takes a deeper step by identifying the lighting configuration produced by the openings in the mosque envelope and evaluating its effect on solemnity. Illumination data, building physical information of envelope and openings, and calibrated photo documentation are collected from three Yogyakarta Mosque building cases representing vernacular, Middle Eastern, and contemporary styles. These data are analyzed according to light intensity, contrast ratio, light distribution, and visual acuity to identify how it affects the formation of a spiritual atmosphere through the generation of visual performance, such as concentration and ability to focus, mood, and comfort. Bright, high-contrast, dramatic, and colored light can undermine the potential for evoking solemnity, while dim, low-contrast, uniform, and natural intensity prevents distractive visual information from flowing into the brain, resulting in a less challenging effort to focus and concentrate. A uniform light generates more visual comfort compared to high contrast as it maintains less eye-adaptation. A serene, calm, dim, humble, and soothing ambient is considered relevant to the generation of solemnity as it promotes humility and assists the prayer to feel calm and relaxed. Further research is needed to reveal the optimal model of mosque shape and opening configuration that contributes positively to the generation of solemnity.

**Keywords:** *Mosque envelope; solemnity; visual composition*

## Introduction

The architecture of mosque buildings in Indonesia has become one of the most developed and varied building typologies. The variety of shapes, sizes layouts, and compositions of mosques in Indonesia varies greatly and took influences from geographical and natural settings, construction knowledge

and skill, local cultural background, and social and even political structure.

The envelope shape and opening configuration of a mosque generate distinct visual imprints within the mosque interior in the form of the composition of the lit area along with its unique visual characteristics containing contrast, light color, and distribution. The visual composition of light that falls within the prayer's range of vision affects their concentration during prayer. This research may provide insights for practicing professionals and the Muslim

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community on what considerations must be taken when configuring mosque envelope and shape.

No specific study in architecture has been found that correlates the visual composition of the mosque interior with the state of solemnity in performing prayer. Dewiyanti and Kusuma (2012) explained that religious worship is influenced by several aspects. One of the biggest influences is the shape of the mosque, the lighting in the space of worship, and the atmosphere that is formed. They further described that a space of worship that has a spiritual meaning can uplift the atmosphere of worship. This then raises a question of how the visual condition of the worship place, i.e., a prayer hall in a mosque, could contribute to creating a spiritual atmosphere and generation of solemnity.

This research focuses on how the visual condition of a mosque's interior can be related to the generation of solemnity. Visual comfort in the worship space can be achieved by fulfilling criteria such as minimum light intensity, acceptable contrast ratio, and desirable atmosphere. However, fulfilling these criteria would not guarantee the building to positively contribute to the generation of solemnity as other non-visual environmental factors also contribute, such as sound ambient, cleanliness and order, the adequacy of space, aesthetics, a presence of congregation, and physical comfort (Yasir Qadhi, 2021).

This study is the first step of more extensive research focusing on the relationship between light and its spiritual influence in space. The study was initiated by observing mosque envelope composition in 3 selected mosques in Yogyakarta representing the most generic typology of Indonesian mosques, which are traditional mosques, mosques with dome roofs, and modern mosques (Saputra, 2020). The fact that a significant variation appears on the visual interior of these mosques suggests that no similar consideration is being followed in generating a similar quality of spiritual atmosphere.

The variety of mosque shrouds, the composition of openings, the type and material used to produce the visual composition of the quantity of light, the hard/soft character of light, the contrast between light and shadow, and ambient light are also diverse. There is a mosque with a bright atmosphere, but there is also another with an even and gentle ambient character, whilst there is also one that plays with high contrast between the exposed surface of light and shaded areas.

Figure 1. Atmosphere Inside Jami' Mosque Pathok Negoro Plosokuning Yogyakarta  
Source: Researcher Documentation



Figure 2. Atmosphere Inside Syuhada Mosque Kotabaru Yogyakarta  
Source: Researcher Documentation



Figure 3. Atmosphere Inside Baitur Rahman Mosque Kopeng Yogyakarta  
Source: Researcher Documentation



The photographs taken showing the interior of the prayer hall from 3 different mosques show big differences in visual characteristics. The visual composition generated during the day inside Jami's Mosque *Pathok Negoro* shows a bright ambient with high contrast. On the contrary, the *Syuhada* Mosque shows a much dimmer ambient with uniform lighting and no contrast. The *Baitur Rahman* Mosque, the newest among the three, has average ambient brightness with a few contrasts scattered on the floor and wall. This research examines and analyzes the distinct visual composition formed by the light that penetrates through respective mosque openings and evaluates the trails on floors and walls within visual range, which may affect the generation of solemnity based on relevant visual theories and criteria according to religious leaders.

The output of this research is a quantitative evaluation of visual composition in the selected mosque, which contributes to the generation of solemnity through compliance with visual performance criteria of visual acuity, focus and concentration, and mood as below parameters:

1. The intensity of lighting and its distribution in space
2. The contrast of light from the highest and lowest intensity within the user's visual range during the prayer
3. The uniformity of lighting distribution
4. Lighting color within the space is generated through reflection and refraction.

