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Towards Identifying Mosque Architectural Characteristics Aligned with Expert Preferences: Application on Selected Mosques in Assuit City, Egypt

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Abstract

Mosques, being public spaces, should be designed with the needs and preferences of the wider community in mind in order to facilitate spiritual practice and convenience. Through face-to-face interviews, mosque users have expressed a desire for a range of specific characteristics in their places of worship, further highlighting the importance of incorporating user input into the design process. The study aims to examine the design features of various mosques and assess their compliance with user preferences, with the broad goal of ensuring that mosques are capable of addressing their functional role. A field survey of six mosques was carried out. The findings show that mosque designers have not fully considered these preferences, resulting in a relative discrepancy between user preferences and actual mosque designs, which introduces concerns about the effectiveness and functionality of mosque spaces. Accordingly, the study recommends active community engagement in the design process from the early stages and emphasizes the need for retrofitting current mosques to address design deficiencies. In this context, the findings are useful for identifying areas for improvement for current and future mosques. They can also be utilized as a practical guideline for architects, designers, and other stakeholders involved in the mosque building process.

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Keywords: User preference; Mosque characteristics, Compliance.

1. INTRODUCTION

The construction of the first mosque in Madinah, Saudi Arabia, played a significant role in shaping modern mosque architectural concepts [1–4]. Since then, mosques have been serving as the center of Muslim unity in both traditional and contemporary settings, emphasizing the importance of this sacred place in the Islamic faith [2–5]. Early mosque builders were forced to rely on the locally available materials such as clay, mud, animal skin, and wood. At that time, mosque buildings were rudimentary and simple, as there was limited building experience. However, over the course of many centuries, mosque designs have greatly improved, resulting in many world-class structures that are considered architectural marvels [6,7]. Nowadays, mosque builders use various materials such as marble, granite, and steel, and have access to advanced building techniques and technologies that enable them to create intricate designs and patterns that enhance the beauty and functionality of the mosques [8,9]. As a result, many of the mosques built in recent times are not only places of worship but also tourist attractions that attract visitors from all over the world [10,11].In terms of mosque design, history shows that it was a complex field that has been influenced by various factors, including local cultures, materials, and political developments thus resulting in a diverse rich and varied history [12,7,13]. Furthermore, traditionally, Mosques have also served as symbols for political ideologies, prevailing architectural styles, and socioeconomic conditions [14–18]. The influence of mosques can also extend to social interaction, social stability, and charity [17,19,18]. As a result, Mosque structures must be sufficiently functional and prominently spiritual. Mosques in particular have historically reflected the status of various social groups, governmental structures, and geographic borders through their construction [14,16,20]. For example, many mosques were constructed to honor monarchs, celebrate national occasions, and encourage variety [16,21,22]. Accordingly, the mosques' architectural features were carefully designed to convey power, authority, and grandeur. The size and form of the mosques often conveyed the intended expressions. Elements such as domes and minarets served as symbols of religious significance and provided a visual representation of the community's devotion to their faith [23]. Additionally, the massive entrances and

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approaches created a sense of awe and reverence for those entering the mosque, further emphasizing its importance within the societal structure [22,18,24]. As part of the architectural process, artistic architectural design has been closely associated with mosques as a means of expression; the aesthetic characteristics of this art subtly reinforce senses of ownership and association [22,25–27]. This connection can be observed in various elements such as calligraphy, geometric patterns, and intricate designs found in the architecture and interior decoration of mosques. Also, the use of luxurious materials such as marble and gold has heightened the mosques' opulence and reinforced its sacredness and prestige. These expressions not only enhance the visual appeal of mosques but also serve as a spiritual reminder for worshippers, creating a harmonious atmosphere conducive to prayer and contemplation [28,29]. Given that the Islamic mediaeval had era occurred nearly concurrently with the Romanesque and Gothic eras in Europe, the influence of its art and architecture are particularly noteworthy [28].

The construction of both traditional and contemporary mosques has been influenced by the previously stated aspects of art and symbolism, as well as other elements including funding, legislation, public affinities and personal preferences [30,31,23,32]. Intrinsically, such characteristics are highly correlated with geographic location and period [31,33]. Observation shows that although the fundamentals of mosque design are similar in different regions of the world, many mosques have developed unique aesthetic styles and design elements that correlate to the cultural and historical context of the area [9,31]. For example, mosques in the Middle East often showcase geometric patterns and elaborate domes [31], while mosques in Asia may incorporate vibrant colors and intricate woodwork, circular arches, pentagon-shaped minarets, Indo-Persian domes, and dual-minaret designs [34–36]. Similarly, the mosques built during different time periods also exhibit distinct features [37,5,36], with older mosques often displaying more traditional and ornate designs, while contemporary mosques embrace modern materials, technologies, and minimalist aesthetics [8,38–40]. Therefore, it is logical to infer that mosque features will evolve throughout time and vary depending on the region. It is even more important to wonder whether this evolution is guided by the preferences of mosque users.

