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DESIGNING MIHRAB USING 'ATUMICS' METHOD: ASY-SYIFAA' MOSQUE AS A CASE STUDY

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ABSTRACT

Revitalizing older artifacts from existing furniture and building elements and integrating them into the interior design of a renovated building necessitates an appropriate methodology. This research aims to develop a new mihrab design for the Asy-Syifaa' Mosque, with a focus on preserving the minbar and the inner dome as key artifacts. The study proposes using the ATUMICS method to guide the design process. To test preference between the ATUMICS-generated mihrab design and another design without ATUMICS, a vote was held among the congregation, and advice from interior design experts was sought on the chosen design. The findings show that the design generated by the ATUMICS method is preferred by both the congregation and interior design experts. Therefore, the ATUMICS-generated mihrab design was developed through adjustments using cutting-edge technologies and materials.

Keywords:
Mihrab; ATUMICS; Interior design; Mosque design

1. INTRODUCTION

Physically, a mosque is seen as a building. But literally, a mosque, which derives from the Arabic term 'masjid', is a place of prostration, as in the Arabic word '*sajdah*'. In a Muslim society, a mosque plays an important role. The mosque, as a place, can host all Muslim activities related to compliance with Allah, not just prayer and ablution [1]. So then, the mosque exists as a building to accommodate Muslim society in doing those activities.

In the mosque topic, some terms may be unfamiliar to non-Muslim readers. For clarity purposes, it is necessary to define some terms at the beginning of this paper. 'Imam' is a leader of congregational prayer who leads the specific ritual prayer [2]. 'Qiblah' is the direction of the Kaaba shrine in Mecca toward which all Muslims turn in ritual prayer [3]. 'Mihrab' is the imam's praying niche in the qiblah wall as the central point of congregational prayers [4]. 'Minbar' is a Muslim pulpit [5].

In a residential area, the mosque is frequently visited by the aging population. There is a board of the congregation, people in its area, who remain committed to determining, organizing, and governing the mosque's activities. As the region and its population develop, the mosque often undergoes adaptation (i.e., renovation) by the people. Thus, the adaptation of a mosque in a residential area should take into account its aging population, which is its most loyal congregation.

Designing for an aging population aligns with the need for skills in universal design, longevity design, renovations, and new construction [6]. Miran & Husein [7] stated that renovation is a type of intervention in the adaptation of historical buildings. Room dimensions and spaces that can accommodate more people are included in the building adaptation. In a building adaptation, the building's interior may need to be transformed. To maintain the heritage properties, the existing interior, architecture, and the iconic aspects of the artifacts should be considered.

In many places, mosques are designated as heritage buildings. One of the holy mosques, the Nabawi Mosque in Madinah, Saudi Arabia, has faced several adaptations since its first construction 1400 years ago. This mosque then becomes an inspiration for how an adaptation project should be conducted. The holy mosque's expansion is inevitable because during the Prophet Muhammad's era, he initiated the first expansion of his holy mosque to accommodate the growing number of Muslims. At the first expansion from 50 x 49.5 meters [8] to the latest expansion, where the total area is 617 x 675 meters [9]. As civilization progressed, there were further expansions and adaptations in building. The Nabawi Mosque was initially built mainly of mud bricks, and its roof was made of palm branches. The Qiblah wall was made from mud bricks, and it was said: "from stones", whereas its walls were made from bricks, and its pillars were made of palm tree trunks, but it had decayed. Then, during the Al-Walid bin Abdul-Malik era, they used the latest architectural techniques of the time for the mosque. The pillars were made of stone filled with iron and lead; mosaics, marble, chains, and lamps were used in the mosque's walls, ceiling, pillars, and door sills [8].

According to history, the qiblah wall as part of the mosque is permissible to be renovated, as is the mihrab. The mihrab area in many mosques tends to receive more attention than other sections [4]. However, the mihrab's appearance should be observed as a finely contemplative decorative element; hence, it doesn't distract someone focused on their prayer. The way the mihrab is decorated in Islam is conditionally permissible, reflecting the belief that pursuing and appreciating beauty is intrinsic to human nature and beneficial for both worldly joy and spiritual focus. This acceptance is fundamentally rooted in Islamic spirituality and is supported by the Prophet Muhammad's teachings that Allah is beautiful and loves beauty. Mihrab designers usually aim to strike a balance between the two, neither missing out on the many advantages of decoration nor compromising the prerequisites of worship or the requirements of the mosque.