The result of this research is expected to provide a clearer perspective for practicing architects and planners that the consideration of internal ambient formed by the mosque envelope and shape should be granted the same priority as other mosque aspects like the embodiment of expression, symbolic form, and ornamentation on the appearance of the mosque. This study is expected to contribute as an evaluative tool for mosque caretakers in assessing the visual quality of their prayer hall and whether it has good conformity with the ideal atmosphere for worship activities. This research is also expected to provide

knowledge and insight for the Muslim community, namely that the mosque should be prioritized as a conducive praying space that requires a specific atmosphere of solemnity and not simply an architectural statement of the community status. As for scholars, this research opens an opportunity for further and deeper studies to reveal the connection between lighting and spiritual atmosphere.

## Methodology

This research focuses on a quantitative study of the relation between lighting characteristics being formed in mosques and the generation of fundamental solemnity criteria. A literature study was conducted to develop fundamental visual criteria that relate to the generation of solemnity in the spiritual atmosphere. The relevant aspects of lighting to be studied include lighting intensity, visual acuity, uniformity of light distribution, glare and level of contrast, color of light, and the generated ambient within the space.

The study was conducted in three mosques in the Yogyakarta Special Region selected according to typology in an envelope which included the diversity of roof model, composition of sheath, color, and texture of dominant material, the shape and geometry of the inner space, and the composition of light openings. The selection of the mosques is based on the influence of their building components on the visual composition being generated within the prayer hall, whether through natural or artificial means.

The three selected mosques are:

1. *Pathok Negoro* Jami' Mosque *Plosokuning* was built in 1724 with three layered fringing roofs with wood and brick material, low ceiling height, and small openings on periphery walls surrounded by a terrace.
2. *Syuhada* Mosque *Kotabaru* was built in 1950 with a dome roof, concrete, and brick material with a paint finish. There are small openings positioned on high walls around periphery walls.

3. *Baitur Rahman* Mosque Kopeng was built in 2011 with a *Joglo Limasan* roof and volcanic masonry material with 2 different opening types, windows, and rosters.

Figure 4. Location of Research Objects  
 Source: Researcher Documentation



- A. *Pathok Negoro Jami'* Mosque Plosokuning
- B. *Syuhada* Mosque Kotabaru
- C. *Baitur Rahman* Mosque Kopeng

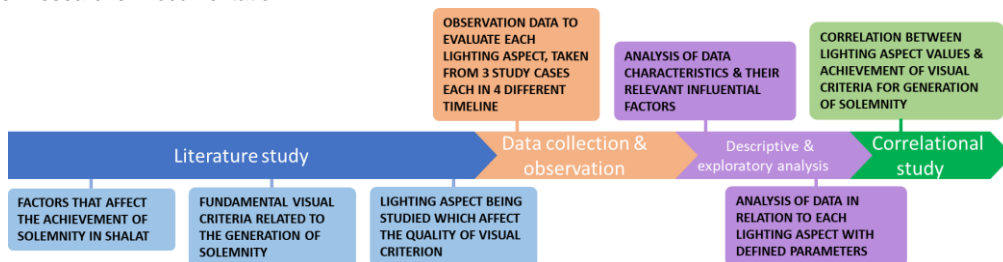
The research was initiated by observing the selected mosque buildings whose envelope and openings are relatively original (alteration and change are considered minor and do not provide significant influence on research data). Observations include the identification of the shroud shape, the size and number of exposure openings, the proportion of horizontal and vertical dimensions, and the type of dominant material being used.

Observation data is collected and includes the level of illumination in lux. The data is measured in the morning, mid-day, afternoon, and evening to cover the entire mosque

operation and will be displayed in the form of a matrix. The other information collected is the identification of material and color as well as the lighting ambient created through reflection in the prayer hall observed through calibrated photo documentation and description of relevant mosque shape and configuration, sheath, and composition of light openings. Photos are an important part of the research. They are taken using the same equipment, a Canon EOS 1000D DSLR camera, to minimize discrepancy. Each shot is configured using the same settings of f/4.5, ISO-800 speed, 18mm focal length, exposure time 1/60sec, manual white balance, and no flash. All resolutions are set in 72 dpi (2816 x 1880 pixels) with 24-bit depth and sRGB color representation. All shots are taken at similar times between one building and the other with similar sky conditions (clear sky).

The observation data are further studied and descriptively analyzed to comprehensively identify, analyze, and evaluate the relationship between criteria of visual composition to light intensity, distribution and uniformity, the resulting contrast ratio, and the ambient of space being generated. Furthermore, the above results will be discussed and evaluated in terms of how and what aspects of visual perception based on Steffy (2002) can be formed to identify how much influence the variables that form the spiritual atmosphere. The quality of these aspects will be evaluated following the literature and the study of the achievement of solemn conditions.

Illustration 1. Workflow diagram of research method  
 Source: Researcher Documentation

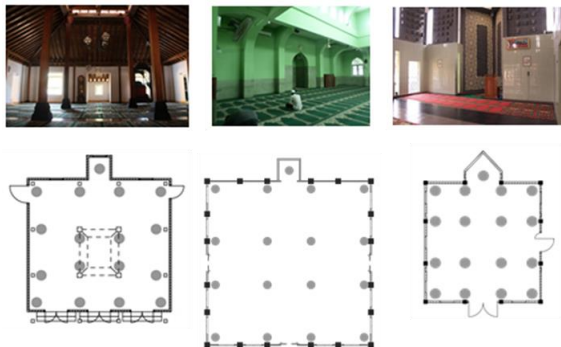


Palmer, S. E. (1999) describes visual perception as the process through which the brain interprets and makes sense of visual stimuli received from the eyes. Several key stages of the process include integration and interpretation, where higher-order processing integrates visual information to recognize shapes, patterns, and complex scenes. The following stage will determine the influence of attention that affects which visual stimuli are prioritized, impacting perception based on context, expectations, and emotional state.