In relation, one could argue that the preferences of mosque users should play a major role in shaping the evolution of mosques. As individuals and communities change, so do their requirements and desires in terms of religious practices and aesthetics. Hence, mosque features should adapt accordingly to accommodate them, ensuring a welcoming and inclusive environment for all worshippers [34,41,42]. Therefore, it is important to wonder if this evolution is guided by the preferences of mosque users and to what extent. Yet, some may maintain that the religious authorities must hold the final decision on mosque designs, thus diminishing the role of users. To add to this issue, little or no literature has explore users' influence on mosque design; most mosque-pertaining literature focused on aspects such as mosques' energy consumption rates [43–48], thermal performances [44,46,49], social influences [50,51], the effect on society and policies [22,52,53], and restoration [54–56]. This gap has motivated the present study.

2. AIM

The aim of this study is to conduct a comprehensive analysis of both traditional and modern mosque designs, with a special focus on their ability to meet the spiritual and functional needs of mosque users. The study aims to provide a detailed understanding of the factors that users prioritize, such as indoor layout, aesthetics, and functionality, which are crucial for architects to consider while designing mosques. Additionally, the study aims to examine various aspects of mosque design that impact the quality of the mosque experience, as perceived by mosque users. By studying such factors, the research aims to contribute to the creation of mosques that better cater to the needs and expectations of their users.

3. GAP AND NOVELTY

Although mosques have been the subject of much literature, little attention has been given to the impact of users' preferences on mosque design approaches. This study bridges this knowledge gap by providing insights on the preferences and needs of mosque users that can be used to inform contemporary mosque architecture. Understanding the preferences of mosque users is crucial for creating inclusive and user-centered designs. By considering user preferences, architects can create praying areas that cater to the needs and aspirations of the community, fostering a sense of belonging and spiritual connection. Additionally, as a novel guideline, this study's findings can inform future mosque evaluations, allowing for a more comprehensive assessment of their functionality and effectiveness in meeting the needs of worshippers.

4. METHODOLOGY

The research incorporates both descriptive and analytical methodologies to better understand the condition of important key characteristics of mosque designs and their alignment with user preferences. As shown in Figure 1, the study first identifies preferred mosque characteristics through face-to-face interviews with a specific group of respondents, consisting of mosque users and officials. Logical analysis and expert reasoning are then employed

to better understand these user preferences and the rationale behind them. This includes many aspects such as the layout, size, accessibility, and amenities. Then, the descriptive methodology is utilized in the form of field visitation in order to survey, examine, and document specific features of six major mosques located within the study area. The actual characteristics of the visited mosques are compared to the acquired user preferences determined in the previous step. This comparison can reveal the advantageous traits and flaws in mosque designs, from the perspective of mosque users. More importantly, the comparison sheds light on the degree to which existing mosques have considered user preference and highlights areas where mosque designs can be improved to better meet the needs and preferences of users, thus providing a novel guideline for future mosque designs.

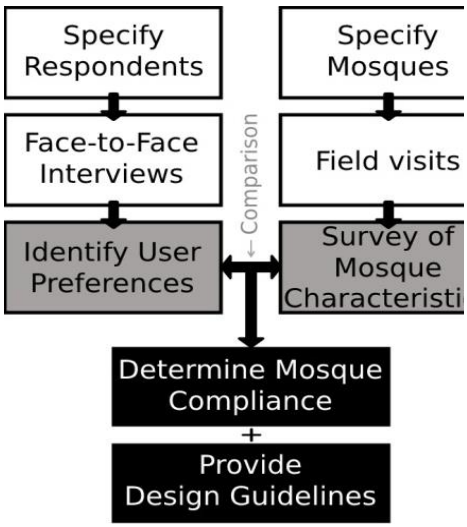


Figure 1: Research process.