In the layout, the mihrab is visible from all directions in the main prayer hall. The mihrab section is located near where the imam prays. In the mihrab, there is a minbar, usually on the imam's right. The decorative pattern of the minbar has been more explored by many designers. This can be proven by the diversity of minbar forms in many mosques. The shape of the minbar tends to be more dynamic, both in its dimensions and in its support. The minbar's shape is designed to accommodate the decorative pattern. Even without decorative features, the minbar still functions as a minbar. The decorative pattern or iconic objective on the minbar may distinguish one minbar from another with the same shape but a different surface pattern or image. In interior furnishing design, the structural elements of furniture refer to the reasonable organization and arrangement of design elements. Interior design shows how the "construction conventions" and "certain treatment methods and mutual relations" come together with the architecture's structural elements [10].

One of the parameters of quality buildings and quality interiors is the seamless integration of all its constituent elements. These include the structural features, site planning, landscaping, furniture, architectural graphics, and interior details. A truly outstanding design is one in which every aspect of the work is in perfect harmony, creating a cohesive and unified whole [11]. Selected elements of a design are arranged following three-dimensional patterns based on the major function, the aesthetic purpose, and the user's behavior. No single part or element in an interior space stands alone. In a design, all the parts, elements, or pieces depend on one another for their visual impact, function, and meaning. Interior design is composed sequentially, part by part, to form a complete order to achieve certain purposes [6].

During the renovation of the mosque's interior, some elements may be preserved, while others are removed for specific reasons. Then, the renovation process involves selecting materials that best meet aesthetic, acoustic, thermal, and budgetary needs. For example, wood is known to have a lower acoustic coefficient than marble [12]. Therefore, wood is better used as a decorative surface in a room that needs minimal echo. To achieve the luxury concept, wood can be coated with a high-pressure laminate (HPL) layer featuring a marble pattern.

An important yet rather specific element in interior design is iconography. Iconography is the use of images and symbols to represent ideas, especially by religious or political groups or by artists [13]. Icons might be used as a unifying element in the design. Commonly, the icons are Arabic calligraphy bearing the names of Allah and Muhammad, or Quranic verses, representing the Islamic holy space. The icon symbolizes a mosque as a communal space for Muslim prayer. One Arabic calligraphy style is "*thuluth*," as shown in Figure 1. The combination of the interior design and Islamic iconography creates a holy space that evokes a certain impression, ideal for prayer.

Figure 1. Thuluth Arabic calligraphy style [14].

Jie explains that in semiotic design studies, the icon is connected to the symbol [15]. The symbol, then, is the representation of a sign. The signs were then carried through the interior design to convey abstract information that could be perceived by consumers or users through their senses. Interior designers cannot rely on the introduction of a language to express abstract information in their design, but they can use the information of design itself, such as modeling, color, material, etc., which can be perceived by people to convey information. Symbols in interior furniture art can also serve as a language that helps visitors understand the regional symbols, history, and culture behind them.

To adapt traditional products to the contemporary context, the ATUMICS method is used. The abbreviation ATUMICS stands for Artifact (A), Technique (T), Material (M), icon (I), Concept (C), and Shape (S) [16]. ATUMICS can be used by designers and engineers to create breakthrough products or systems by combining modern and traditional elements, resulting in a new object that preserves both characteristics. Figure 2 is a diagram showing an example of how a new object is composed of particular traditional and modern elements.

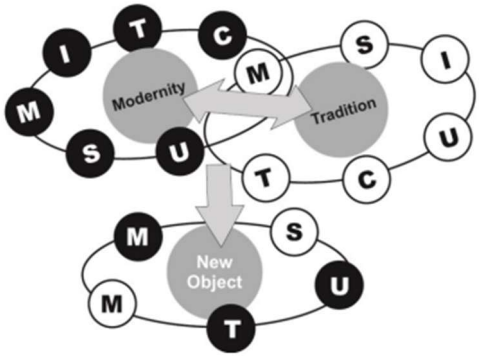

Figure 2. The Representation of ATUMICS method [16].

In architectural and interior studies, ATUMICS was reported in fabric workshop design research [17], office building research [18], and educational building research [19], where traditional identity served as the main inspiration for its application. In other research, human factors serve as the primary inspiration for the ATUMICS application, introducing an innovation in café interior design [20]. In those previous studies, the ATUMICS method was implemented either during the pre-construction phase or the post-construction phase. The ATUMICS research on a mosque building and its implementation in a renovation project has not been found.

CASE STUDY

Since its construction in May 1991, the Asy-Syifaa' Mosque has become a venue for various worship activities, especially for the Muslim community in the Central Antapani Region and, more generally, in Bandung City. Along with increased activity and regional growth, the number of Muslim communities in the area around the Asy-Syifaa' Mosque is also increasing. This often makes the mosque's capacity insufficient to accommodate the worshipers, especially during Friday prayers.