This study only focuses on the aspect of lighting as the generator of solemnity. Other aspects, such as thermal and acoustic comfort, as well as other qualitative variables, will not be discussed in this study.

Figure 5. Prayer Hall Ambient and Illumination Measuring Points

Source: Researcher Documentation



This final step of the research consists of a study and review of data and information related to the condition and quality of the visual environment, which was achieved in the selected case of mosque buildings, in comparison to the criteria for a spiritual atmosphere that needs to be achieved. The analysis compares the illumination characteristics of each mosque and sorts the results based on the parameters of visual criteria in generating solemnity following according to the below aspects:

1. Analysis of measurement data of the lighting intensity and their correlated visual acuity and its relation to the ability to retain focus and concentration

2. Analysis of lighting uniformity and contrast and its relation to visual comfort.
3. Analysis of the ambient within the space and the generation of respective moods.

The final section of the research will summarize the findings of how visual quality, being defined by the light characteristics within the space, constructs the visual acuity, comfort, and mood that affect the ability to generate solemnity.

## Result and Discussion

### A. General Mosque Form and Composition

Generally, the main part of all prayer halls from the three mosques is shown in a rectangular geometrical shape with an orientation towards Qibla. The notable difference between the three is in the shape of their roof. At Pathok Negoro Jami' Mosque Plosokuning, the roof is made of a three-layered pyramid with gaps between the layers, which allow light to penetrate. The Syuhada Kotabaru Mosque has an onion-type dome roof whose structure is supported by an octagonal foundation with two window monitors on each side. The Baitur Rahman Kopeng Mosque has a joglo-shaped roof with half of the material on top using semi-transparent material with the bottom section divided into five smaller parts.

Figure 6. Building Layout

Source: Researcher Documentation



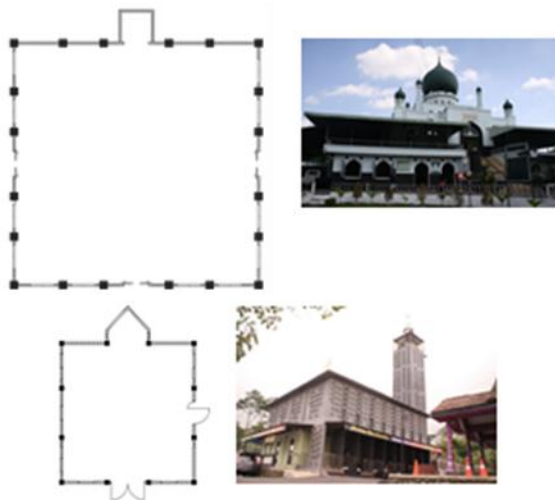
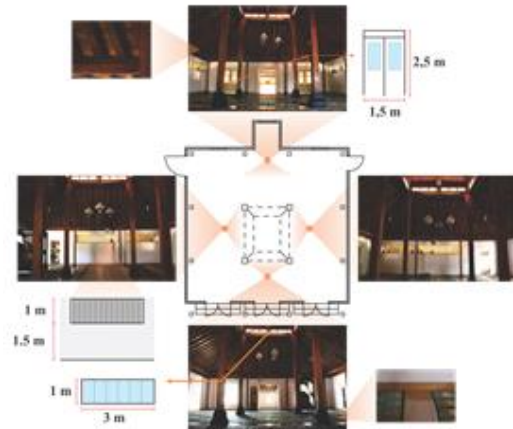


Figure 7. Pathok Negoro Jami' Mosque Plosokuning  
 Source: Researcher Documentation



## B. Prayer Hall Composition

Each mosque has a different composition of walls, openings, and floors with their distinct color and materiality.

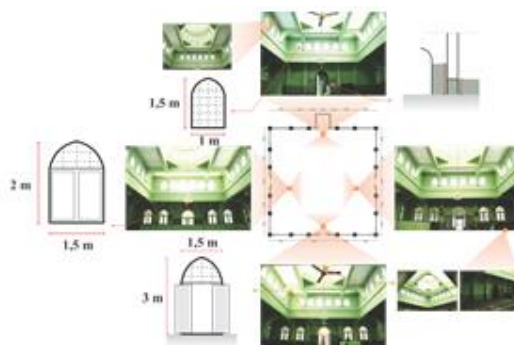
### B.1. Pathok Negoro Jami' Mosque Plosokuning

The wall in the Pathok Negoro Jami Mosque Plosokuning is constructed using plastered clay brick with a white paint finish. The visually dominating color and texture is wood, which resides mainly on the column and ceiling of the main prayer hall. The openings in this mosque are three main double doors with a size of 1.5m x 2.5m on the east side with 2 additional secondary doors on each north and south. There are two windows with a size of 1m x 1.5m on the west side and two ventilations with the size of 1m x 3m located at a height of 1.5m on the north and south sides. In addition, there is also a glass opening on the roof, which is 1m x 3m in size, which provides natural lighting during the day. The floor area is made of brown 20cm x 20cm ceramic tiles covered with a green rug (in a sajada pattern). The main color composition formed by the walls, ceiling, openings, and floor in Pathok Negoro Jami' Mosque Plosokuning is brown, beige, white, black, and green.