5. USER PREFERENCES

The present study aims at determining an accurate representation of the preferences of mosque users in terms of the mosque buildings' designs. The interviews were limited to the officials of the Egyptian Ministry of Awqaf (the Ministry of Endowments), which is the Egyptian governmental regulatory body responsible for managing and upkeeping all religious buildings within the country. The interviewed officials included local mosques' head prayer conductors (*Emams*), experienced curators, and managerial consultants. Even though the general public uses mosques extensively, the authors decided to focus the interviewing process on the previously mentioned officials as a representative user sample, excluding typical mosque users, for the following reasons:

A) As their occupation dictates, these officials' knowledge base entails of a large variety of mosques within the study area, unlike typical users whose knowledge may be limited to select mosques based on the proximity to home or work. Hence, they are able to provide the study with exceedingly comprehensive views on mosques.
B) Where typical mosque users focus mainly on prayers only, the officials consider a wider scope of mosque-related aspects as part of their duties. This allows them to be more familiar with mosque attributes and user behavior, which are vital to the present study.
C) The miscellaneous background of the officials is highly beneficial; for example, Emams are able to present the relevant Islamic aspects of mosques where ministry officials are able to highlight related administrative aspects.
D) The officials' extended awareness with mosque characteristics, as their occupation is directly influenced by them, allows for highly accurate responses.
E) The officials are able to provide valuable insight into the historic evolution of mosque characteristics and the public's response to each of them.

A total of seventeen face-to-face interviews were carried out inside mosques. In each interview, a set of questions were asked which were designed to accurately acquire the respondents' opinions and preferences, examples of which are presented in the following:

- How well do current mosques tend to your personal requirements? / Are you satisfied with current mosque designs?
- What do you think of Mosques' exterior appearance? / What would you change about it?
- Do the current praying areas suit your personal needs? / Are the current praying areas comfortable and accommodating for your personal needs? / Would you suggest any changes to the layout, lineup arrangements, or other features to make them more conducive to prayer?
- Within the study area, do you think that it is easy to access mosques?

- Are there any characteristics of mosques that hinder your ability to pray? / Are there any distractions or disruptions that make it difficult to focus during prayer?
- What can be done to improve your spiritual experience? / What would you change about the praying areas' designs?
- Do you feel safe in the mosques in terms of the buildings' structural integrity? / Do you feel that mosque buildings are robust and persevering?
- How well are mosque buildings perceptible within the urban fabric of your neighborhood?

The obtained responses are logically and rationally analyzed to shed light on the desired mosque characteristics, from the perspective of users. It is important to point out that the acquired opinions are naturally prone to a degree of error in terms of alignment to Islamic rules or architectural standards. Hence, as part of the analysis, such errors are highlighted and rectified. The following section presents the conducted analysis, categorized into groups by the authors, as follows:

5.1 Functional characteristics

The respondents were able to significantly comment of many characteristics that have an effect on the functionality of the mosque. This refers to the mosque's ability to house worshipers and provide an appropriate spiritual ambience, in addition to other generic functions such as accessibility and crowd control. The perceptibility of mosque buildings within the urban fabric is of inherent importance to allow the mosque to function as a spiritual focal point within the city, thus promoting its use. Accordingly, respondents have emphasized their preference for the mosque to be visually recognizable. Additionally, exceedingly visible mosques differentiate them from the smaller praying areas that are typically located on the ground floor of residential buildings, consequently further conveying a sense of importance for the mosques. Accordingly, the respondents have mentioned that the mosque building should be: a) a standalone-style building, b) have visible facades, and c) of a monumental scale, as presented in Figure 2(A&B). Buildings in this context are best erected in locations that provide views of expansive squares, panoramic views, or major thoroughfares.