Before the renovation planning, Asy-Syifaa' Mosque did not yet have an interior design plan, including the mihrab. However, as is common in grand mosques, there is a tradition of preserving artifacts from earlier mosques. The artifacts in this mosque also serve as genealogical records for tracing the succession of former Muslim community leaders. Given this, the designer needs a method for proposing a design that harmonizes the prior mosque artifacts with the new mihrab.

The purpose of this research is to assist in the creation of a new mihrab design. In this case study, the Asy-Syifaa' Mosque renovation project is the subject of the research, with the minbar and the inner dome as the artifacts to be preserved. The ATUMICS method is proposed to determine the new mihrab design for Asy-Syifaa' Mosque.

2. METHODS

2.1 ATUMICS

ATUMICS is an acronym that explains six fundamental aspects in designing an artifact. The acronym also represents a method of revitalizing tradition through product design. The letter 'A' in the ATUMICS refers to the Artifact, whereas the respective letters refer to Technique, Utility, Material, Icon, Concept, and the Shape [16]. In the ATUMICS method, an artifact that preserves a tradition is designed by combining modernity and traditionality [16]. For example, an artifact could be reproduced using modern methods while retaining its traditional materials and utility. Another artifact may still be produced using a traditional technique, yet the icon and shape are transformed in a contemporary fashion.

There is a long-standing discourse in the design field about a practical method for interpreting tradition and manifesting its essence in new design. Shape, as one of the main aspects of generating artifacts in the ATUMICS, can be produced through various methods.

Formgiving refers to the molding and fashioning of objects in industrial design [21]. Digital form-finding is a term related to designers' activity of synthesizing an optimal shape or three-dimensional form, constrained by a set of constraints, using parametric computational tools [22]. Form-finding may be conducted through physical modeling [22] or through digital modeling [23] [24].

Another approach to generating shapes is through Shape Grammar [25] [26], which uses translation operations such as scale, mirror, move, rotate, trim, crop, and merge, along with Boolean operations, to generate shapes. Both shape grammar and digital form-finding are modern techniques for generating shape.

Another aspect that constructs an artifact in ATUMICS, the Technique, may hold a major role in transforming a traditional artifact into a contemporary form. New techniques for producing artifacts align with the broader industrial movement. Fabrication tools with end-to-end automation, such as CNC machines, 3D Printers, CNC Robotic Arms, and Automatic Assembly Machines, are examples that could transform many artifacts. Another recent technique that may significantly affect the quality of an artifact is finishing and detailing, supported by advances in polymer and composite research.

The utility of traditional artifacts might be transformed or substituted for new functions. Some artifacts with maintained utility may also be designated for new users [16]. A change in utility or target user may also affect the whole appearance of the traditional artifact.

The material used for an artifact is also important. Research on advanced materials might influence the fabrication technique, shape, and form of an artifact. The choice of materials from advanced materials research, such as engineered wood, solid wood, composites, bamboo, bioresins, biocomposites, bioplastics, biomaterials, and smart materials [27], may add the full value and properties of an artifact. Material and Technique are also related to the lifespan and the life cycle [28] of an artifact.

An icon is a specific image that distinguishes an artifact from other artifacts. An icon might be constituted from any kind of representation in nature, ornament, color, myth, or legend.

Then, the concept is the hidden aspect beyond just physical shapes and objects. The concept is believed to be the aspect most at risk of extinction. Concepts as hidden aspects can be customs, norms, believes, ideologies, and common culture. The role of these hidden aspects is vital. The application of new systems and products will be effective and sustainable in society only if the new element matches or is compatible with the norms, customs, and local culture [17].

2.2 *MUSYAWARAH* FOR APPLYING ATUMICS

Design problems and requirements are generated by four roles: client, user, designer, and legislator [29]. The design approach, methodology, design decisions, and the final design in a project should address the design requirements. However, the design process itself is often iterative [29]. The design problem and requirements can be revisited, evaluated, adjusted, or revised during the design process, provided they are known to and approved by the stakeholders.

Design limitations, such as budget, schedule, and other constraints, help focus the design requirements and establish the design. In this project, there are additional constraints and concerns related to the mosque as a public building, where the congregation, as the primary users, is given the highest priority. Design that involves users as stakeholders is classified as participatory design [30] [31] [32]. Participatory design, especially in Indonesia, may include *musyawarah* [33]. *Musyawarah* may help build consensus and address disagreements within the congregation while maintaining social harmony [33].