### B.2. Syuhada Mosque Kotabaru

The wall in Syuhada Mosque Kotabaru is made of plastered clay brick with a light-green paint finish, combined with a 1-meter-high dark green ceramic tile. The mosque has opening elements in the form of double doors with dimensions of 1.5m x 3m. Each is located on the east, north, and south sides. On the east, north, and south sides, there are four windows with similar-sized doors in the size of 1,5m x 2m. There are high-level glass openings with a size of 1m x 1.5m located at an elevation of  $\pm 5m$  and  $\pm 9m$  on all sides, which serve as natural ventilation and illumination during the day. The floor is made of ceramic tile covered with a green mat with a repeating sajada pattern. The predominant color composition at this mosque is white, light green, and dark green.

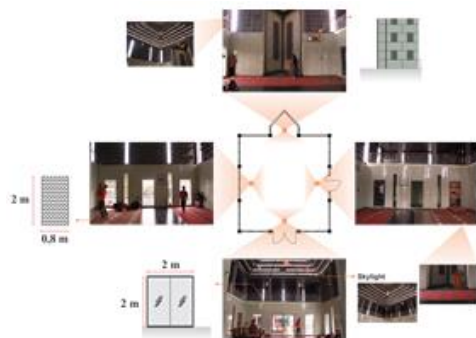
Figure 8. Syuhada Mosque Kotabaru  
 Source: Researcher Documentation



### B.3. Baitur Rahman Mosque Kopeng Merapi

The walls that support the Baitur Rahman Mosque Kopeng Merapi are made of volcanic-ash brick layered with ceramic tile finish as high as  $\pm 3$  meters and painted in grey color on the upper part. An ivory-white ornament and grey-colored mihrab appeared on the western wall. The openings of this mosque consist of one 2m x 2m door on the east side and a 1m x 2m door on the north side leading to the ablution area and toilet. Two windows with a size of 0.8m x 2m sit on the north, south, and east sides. On a high level, a 30cm wide vertical window glass opening on each side provides natural lighting during the day. The floor is made of black and grey ceramic tile covered with a red mat with a repeating sajadah pattern. The predominant colors in this mosque are grey, ivory (beige), and red.

Figure 9. Baitur Rahman Mosque Kopeng  
 Source: Researcher Documentation



### C. Prayer Hall Visual Condition

The visual quality of the building cases is measured in lumen per sqm (lux) and categorized into three visual conditions that relate to human capability to determine visual objects based on the amount of functioning eye receptor cells (rod, cones, and RGC). The visual category comprises; scotopic condition, which occurs under low light (Em value less than 20lux) with functioning receptor cells predominantly by rod cells; photopic condition, which occurs under plenty of light (Em value more than 100lux) where plenty of cone receptor cell are active; and mesopic condition, which occur in lighting condition with Em value

between 20 to 100lux with both rod and cone cell are functioning as a receptor.

The three different visual conditions affect the level of visual acuity within the space. Visual acuity determines the ability of humans to recognize visual detail (Asgari et al. I, 2018). The higher the light level inside the mosque, the more the cone cells are functioning in the occupant's eyes and therefore, the ability to identify details and colors is increasing.

Table 1. Visual acuity with visual condition and illumination level

Visual Condition	Ave. Illumination level (Lux)	Visual Acuity
Scotopic	<20	N/A
Mesopic	20-100	Low
Photopic	>100	High

Source: Researcher Documentation

Based on Stockman (2006), in bright conditions ( $> 100$  lux), the eye is in photopic condition and can see and identify details and colors well due to the active cones and cylinders. In mesopic conditions where some cone cells are not working properly, low identification of colors and shapes occurs, except for compositions composed of black and white elements in a single visual image. In scotopic conditions, the object visual identification process is mainly processed by the rods that are most sensitive to blue-green wavelength (498nm) which results in monochromatic blueish reception.

During prayer, the eyes are mainly oriented to the point where the head is located during sujud (bowing), making the visible area of praying limited mainly to the surrounding floor area and a part of the lower west wall.

Figure 10. Illustrative comparison between photopic (top left and right), mesopic (bottom left), and scotopic (bottom right) condition

Source: <https://www.istockphoto.com/id/foto/4-momen-siang-hingga-malam-hari-lokasi-konstruksi-pusat-kota-singapura-gm680743766-124766703>



### C.1. Pathok Negoro Jami' Mosque Plosokuning





The average illumination level (Em in lux) in the prayer hall of Pathok Negoro Jami' Mosque Plosokuning varies between 9.9lux in the morning, 34.2lux during midday, increasing to 135.1lux in the afternoon and decreasing substantially afterward to 12.1lux in the evening. This results in low identification of shapes and colors throughout all visible surfaces during the first half of the day. The articulation of the floor mat pattern is fading, and colors are not distinctively identifiable. The dominant wood color appears to be significantly darker, and no texture is visible. In contrast, from midday onward to the afternoon, the level of identified details and colors on the floor increases as a result of increasing light levels. The mat pattern details on the floor are revealed, as well as the pedestal details, roof structure, and wood texture. However, as night falls, the visual acuity decreases again to a similar condition to the morning. There is no notable difference in color perception between morning and evening conditions, even though there is a difference in light source as both are under scotopic conditions.