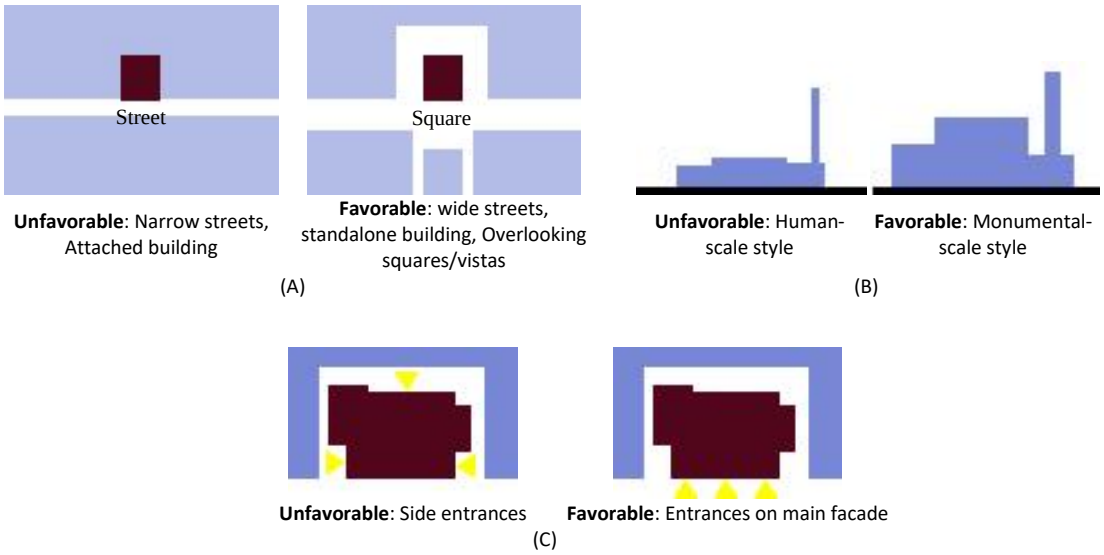


Figure 2: Favorable and unfavorable Mosque characteristics; (A) Layout and surroundings; (B) Building scale; (C) Location of entrances.

Responses also indicate that similar to the building itself, the entrance must be visible. According to the interviews, locating main entrances in façades that oversee main streets or public squares is most favorable, as shown in Figure 2(C). They also favor highly ornamented entrance walls and axial entrances that align with the *Mehrab* or the *Minbar*, as these features significantly enhance the perception of the entrance. In addition, axial entrances can allow for a relatively quick entry, which is more than often required in cases where users are late for an ongoing prayer. As worshipers typically enter and exit the mosque simultaneously in large numbers, the respondents feel that a minimum of three entrances is reasonable to facilitate movement and avoid crowding, regardless of its area. Naturally, large mosques should have more entrances as they accommodate more worshipers. Additionally, it is important to dedicate a minimum of one entrance to women, in compliance with Islamic teachings that decree a form of separation between males and females in worship areas. Respondents point out that the entrances should vary in terms of allowing access to the ablution area or allowing direct access to the prayer area. They feel that the availability of both types of entrances is critical to achieving a smooth flow in and out of the mosque. Also, the location of entrances should ensure that worshipers can enter the praying area from

the rear so as not to overstep other worshipers who are aligned towards the *Miharab* at the front of the praying area.

As Islamic teachings state, worshipers stand beside each other in straight aligned lines to perform all group prayers. The first few lines, with emphasis on the first line, are spiritually desired. Hence, users prefer the creation of elongated rectangular-shaped prayer areas, with the longer direction paralleled to the lineup direction to allow for as many worshipers as possible in the first lines, as shown in Figure 3(A). The respondents also point out that the prayer areas are not typically large enough to accommodate all the worshipers, which results in worshipers lining up in the adjacent streets to join the prayers, especially during the Friday sermon. Accordingly, an accurate forecast of the number of expected worshipers should be carried out during the design phase to ensure that the appropriate floor area of the mosque has been created. The use of architectural solutions that allow for expanding and decreasing the prayer area is highly advantageous in this case. Alternatively, the design of adjacent outdoor squares as part of the mosque is advantageous as it can be temporarily transformed into an extension for the prayer area when required, as presented in Figure 3(B). In this case, the square should be equipped with appropriate flooring and shading devised to facilitate use by worshipers, and more importantly it must consider Islamic rules regarding the design or prayer areas such as the visual connectivity and the spatial relation to Imam. Respondents also mentioned that monumentally scaled indoor prayer areas, through the use of high ceilings and large-spanned construction methods, evoke a heightened sense of spirituality that benefits the overall ambience of the mosque.

The ablution area is an essential component of the mosque. However, Islamic principles consider this area less pure or of inferior cleanliness, compared to the revered praying area. As such, respondents have expressed their desire that this area be designed with independent access and interconnecting lobbies, as shown in Figure 3(C). The purpose of this is to ensure that no filth or contaminants reach the prayer area. For further adhesion to Islamic principles, respondents call for a complete separation between the ablution area and toilets.