Because the new object is not a standalone object but part of the building, when harmonizing it with the existing design and architectural concept, the designers should determine the appropriate line, form, shape, texture, space, size, and color. The interior design experts offer perspectives to help make finer choices.

The method used in this research is ATUMICS [16]. Aspects concerned should be in ATUMICS: technique, utility, material, icon, concept, and shape. But in common uses of ATUMICS, these aspects are not merely used to compose the new object. For this project, the ATUMICS method can be used because, first, it serves the preservation of existing artifacts. Then, the new mihrab shall be generated through transformation processes, creating a design derived from existing artifacts and various material combinations.

To validate the new mihrab design generated by ATUMICS, a vote by the congregation's representatives will compare the preference for the ATUMICS design with that for another design without ATUMICS. The sample of the congregation as the voters is 24 persons: 18 males and 6 females. This gender ratio follows the Islamic rule that men have a greater obligation to attend the mosque than women.

3. RESULT AND DISCUSSION

3.1 RESULT

The design process for the new mihrab includes artifact observation, development of a design proposal, voting, a *musyawarah* to select the alternative design, and implementation of the decision made during the *musyawarah*.

3.1.1 ARTIFACT ANALYSIS

The existing minbar in the Asy-Syifaa' Mosque comes from Jepara, Central Java. It is made from solid teak wood. The coating is mainly stained, with some spots painted. The shape of the minbar is similar to that of other minbars commonly seen in the Java region, as explained by Makmur & Lubis [34].

Figure 3. The minbar as the older artifact.

Figure 4. Arabic calligraphy in the minbar.

This minbar is decorated with hand-carved wood. Decorations on Asy-Syifaa's minbar included geometric patterns, floral ornaments, and Arabic calligraphy, as shown in Figure 3. On the minbar, as shown in Figure 4, there is a decoration that resembles an Islamic geometric pattern produced using a modern technique, as represented by Kaplan & Salesin [35], as *Najm. Najm* is a set of tools (functions and scripts) for developing Islamic geometry using three model elements: the star, the rosette, and the extended geometry. The star will be the core; the rosettes are geometric shapes developed around the star, while the extended design element fills the gaps between the main polygons that contain the star. The basic *Najm* visualization model is shown in Figure 5.

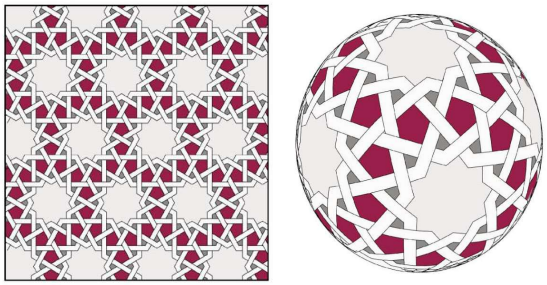

Figure 5. Islamic geometric pattern using the Najm process [35].

The geometric decorations include the three concave stripes along the vertical edges and the decagonal Najm pattern on the front, left, and right faces of the minbar. The floral ornaments are carved at the corners around the minbar and at the back of the inner apron. These ornaments appear on the minbar, as seen in other mosques. The pattern of floral used is the sterilization of plants in the form of leaves, roots, stems, or flowers [36].

The Arabic calligraphy carvings are found at three positions, as shown in Figure 4. First, on the front central face, is written the Arabic sentence for the Asy-Syifaa' Mosque, fitting inside a circular shape. Second, the shahadah is written on the frontal apron in Arabic. Third, on the inner back apron is a passage from the Quran: Surah Al-Baqarah, verse 283. In Arabic calligraphy, according to Allaf & Al-Hmouz [14], the Asy-Syifaa' Mosque minbar belongs to the thuluth style, which fills the space of several forms. In general, the thuluth is represented as shown in Figure 1.

Figure 6. (a) The inner dome above the mihrab before being renovated; (b) the inner dome above the mihrab after the renovation.

Another artifact is the ornament in the inner dome. It is shown in Figure 6. The inner dome is made of concrete. So, it is colored by the wall paint. Geometric and floral ornamental drawing combined with Arabic calligraphy. The base color is mainly pale yellow. The line color for the geometric ornament is brown. Other colors that are used are green and gold. The Thuluth style is also found in the calligraphic decoration on the inner dome. Since no other calligraphic style is used in the interior of the Asy-Syifaa' Mosque, the iconic aspect of the Arabic calligraphy is thuluth.