The building envelope composition created a relatively uniform light in the morning, midday, and evening. However, the west-facing windows generate a high level of contrast on

the floor and lower wall in the afternoon as they are not sufficiently shaded, unlike the three large door openings on the east side, which are entirely under a covered porch. The ambient inside the hall, which is generated by direct sunlight and reflected lights from wood, white walls, and green-patterned mat, is still considered natural.

Figure 11. The average intensity measured in Pathok Negoro Mosque

Source: Researcher Documentation

	
Morning 9,9 lux (very low)	Midday 34,2 lux (very low)
	
Afternoon 135,1 lux (low)	Evening 12,1 lux (very low)

### C.2. Syuhada Mosque Kotabaru

In general, Syuhada Mosque Kotabaru achieves a uniform level of light distribution within the floor area and the interior walls. No significant contrast ratio appears during observation and measurement. Large eastern door openings are sufficiently enclosed by a covered terrace.

The average illumination level received in the prayer hall showed the highest value of 138.72lux in the morning because of its large eastern openings and high-level windows on all four sides. However, the value gradually decreases to 108.04lux at midday and further to 18.89lux as the effectiveness of high windows decreases against direct sun angle. In the evening, the average illumination generated by artificial light sources shows a value of 13.54lux. The condition suggests that

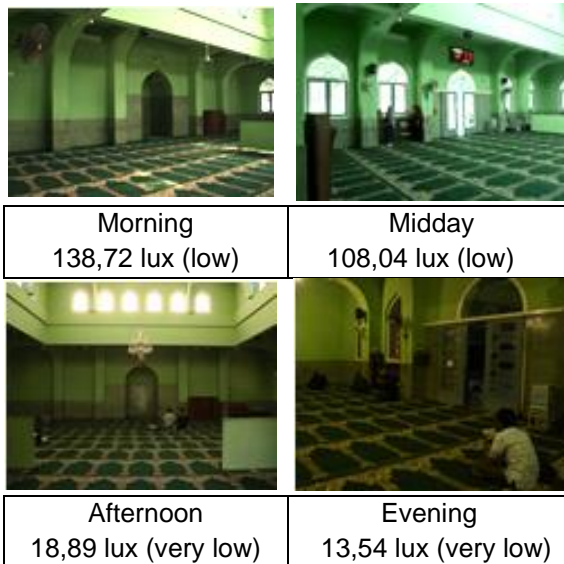


the perception of details and colors within the mosque interior in the morning is at its highest level, with clear visibility of floor pattern articulation and wall tiles.

As time flows, the visual acuity decreases and falls into a scotopic condition in the evening. Since this mosque's interior is predominantly made of green color, from morning to evening, the green color is still notifiable whilst shifting from light to dark green.

The ambient of the prayer hall is considered unnatural, with most of the reflected light dominated by the greenish spectrum.

Figure 12. Average intensity measured in Syuhada Mosque  
Source: Researcher Documentation



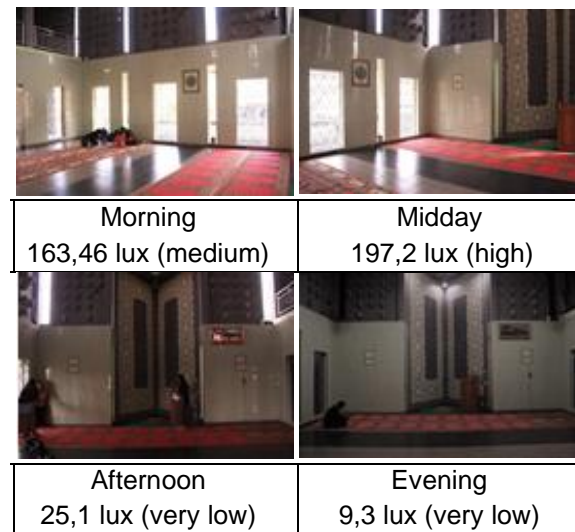
### C.3. Baitur Rahman Mosque Kopeng Merapi

This mosque has the highest window-to-wall ratio amongst all three, and in addition to its opening through a multi-layered roof, this advantage reveals measurement data with the highest average illumination level from morning to midday. In the morning, the measurement shows a value of 163.46lux and then increases to 197.2lux during midday. This suggests an excellent perception of details and colors during the first half of the day, with a red floor mat pattern and details visible, as well as an articulated higher wall design. In the afternoon, there was a drastic decrease in the light intensity to 25.1lux. This is mainly caused

by the significant difference in the number of openings on the west wall compared to the remaining sides. The nighttime measurement shows a value of 9.3lux due to insufficient artificial light being installed within the prayer hall area. Both latter conditions suggest low visual acuity with minimum identification of detail and color.

The composition of large and small openings within the envelope creates a good distribution of light on the floor. However, the opening design and its surrounding wall combined create significant contrast on the wall level. The existing material colors and textures within the hall are considered to generate a relatively natural ambient and reflected light. The amount of direct light coming from openings is still superior to those reflected by colored surfaces.