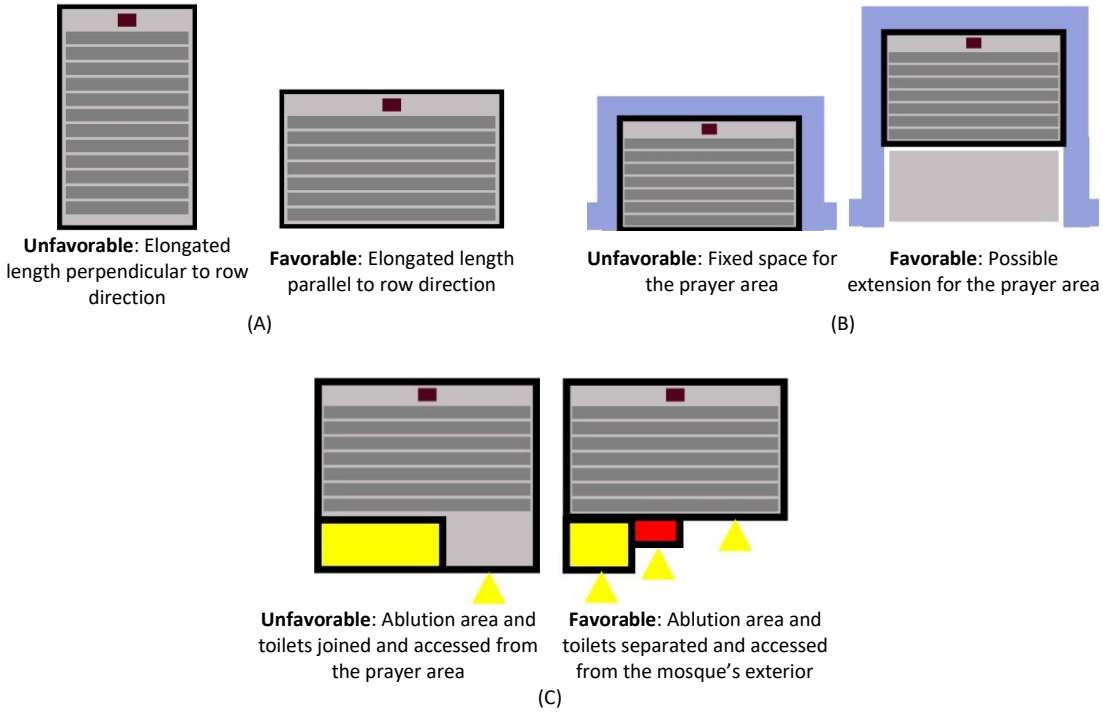


Figure 3: Favorable and unfavorable Mosque characteristics; (A) Direction of prayer area elongation; (B) Outdoor extension for the prayer area; (C) Design of ablution area and toilets.

Designing a wall-integrated Minbar, which is a platform dedicated for the Emam to deliver sermons, is evidently preferred to the traditional separated wooden Minbar; The separated Minbar occupies a significant portion of space within the praying area due to its protrusion from the Qibla wall, specifically at the front rows, which is a desirable spot in the mosque. However, the integrated Minbar can perform the same function as the separated design, yet with no significant protrusions into the praying area. Furthermore, according to the respondents, the contemporary craftsmanship of wooden Minbars is of less quality, due to many financial influences. The low durability of the wooden Minbars seems to be an additional discouraging quality, as the integrated Minbars are typically constructed of highly durable building materials such as concrete or brick. Hence, the modern integrated Minbar seems more practical and aesthetically pleasing despite the fact that wood is historically linked to the Islamic culture.

5.2 Aesthetical characteristics

As a spiritual building, the mosque is expected to evoke many emotions and convey special Islamic meanings. This is achieved by the creation of a variety of architectural elements that aim to enhance the aesthetic qualities of the building. Ornamentation is one of the main contributors to the visual design of mosques. In this context, the respondents have indicated that they prefer moderate use of external ornamentation on the building facades; They believe that a lack of ornamentation communicates a poor sense of design and inferiority. Contrarily, they agree that excess ornamentation conveys a sense of vanity, which contradicts Islamic principles. Accordingly, designers must investigate the culturally appropriate degree of exterior ornamentation as part of their design processes. Participants have also indicated that the upper edges of the buildings, the windows and door perimeters, and the minaret (Ma'zanah) are the appropriate locations for exterior ornamentation. When asked about the preferred ornamentation style, there seemed to be an accord on floral-styled themes, as opposed to geometric themes or calligraphy. In the case of interior ornamentation, the respondents feel that ceiling ornamentation may be pointless as worshipers mostly view eye-level decorations only. The fact that prayer areas are commonly constructed on a monumental scale, with high ceilings, adds to the misperception of ceilings. Hence, ornamenting the walls and columns within the prayer is important, with emphasis on the *Qibla* wall that encompasses the *Mehrab* and *Minbar*, as they are the main focal points of the users. As for the ornamentation style, in addition to the floral-styled theme, the use of limited calligraphy containing verses of the holy Quran located at an eye level is evidently favored as it acts as a form of spiritual reminder of Islamic values.