3.1.2 PROPOSED DESIGN

As a new object, the mihrab is composed of two existing artifacts: the minbar and the inner dome. This composition concept is interpreted from the ATUMICS method. Due to limited funds, the committee overseeing the Asy-Syifaa' Mosque renovation decided on a plywood as the main material for the mihrab.

3.1.3. TECHNIQUE AND MATERIAL

In its construction, the new mihrab used a different technique from that of the existing minbar and the inner dome. While the minbar is carved by hand, the new mihrab is produced on a CNC machine. Different production methods can be observed in the appearance of the carvings. Finishing methods for the elements also differ. While the inner dome is coated and the minbar is painted, the new mihrab is covered with laminated HPL sheets.

3.1.4. UTILITY

The main utility of the mihrab is as a place for the imam to pray. However, the new mihrab has secondary functions: to improve the overall visual quality of the mosque interior and to serve as a cover for the speaker installation. The new mihrab utility, as a decorative element, is similar to the inner dome decoration. The inner dome is set on the building's ceiling, while the new mihrab is in the front part of the main praying hall. In the meantime, the minbar differs, as its main purpose is to deliver sermons.

3.1.5. MATERIAL

The minbar and the new mihrab are made of the same basic material: wood. The wood creates a warmer atmosphere. To achieve a modern, sleek look, the new mihrab is built from plywood wood and finished with HPL. There are three HPL patterns used in the project: wood, granite, and stone. There is a contrast in the choice of inner dome material. While the inner dome is made from painted concrete, the new mihrab is built using plywood wood covered with HPL.

3.1.6 ICON

Among all the aspects that constitute an artifact in the ATUMICS, the icon aspect is similar in the minbar design, the inner dome, and the new mihrab. It is due to the new mihrab's design objective, which had to be integrated with and harmonized with the minbar and the inner dome. On the minbar, there is calligraphy in the thuluth style, set within pillars at each corner, decorated with floral carving, and elaborated with a geometric pattern on the front face. Then, on the inner dome, there are calligraphies in the thuluth style and a radially arranged geometric pattern. These similarities are incorporated into the new mihrab design, which features calligraphy in the thuluth style, pillars at its front corners, and geometric-relief patterns on its top.

3.1.7 SHAPE

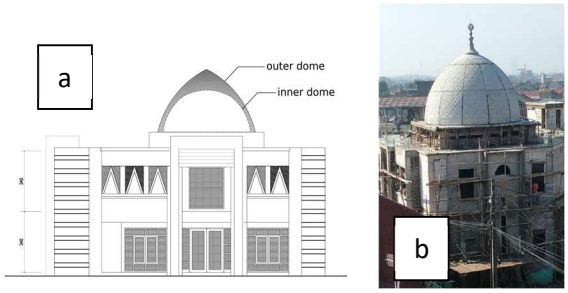

Figure 7. (a) Position of the inner and the outer dome; (b) The outer dome.

Figure 8. LED light strips and an attached speaker are the extra features.

The shape of the new mihrab is designed by combining the properties of the minbar and the inner dome. Accommodating these properties is crucial to harmonizing the minbar, a small object, with the inner dome, a large object. The minbar's basic shape is cuboidal, but the rear side is curved. The basic shape of the inner dome is a half-sphere. So, the main shape of the middle bottom of the new mihrab is cuboid. Then, the upper half of the new mihrab is designed as a half-circle (arch) combined with a pointed vault. Its dimensions are roughly the same as those of the inner dome, creating a similarity between the two objects. The combination of the arches and a

pointed vault also creates a similarity to the outer dome. The view of the outer dome is shown in Figure 7. Then, the multiple steps of the arch and pointed vaults are similar to the exterior building section located directly behind the mihrab, as seen in Figure 8. The arch shape is chosen because the object is attached to a flat wall, which makes it impossible to build a hemisphere. The results of the observation of existing artifacts, compared with the proposed properties of the new mihrab design, are presented in Table 1. They are identified based on ATUMICS elements.

3.1.8. EXTRA FEATURE

The new mihrab is illuminated. The lighting installation, hidden inside the panel, consists of LED strips. The arrangement improves color gradation and saturation in the upper half of the mihrab. Another lighting feature is placed behind the "Allah" calligraphy, causing the inner light to spread around it. Another unique feature is the placement of the audio speaker inside the new mihrab. The purpose is to make the congregation focus on the new mihrab's visual appearance rather than the utility installation. Otherwise, the audio speaker will look like a knobbing block attached, which can disturb focus on the whole new mihrab appearance.