Figure 13. The average intensity measured in Baitur Rahman Mosque  
Source: Researcher Documentation



### C.4. Comparison of Illumination Characteristics of Case Study

The three mosques of the study object show different lighting characteristics. Comparing their measured light intensity, all of them show inconsistency throughout the day. The Pathok Negoro Jami' Mosque Plosokuning shows a substantial intensity increase from morning to afternoon before it drastically drops in the evening. On the contrary, Syuhada Mosque Kotabaru shows a decreasing trend of intensity

from morning to evening. Baitur Rahman Mosque Kopeng Merapi shows a slight increase from morning to midday before a significant fall in the afternoon and evening.

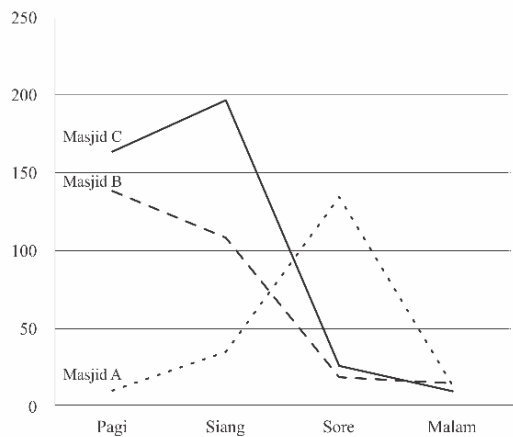
Table 2. Light intensity comparison between objects

Mosque	Light Intensity (Lux)			
	Morning	Midday	After noon	Evening
Plosokuning	9,9	34,2	135,1	12,1
Kotabaru	138,72	108,04	18,89	13,54
Kopeng	163,46	197,2	25,1	9,3

[Source: Researcher Documentation]

Figure 11. Graph showing a trend of light intensity changes against time from study objects

Source: Researcher Documentation



- A. *Pathok Negoro* Jami' Mosque Plosokuning
- B. *Syuhada* Mosque Kotabaru
- C. *Baitur Rahman* Mosque Kopeng Merapi

The varying intensity results in the inconsistency of visual acuity through the changes in photopic-mesopic-scotopic condition. The visual acuity during one specific time of the day also varies as a result of the high contrast ratio produced within the space. This occurs in the *Plosokuning* Mosque in the afternoon and the *Kopeng* Mosque in the morning and midday. *Syuhada* Mosque does not experience this variation since the uniformity of light distribution in its prayer hall is achieved on the entire day and on all surfaces.

Table 3. Uniformity and contrast comparison between study objects

Mosque	Uniformity	Contrast
Plosokuning	Achieved in the morning, midday, and evening	High contrast in the afternoon
Kotabaru	Achieved on all-day	No high contrast
Kopeng	Achieved on floor level in morning and midday	High contrast on the wall level

Source: Researcher Documentation

### C.5. Generated Impression of Space

*Pathok Negoro Jami'* Mosque Plosokuning is an old vernacular mosque that has a warm feel of interior space, which is frequently found in Indonesian mosques built within the same period. The dominant wood material found on the columns and ceilings of the building generates a deep impression of intimacy in the interior atmosphere. The authenticity of the mosque's material can still be seen in the use of teak wood on the columns and the overlapping roof structure with crown details on it, which is still being used today. Several elements have changed, such as the plaster floor, which has been replaced with tiles; the two-brick-thick walls, which are now replaced by one brick-thick wall; and the main doors, which have become bigger. The warm color tones of wood and stone textures in dim lighting give this mosque a solemn sense of space.

In contrast to the *Jami' Pathok Negoro* Mosque, the *Syuhada* Mosque Kotabaru has a fairly bright spatial atmosphere, especially at the top section of the room, which is obtained from the upper clerestory and openings on the three sides of the walls. The relatively light color of the walls and ceiling makes a significant contribution to the brightness level of the room's atmosphere. The dominant green color on the walls and ceiling, combined with a green patterned praying mat on the floor, generates a rather monotonous impression of the space.

At the Baitur Rahman Mosque Kopeng Merapi, the contemporary design of its multi-layered roof provides sufficient natural light to its main hall. The original design reveals an all-grey painted interior finish, giving its interior a dreary impression of space. The lower half of the wall today has been covered with ivory-white ceramic tiles to match the decorative wall inside the mihrab, giving a brighter ambiance to the entire hall. The partial addition of a red-patterned prayer mat on top of the original black-grey floor tile creates a vibrant contrast to the interior.

Figure 16. Prayer hall ambiance in Baitur Rahman Mosque  
 Source: Researcher Documentation



Figure 14. Prayer hall ambiance in Pathok Negro Mosque Source: Researcher Documentation



Figure 15. Prayer hall ambiance in Syuhada Mosque Source: Researcher Documentation



The generated ambient inside the Plosokuning Mosque is considered to be natural, with light reflected on white, wooden, and greenish material in balanced proportion. The Syuhada Mosque, on the other hand, shows a tendency to create unnatural conditions as a result of its predominant green surface finish, whilst the Baitur Rahman Mosque shows a fairly natural ambiance, although there is a presence of a partially vibrant red prayer mat on the floor.

#### D. Visual Analysis Related to the Generation of Solemnity

There are several criteria for achieving solemnity during prayer. Some of the measurable approaches are the ability to focus and concentrate, the creation of a comfortable environment, and the generation of a calming ambient. Summarizing from various sources, Afdhil Fadli (2014) concluded that solemnity is a condition in which a person performs the prayer by fulfilling all the conditions, the pillars and sunnah of the prayer, and is performed in calmly state, with full concentration, inspired and fully live the verses and dhikr that is recited in prayer.