Despite the obsolete acoustic function of the Minaret in contemporary mosques, it is visually pleasing and acts as a landmark indicating the presence of a mosque in the area. Hence, it is considered by many as an element of ornamentation rather than a functional element. However, respondents find that independent Minarets are more attractive and perceptible compared to Minarets that are integrated with the mosque's building. Also, a single Minaret seems to suffice. Designers should explore innovative ideas to optimize the Minaret's functionality. For instance, one respondent suggests utilizing the staircase of the Minaret to serve the women's prayer areas which are commonly located on an upper floor, separated from the men's area.

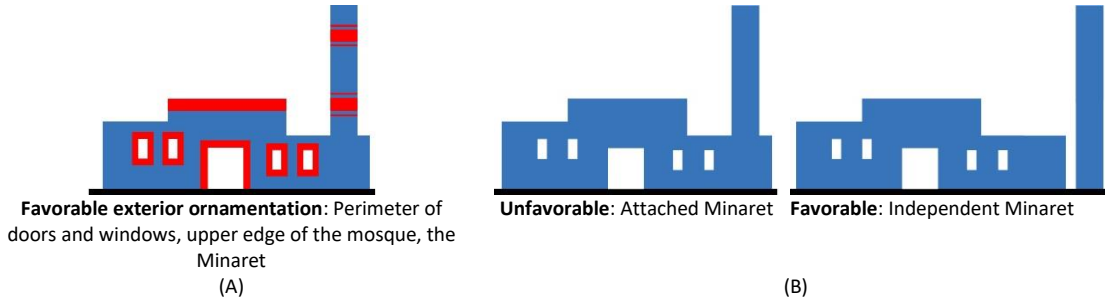


Figure 4: Favorable and unfavorable Mosque characteristics; (A) Location of ornaments; (B) Minaret design.

5.3 Structural characteristics

The structural integrity and durability of modern buildings are essential characteristics. Yet, according to the respondents, there are no particular building materials that are noteworthy. They do agree, however, that because mosques are public structures frequently used by large numbers of people, all materials must be robust. This applies to interior finishes as well. For example, using marble on indoor walls is preferable to regular paint as it can retain its original state under exposure to extensive staining and waring. The respondents have also emphasized the importance of constructing ceilings from durable materials, such as concrete, even though the ceilings of some traditional and historical mosques are constructed from frail materials, such as wood. In this context, the use of high ceilings with domes or skylights is highly favored by respondents to emphasize the spiritual aspects of the prayer area.

The inherent large span of the prayer area promotes structural engineers to use columns within it to decrease structural costs. However, the presence of visually obstructive columns within the prayer area reportedly hinders the worshippers' views. The fact that some mosques have irregularly spaced columns further disadvantages the prayer area. With modern construction abilities that allow for column-free large-spanned spaces, mosque users call for the elimination of columns in the prayer area. The use of construction techniques such as steel or concrete frames is desirable. Besides, the column traditionally had a secondary function of acting as a representation for the mosque's teaching ring; traditionally, an Islamic teacher (*Shiek*) would sit beside the column as their students would gather around. However, in modern times, this activity is outdated and is seldom carried out in this manner.

It is important to point out that the mentioned earlier user preferences constitute a viable guide for future mosque design efforts, in addition to the rudimentary mosque design standards. These preferences should be fully considered by architects and accordingly addressed to achieve satisfactory designs. Table 1 shows examples of the responses gathered from users, presented as translated quotes, and show their corresponding mosque characteristic in addition to a summary of the acquired opinions.

TABLE 1: EXAMPLES OF QUOTES ACQUIRED THROUGH INTERVIEWS, TRANSLATED FROM ARABIC BY THE AUTHORS.