To compare the designs generated with and without ATUMICS, refer to Figures 9 and 10. These designs have some similarities, almost apple-to-apple. The congregation may choose a favorable design for artifact preservation and harmonization purposes

Table 1. The properties of the existing artifacts and the proposed properties of the new mihrab design.

Aspect	Minbar	Inner dome	New Mihrab
Technique	carved	painted	CNC-cut, laminating
Utility	lecture	decoration; ceiling;	decoration; speaker cover.
Material	wood	concrete	plywood and high-pressure-laminating (HPL) veneer
Icon	thuluth calligraphy style; pillar; floral; geometric pattern	thuluth calligraphy style; geometric pattern	thuluth calligraphy style; pillar; floral; geometric pattern
Shape	cuboid; curvy	half sphere	half-circle (arch) and pointed vault; cuboid;

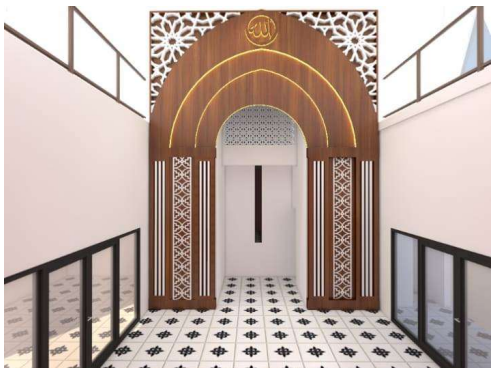

Figure 9. Mihrab design alternative without using ATUMICS.

Figure 10. Mihrab design alternative using ATUMICS

3.1.9 *MUSYAWARAH*

Voting was conducted to determine whether the design generated with ATUMICS is a valid choice among users. In this context, the users are the congregation. There are 24 voters involved in the voting process. They are the representative of the whole congregation. The congregation that does not vote, they might appeal to the voters. The voting results show that 11 people chose the mihrab design generated without ATUMICS, and 13 chose the mihrab design generated with ATUMICS, with several notes. To evaluate the voting results and their notes, three interior experts were interviewed in this research. They have some suggestions to improve how the voting results (the preferred design) could be implemented.

Interior design expert 1, who has 8 years of experience and has a bachelor's in architecture, said, “My suggestion for the mihrab design with ATUMICS is to add a little bit of lighting (warm light) to each partition curve to enhance the luxurious feel. Additionally, the backdrop can use the metallic colors such as silver, gold, or bronze.”

Interior design expert 2, who has 2 years of experience and has a bachelor's in interior design, said, “It would be better if the red color in the design were not included or replaced, as this color becomes the focal point on the mihrab and does not harmonize with the exterior appearance of the building. Additionally, the geometric patterns and shapes, as well as the waterline on the right and left sides of the mihrab, should be simplified. For example, if you don't want to use too many geometric shapes, use materials with sufficient texture, such as granite. Conversely, if you want to use many geometric shapes or accents, use materials with minimal texture”.

Interior design expert 3, who has 3 years of experience and a bachelor's in architecture, said, “The red background should be replaced with a softer color. Avoid using bright or striking colors. The design can be enhanced by adding LED lights.”

Then, the new mihrab was constructed according to the design, using the ATUMICS method and incorporating suggestions from interior design experts. Those accepted suggestions are: (1) applying a little bit of lighting (warm light) to each partition curve to enhance the luxurious feel; (2) using metallic colors such as silver and gold; (3) using materials with sufficient texture, such as granite; and (4) the red background is replaced with a softer color, which is white. When the design was executed, the congregation was still required to make minor adjustments, which did not make a severe deviation. It will be explained in the discussion section later.

Figure 11. The mihrab construction process.

Figure 12. Finished mihrab

3.2 DISCUSSION

3.2.1 COLOR ADJUSTMENT

The proposed design is implemented through a construction process. Since some of the materials contain plywood, the construction process includes cutting, coating, and installation. Some materials that are not made of wood are installed directly or applied by painting. At the project site, certain parts were being assembled, as shown in Figure 11. During the assembly process, the congregation found that a few properties needed adjustment, provided the adjustments are not a drastic departure from the project's basic idea and true objective.

As Lawson [29] explained regarding the design process, some designs seem to offer a reasonably accurate and reliable model of appearance but not necessarily of performance. For example, the pillars are originally designed to look marble-like. The pillars are fully gray-themed, while the mihrab's top front is fully cream-themed. But the fully gray color makes the whole mihrab too pale. So, in the design revision, it is proposed that the vertical ornament of the pillars, rather than being fully marble-like, should have a cream-colored surface, similar to the top front of the mihrab.