In general, the perceptual span of the human eye is approximately 120 arc degrees. This is the peripheral vision, which is being considered in capturing the quality of the visual environment during prayer, which includes the

composition of material and color, the uniformity of luminance and appearance of contrast, as well as the ambient of space. The area being covered by this peripheral vision during prayer is approximately 2.8m in diameter centers at the point where the head is positioned during sujud (bowing).

Since a higher density of cone cells reside at the macula, the perceptual span being considered in observing articulated shapes and details is limited to 16 arc degrees. During prayer, the size of the area being covered by this angle is approximately 50cm in diameter. The visible area of the interior, depending on the prayer position during salat (prayer), typically covers the floor and a small part of the lower wall.

A specific type of light, which is rich in blue wavelength spectrum, can make the eyes identify visual detail well enough even under low-level intensity. This happens because it can optimize the performance of ipRGC (intrinsically photosensitive Retinal Ganglion Cell) (Do & Yau, 2010).

Figure 17. Peripheral vision at Pathok Ngoro Mosque  
Source: Researcher Documentation

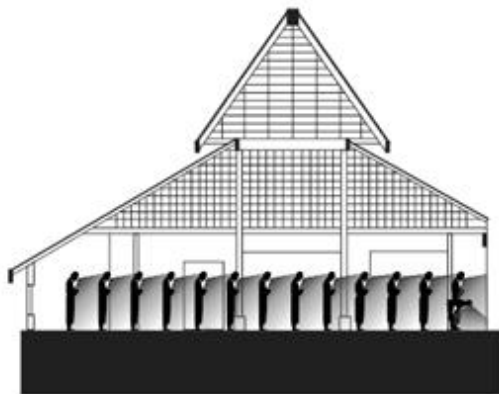


Figure 18. Peripheral vision at Syuhada Mosque  
Source: Researcher Documentation

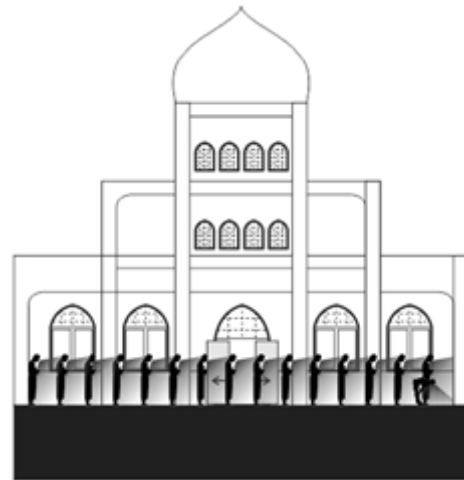
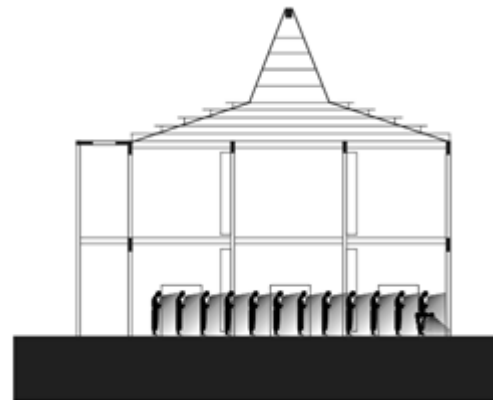


Figure 19. Peripheral vision at Baitur Rahman Mosque  
Source: Researcher Documentation



#### D.1. Focus and Concentration

During prayer, the eyes remain open and function typically as any other visual activity in general, which distinguishes the processing of information that occurs in the brain. In doing so, the brain is consciously directed to focus on the invocation, prayer motion, and sound of the *imam* (*shalat* leader). All other information is considered a distraction and therefore needs to be suppressed.

The variety and complexity of visual objects are not always static but more likely to be dynamic based on the environmental conditions and quality of light within. The space. As the illumination condition inside the space changes as a result of building envelope composition

working in tandem with natural lighting, the variety and complexity of visual composition also change.

The more the variety of visual object information recorded by the eye and received by the brain during prayer, the higher the processing activity occurs. This increased flow of information and processing activity will eventually result in a harder attempt to focus as both the process and focusing attempt are conscious efforts.

At Pathok Negoro Mosque, complex visual objects that can be found within peripheral vision are the floor mat pattern and stone pedestal details. These details will make the focus attempt hard during afternoon prayer when visual conditions are in a photopic state. However, they have no substantial visual impact at any other time of the day when conditions are mesopic and scotopic.

The visual acuity in Syuhada Mosque during morning and midday is recorded to be high, with complex visual objects located within peripheral vision, mainly the floor mat pattern. These details will make the focus attempt hard during the first half of the day in photopic conditions. During the second half of the day, focus attempts are easier due to mesopic and scotopic conditions.

Similar to the second mosque, the concentration attempt at the Baitur Rahman Mosque will be challenging during morning and midday. The complex visual objects that can be found within peripheral vision are the floor mat pattern and mihrab wall detail. In the afternoon and evening, the attempt to concentrate will be less challenging when the visual condition falls into mesopic and scotopic.