Characteristic	Example quotes	Summery
Visual perception	*"A large mosque must be significantly different form a small praying corner in a building, and must be very visible."*	Recognizable building. Standalone structure Visible facades. Monumental scaled structure. Overseeing squares or vistas.
Entrances	*"The entrances must be very visible and have many decorations.", "The entrance should directly face the Mehrab and Minbar so that the worshiper can quickly enter the prayer if they are late".*	Visible entrances. Axial/aligned entrance. Minimum of three entrances. Dedicated female entrances. Rear Entrances.
The prayer area	*"The more people are standing in the first rows the better", "It is better that the mosque is large enough to contain the large number of worshipers so that they do not pray in the public streets".*	Sufficient prayer area. Elongated rectangular-shaped prayer area parallel to lineup direction. high ceilings.
Ablution area	*"The ablution area must be located separately from toiles, for cleanliness", "The existence of an entrance to the ablution area retains the carpeting of the prayer area".*	Creating independent accesses and interconnecting lobbies for ablution areas. Separating ablution areas and toilets.
The Minbar	*"The separated wooden Minbar is a thing of the past when there was an abundance of money, land, and good hand craftsmanship. Nowadays, the integrated Minbar is much better".*	Utilizing wall integrated Minbars. Using robust materials for Minbar construction.
Ornaments	*"The mosque building cannot look like any ordinary building, it has to be differentiated by ornaments", "Indoor ceiling ornamentation can be a distraction to worshipers, if noticed", "Ceiling ornamentation mostly goes unnoticed as we always are looking towards the Emam, especially in sermons".*	Moderate exterior ornamentation. Locating ornaments at upper edges, windows and door perimeters, and the minaret. No indoor ceiling ornaments. Heavy ornaments at Qibla wall. Using floral and calligraphy themes.
The Minaret (Ma'zanah)	*"Currently, there is no need for multiple Minarets, one large noticeable minaret is more than enough".*	Use of independent Minarets. Optimizing the Minaret's functionality.
Construction materials	*"The indoor walls should be lined with marble, so as not to be affected by people's wet hands and people leaning on the walls".*	Use of robust enduring construction materials. Use of cleanable indoor finishing materials.
Ceilings	*"It is best to have some windows in the ceiling just below the dome or ShokhShikha".*	Constructing ceilings from robust materials. Using domes or skylights.
Columns	*"In the past, Shieks used to sit by the column and their students would gather around them. Now, this is long gone. So, there is no real need for columns if the building can be constructed without them".*	Constructing column-free prayer areas, or regularly-spaced columns.

6. FIELD SURVEY

To evaluate the degree to which mosques adhere to the preferences of users, mentioned earlier, the characteristics of a selection of mosques were surveyed. The study was limited to the area of Assiut city, Egypt, which is the administrative capital of the Assiut governance located in upper Egypt. The investigated mosques were chosen on the bases of being locally significant or well-known mosques within the study area. This is vital as the designers of such mosques pay noticeable effort in terms of achieving sound designs and conveying good aesthetic qualities, in comparison to smaller mosques that are typically created through uninformed efforts without the consultation of professional architects. Furthermore, the selected mosques are officially recognized by the Egyptian Ministry of Awqaf in order to exclude all arbitrary mosque designs. The surveyed mosques also intentionally vary in terms of construction period. These selection criteria are important to ensure that the studied mosques properly reflect the state of mosque designs. After procuring an official list of mosques in the area, six mosques were selected as a representative sample of the mosques within the area, as follows (name (abv.), construction year):

- El-Magzoub Mosque (MAG), 1695.
- El-Helaly Mosque (HLY), 1932.
- Khashaba Mosque (KBA), 1940.
- Omar Makram Mosque (OMR), 1960.
- Mekka Mosque (MEK), 1980.
- El-Bakley Mosque (BKL), 2020.

In each mosque, visits were made to determine the presence and state of each user preference within the mosque. Based on the user preferences mentioned earlier in section 5 and the findings of the field survey of the mosques, TABLE 2 is formulated. The table presents, for each mosque, a comparison between the compliant characteristics (desired by users) and the noncompliant characteristics (undesired by users). This is useful in determining the degree to which the surveyed mosques are able to gratify users' expectations. For documentation purposes, photographs have been taken of the surveyed characteristics in each mosque, examples of which are shown in Figure 5.

TABLE 2: SURVEYED MOSQUE CHARACTERISTICS, COMPLIANT AND NON-COMPLIANT WITH USER PREFERENCES.