The completed mihrab, designed using the ATUMICS method, shows at Figure 12. After the mihrab was completed, the interior design experts were asked to rate, on a scale of 1 to 10, the suitability of the new mihrab's appearance to its design intention. Interior design expert 1 gave a rating of 7, expert 2 gave a rating of 4, and expert 3 gave a rating of 10 out of 10.

3.2.2 IN ISLAMIC ART 'ICON' ASPECT IS CLOSELY RELATED TO SHAPE

In Islamic art, the icon aspect is closely related to the shape and the concept aspects. For example, Islamic geometric patterns are iconic in Islamic art, yet they represent Islamic belief in various forms and shapes. The main models for constructing polygon-based Islamic geometry are the najm, rosette, and extended design elements [35][36]. The geometry is created with circles as guides and a basic polygon as a base, then developed using Euclidean transformations and trigonometry. Islamic geometry is also referred to as absolute geometry since it emphasizes the use of the perfect number [37]. The sense of symmetry in polygon-based and circle-based Islamic patterns also represents the balance in nature, serving as a remembrance of Allah, the Sole Creator and the Great Geometer [37]. Further interpretation for a certain kind of Islamic pattern, for example, the use of a decagonal pattern, may correlate the shape with lunar movement and the Hijri calendar [37]. For comparison, in ancient Greek, the octagon is associated with the lunar calendar, while the square is associated with the sun and the four seasons [37].

Another tool for developing Islamic geometry is the Hasba method [38], as shown in Figure 13. This method was implemented by generating base geometry, such as rectangles, squares, octagons, and other polygons, as the base pattern, which is then divided using an empirical unit of division called *qassma* (*q*). $L = h.\ q$ is the ratio of length relative to *h*, that is, the dimension for the "Hasba" of the pattern. In the interior design of Asy-Syifa Mosque, a decagonal Islamic geometric pattern is used on the mihrab pillar. This pattern was also applied to the upper part of the mihrab's wall background.

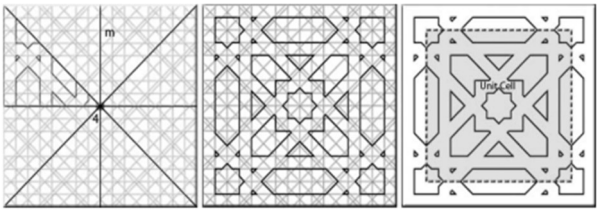

Figure 13. The process of generating base geometry for Islamic Art using Hasba [38].

3.2.3 THE 'CONCEPT' HAS NOT CHANGED

One of the ATUMICS aspects, the concept aspect, has not changed in the Asy-Syifaa' Mosque mihrab design. The proposed mihrab is designed to attach an additional wall element and cover the existing mihrab part of the interior mosque building. The part that previously existed is a plain wall. The concept aspect in the mihrab is not impossible to implement. The objective of implementing this aspect is to encourage innovation in the proposed design while still meeting the norm or standard. There are examples of how ATUMICS' conceptual aspects can be applied, as shown in Figure 14. The ideas derived from deconstructing a mosque's design [39].

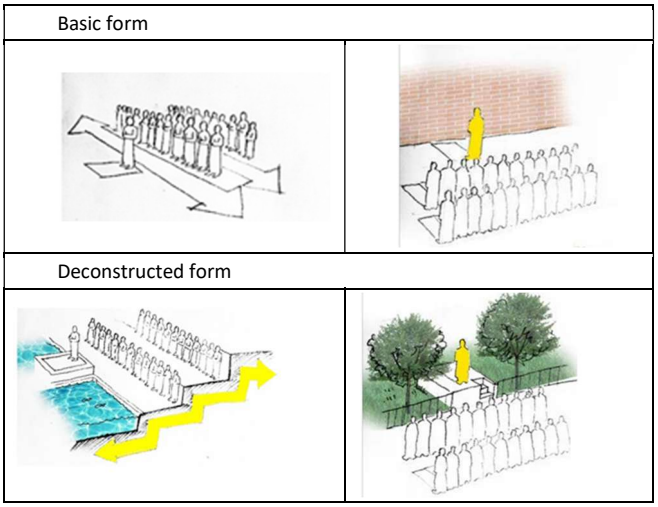

Figure 14. Example ideas of how the mixture of ATUMICS's concept aspect applied [39].

The implementation of the concept aspect is evident in the pool at Al Irsyad Satya Mosque in Bandung, which became part of the mihrab. As shown in Figure 14, the presence of this pool limits the row of prayer congregations. In Islamic jurisprudence, the prayer congregation's row does not exceed the imam's row. Usually, there are physical boundary restrictions, such as a line, various leveling, a wall, or a representation of a wall. The use of a pool was proposed as a new concept of the congregational prayer boundary.