Table 4. Degree of attempt to reach focus and concentration during prayer

Mosque	Attempt to focus/concentrate			
	Morning	Midday	Afternoon	Evening
Plosokuning	Low	Low	High	Low
Kotabaru	High	High	Low	Low
Kopeng	High	High	Low	Low

Source: Researcher Documentation

## D.2. Mood Generation

Moods that will be generated by prayers in the mosque are influenced by the color of light, light intensity, contrast of light, and the character of the ambient within the space. The preferred ambiance of a prayer hall in the mosque, which is considered to have a strong relation to solemnity, is a serene, calm, dim, humble, and soothing sensation (Hasbi & Musdinar, 2020).

The ambient generated in Pathok Negoro Mosque in the morning, midday, and evening is relatively serene, humble, and dim as a result of the low light intensity, low contrast, and uniform distribution of light as well as reflections coming from wood material, white walls, and green floor mat. On the contrary, the afternoon ambient appears to be dramatic and harsh, mainly caused by the high contrast and sharp light penetrating from the west-facing wall.

At Syuhada Mosque Kotabaru, fresh ambient is formed during the first half of the day by bright uniform light that enters the space from the clerestories. After midday, the low light intensity generates enough soothing ambient in the afternoon throughout the evening. However, the greenish ambient does not benefit the overall ambient of the space in achieving solemnity.

Similar to the Syuhada mosque, the morning and midday ambient of Baitur Rahman Mosque do not reveal any of those with close relation to solemnity. This happens as a result of bright intensity and high contrast on walls. However,

in the afternoon, calm and soothing ambient starts to form and lasts until evening.

Table 5. Degree of attempt to reach focus and concentration during prayer

Mosque	Ambient Compliance with Solemnity			
	Morning	Midday	Afternoon	Evening
Plosokuning	Full	Full	No	Full
Kotabaru	No	No	Partial	Partial
Kopeng	No	No	Partial	Full

Source: Researcher Documentation

### D.3. Visual Comfort

The visual comfort during prayer is determined primarily by the uniformity of light distribution and the absence of glare produced by the high contrast ratio. There is no minimum light level requirement specifically except that of sufficient for the navigational purpose and basic identification of generic objects, i.e., the point of *sujud* when standing, the prayer's toes during *ruku'*, and the tip of prayer's nose during *sujud*, at 2lux.

The Pathok Negoro Mosque envelope and interior develop good visual comfort in the morning but decrease slightly toward midday, then drop in the afternoon in parallel to the increasing level of contrast. In the evening, the general type of artificial lighting being operated in the prayer hall provides enough uniform light with less contrast. This helps the space to obtain sufficient comfort.

Comfort is continually formed in Syuhada Mosque Kotabaru throughout the day and evening as even light distribution appears all day without significant appearance of high contrast that potentially hampers the uniformity. In the evening, the illumination produced by the main pendant light, in addition to the general GLS type downlight creates relatively even light distribution. Although a degree of contrast appears on ceilings where these downlights are installed, the gradual light traces are still acceptable to the naked eye.

Contrasts appear to be a substantial visual issue within Baitur Rahman Mosque as they are produced in the morning, midday, and afternoon. Although the uniformity of light distribution is achieved on the floor the entire time, the level of contrast on the wall remains a threat to discomfort. The only time comfort is achieved is in the evening when light is produced from inside the mosque.

Table 6. Degree of visual comfort inside the prayer hall

Mosque	Visual Comfort Level			
	Morning	Midday	Afternoon	Evening
Plosokuning	Good	Fair	Poor	Good
Kotabaru	Good	Good	Good	Good
Kopeng	Poor	Poor	Fair	Good

Source: Researcher Documentation

## Conclusion

Praying in solemn conditions is a spiritual achievement that can be obtained by complying with several visual criteria. The condition of the atmosphere and the environment of the prayer hall are among the factors that can contribute to the achievement of solemn conditions. Many mosques are designed with articulation of shapes and compositions. Commonly, the prayer halls are composed of decorative elements and ornaments of Islamic impression such as calligraphy, other decorative elements derived from Arabic or the Middle East region, or even elements borrowed from other notable mosques with the intent of being able to build a spiritual atmosphere. Although prayer halls with good spiritual atmospheres do not always result in the achievement of solemnity, they attempt to reach one easily if done correctly.

In reaching the solemn condition during prayer, the mental condition and the heart of the congregation before the prayer become one of the determinants of fervent prayer. The important role of the spiritual atmosphere is to provide a supportive ambient and comfortable visual environment before performing prayer. During prayer, the role of the spiritual atmosphere is to provide conditions that facilitate the congregation to reach the highest level of concentration and

state of focus.

A low level of light intensity that creates low visual acuity in scotopic conditions helps to disguise object details and lower visual complexity to prevent distractive visual information from flowing into the brain. This may result in a less challenging effort to focus and concentrate. A uniform light generates more visual comfort than a high contrast as it maintains less eye-adaptation. A serene, calm, dim, humble, and soothing ambient is considered relevant to the generation of solemnity as it promotes humility and assists the prayer to feel calm and relaxed.

The purpose of this study is not to compare which mosque design or typology is better for creating solemnity compared to the other. It is to observe all aspects within the mosque envelope that would promote or neglect the visual outcome in generating solemnity.

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