3.2.4 DISTINCTION BETWEEN ATUMICS AND REMIX THEORY

To understand the Remix Theory and its relevance, one should look at Walter Benjamin's paper [40] titled "The Work of Art in the Age of Mechanical Reproduction'', followed by recent development of reproduction which is represented in papers titled "The Influence of Artificial Intelligence on Art Design in the Digital Age" [41], " Art in an age of artificial intelligence" [42], and "The Work of Art in the Age of Artificial Intelligence: What Artists Can Teach Us About the Ethics of Data Practice" [43].

Walter Benjamin's paper presents the idea that originality in the work of art is situated between time and place. That is because originality is tied to happenstance. Also, the uniqueness of a work of art itself is embedded in the tradition of a certain period of time [40]. The paper states that any artifact can be reproduced by humans. However, even the most perfect reproduction will not achieve the same degree of originality as the original, given the original's status as the first to appear in a given time and place [40]. On the contrary, there is a theory suggesting that every artifact may not be an original creation, since it mimics nature or draws on natural ideas and inspiration. It is then suggested that every artifact is possibly a remix.

Although the remix theory was popularized in the movie and music industries, it has been applied across a wide range of creative and innovative fields [44], including written work, coding, two-dimensional design, and three-dimensional design [45]. The wide application is also supported by the development of Creative Commons Licensing, which promotes remake and remixing.

In the Remix Theory, remixing is carried out through designers' activities of copying [45], combining [44], transforming [45], and translating [26]. Today, there is a digital end-to-end tool called Artificial Intelligence (AI) that can handle the entire process automatically. The term Artificial Intelligence was coined in 1956 [41]. Artificial Intelligence, in its relation to art reproduction, is based on computer technology, whereas computational design is widely adopted in the design field. The usage of artificial intelligence for art reproduction may change the rules of reproduction in design and innovation. The ideas of novelty and originality may compete with generativity [41]. There might also be a discourse about taste and aesthetics in the machine-generated artifact [46][44]. Artificial Intelligence may be beneficial for combining collective creativity by crowdsourcing information and efficiently generating outcomes [44]. In the Remix Theory, the objective is not about the preservation of traditional aspects but rather a continuous process of creation.

In the ATUMICS method, the designer plays a major role in decision-making, especially in determining which aspects should be handled with a modern approach and which with a traditional one. Therefore, in the ATUMICS method, designers may decide whether to use AI as a technique, as a shape generator, as part of a data-processing machine, or not use it at all. It might be said that remixing is also an implementation of the ATUMICS method. At the same time, there is a similarity between ATUMICS and Remix Theory, and it is unclear which ideas influence the other. However, the discussion of ATUMICS methodology is relatively new compared to that of the Remix Theory. The major distinction between Remix Theory and the ATUMICS method lies in ATUMICS' objective of preserving traditional value. The Remix Theory addresses the full range of artifacts and does not focus on preserving tradition.

4. CONCLUSION

This study demonstrates the effectiveness of the ATUMICS method in designing a new mihrab for the Asy-Syifaa' Mosque that harmoniously integrates the preserved artifacts with the contemporary design elements. By systematically analyzing and incorporating the Artifact, Technique, Utility, Material, Icon, and Shape aspects, the ATUMICS approach facilitated a design process that respected tradition while embracing modern aesthetics and functionality.

The preference for the ATUMICS-generated design among both the congregation and interior design experts underscores the method's success in balancing cultural preservation with contemporary design principles. This outcome suggests that ATUMICS can serve as a valuable framework for similar renovation projects in religious and cultural spaces, where integrating historical elements with modern design is crucial.

Furthermore, the study highlights the importance of stakeholder engagement in the design process, particularly through the traditional *musyawarah* approach. This collaborative decision-making process ensured

that the final design not only met aesthetic and functional criteria but also resonated with the community's values and expectations.

The application of cutting-edge technological processes and materials in realizing the final design demonstrates how prior artifacts can be successfully translated into contemporary forms. This synthesis of old and new exemplifies a path forward for architectural and interior design projects that seek to honor the heritage while meeting the modern needs.

In conclusion, this research contributes to the field of mosque interior design by providing a replicable methodology for integrating historical artifacts into contemporary spaces. The success of the ATUMICS method in this context opens avenues for broader application in architectural and cultural preservation, offering a balanced approach to innovation that respects and revitalizes tradition.

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