	Compliant characteristics	Non-compliant characteristics
MAG	Standalone structure, overlooking a vital square (Figure 5(A)). Entrances axial to the Qibla and located at the rear of the prayer area. Sufficient praying area (~ 225 m2), with a high ceiling (~ 5.0 m). Large independent Minaret. Exterior ornamentation is located only at the upper edge of the building, the Minaret, and around windows and doors (Figure 5(A)). Interior ornamentation limited to the Qibla wall. Concrete ceiling with a cubical protrusion and skylight openings (Figure 5(A)). Robust construction materials.	Human scale construction. Independent wooden Minbar (Figure 5(A)). Most ornamentation is calligraphic and geometric, with no floral themes. Only one male entrance. The prayer area but not elongated and angled in relation to the Qibla direction, with very limited spots in the front rows. 15 regularly-arrayed columns in the prayer area (Figure 5(A)). Ablution area is accessed from within the mosque, and integrated with toilets. Balcony-style women's area constructed from wood.
HEL	Standalone building overlooking a large busy square (Figure 5(B)). Monumental scale. 2 male entrances. Noticeable, yet, integrated Minaret. Sufficient praying area (~ 300 m2), with a high ceiling (~ 5.0 m). Exterior ornamentation located only at the upper edge of the building, the Minaret, and around windows and doors (Figure 5(B)). Floral interior ornamentation limited to the Qibla wall. Concrete wall-integrated Minbar (**Error! Reference source not found.**(C)). Concrete ceiling with a cubical protrusion and sky light openings (Figure 5(B)). Robust construction and finish materials.	Entrances unnoticeable. No female entrances. Entrances not axial with prayer area or Qibla. The prayer area but not elongated, thus, there are limited spots in the front rows. 6 arrayed columns in the prayer area (Figure 5(B)). Ablution area is accessed from within the mosque, and integrated with toilets.

KBA	1 male entrance and 1 female. Sufficient square-shaped praying area (~ 260 m2), with a high ceiling (~ 5.0 m). Floral and calligraphy exterior ornamentation, located at the upper edge of the building, the Minaret, and around windows and doors (Figure 5(C)) with no interior ornaments. Concrete ceiling with a cubical protrusion and sky light openings. Robust construction materials.	Unnoticeable attached structure, overlooking a main street (Figure 5(C)). Unnoticeable entrance. Human scale. Entrance not axial with Qibla wall. Attached Minaret. Geometric and floral interior ornamentation located on the ceiling, walls, and columns. Independent wooden Minbar (Figure 5(C)). 4 arrayed columns in the praying area. Ablution area accessed from the praying area, and integrated with the toilets. Frail wood-glazing finish.
OMR	Visible standalone structure, overlooking a main street (Figure 5(D)). Monumental scale. Noticeable entrance overlooking the main street, axial to the praying area. 2 male entrances and 1 female. Large square-shaped praying area (~ 600 m2), with a high ceiling (~ 7.0 m). Visible Minaret. Exterior ornamentation located at the upper edge of the building, the Minaret, and around windows and doors (Figure 5(D)). Concrete central dome. Robust construction and finishing materials.	Entrance is not axial with the Qibla. Attached Minaret. Geometric and floral interior ornamentation located on the ceiling, walls, and columns. Independent wooden Minbar (Figure 5(D)). 20 columns in the praying area. Ablution area accessed from the praying area, and integrated with the toilets.
MEK	Visible standalone structure, overlooking a main street (Figure 5(E)). Monumental scale. Noticeable entrances, axial with praying area. 2 male entrances and 1 female. Sufficient square-shaped praying area (~ 300 m2), with a high ceiling (~ 7.0 m). Independent Minaret. Floral and calligraphy exterior ornamentation, located at the upper edge of the building, the Minaret, and around windows and doors (Figure 5(E)). 6 columns only to the rear of the praying area. Concrete dome and sky light openings. Robust construction and finish materials.	Entrance not axial with Qibla wall. Ornamentation on walls and columns. Geometric and floral interior ornamentation located on the ceiling, walls, and columns. Independent concrete Minbar (Figure 5(E)). Ablution area accessed from the praying area, and integrated with the toilets.
BKL	Visible standalone structure, overlooking a main street (Figure 5(F)). Monumental scale. Noticeable entrances. 2 male entrances and 1 female. Large square-shaped praying area (~ 1500 m2), with a high ceiling (~ 8.0 m). Noticeable Minaret. Geometric ornamentation, located at the upper edge of the building, the Minaret, and around windows and doors. Additional heavy ornaments at Qibla wall (Figure 5(F)). Merged Wooden Minbar. Concrete dome and sky light openings. Robust construction and finish materials.	Entrance not axial with prayer area or Qibla wall. Merged Minaret Ornamentation on walls and columns. Geometric ornamentation located on the ceiling and walls. 15 arrayed columns in prayer area. Ablution area accessed from the praying area, and integrated with the toilets.

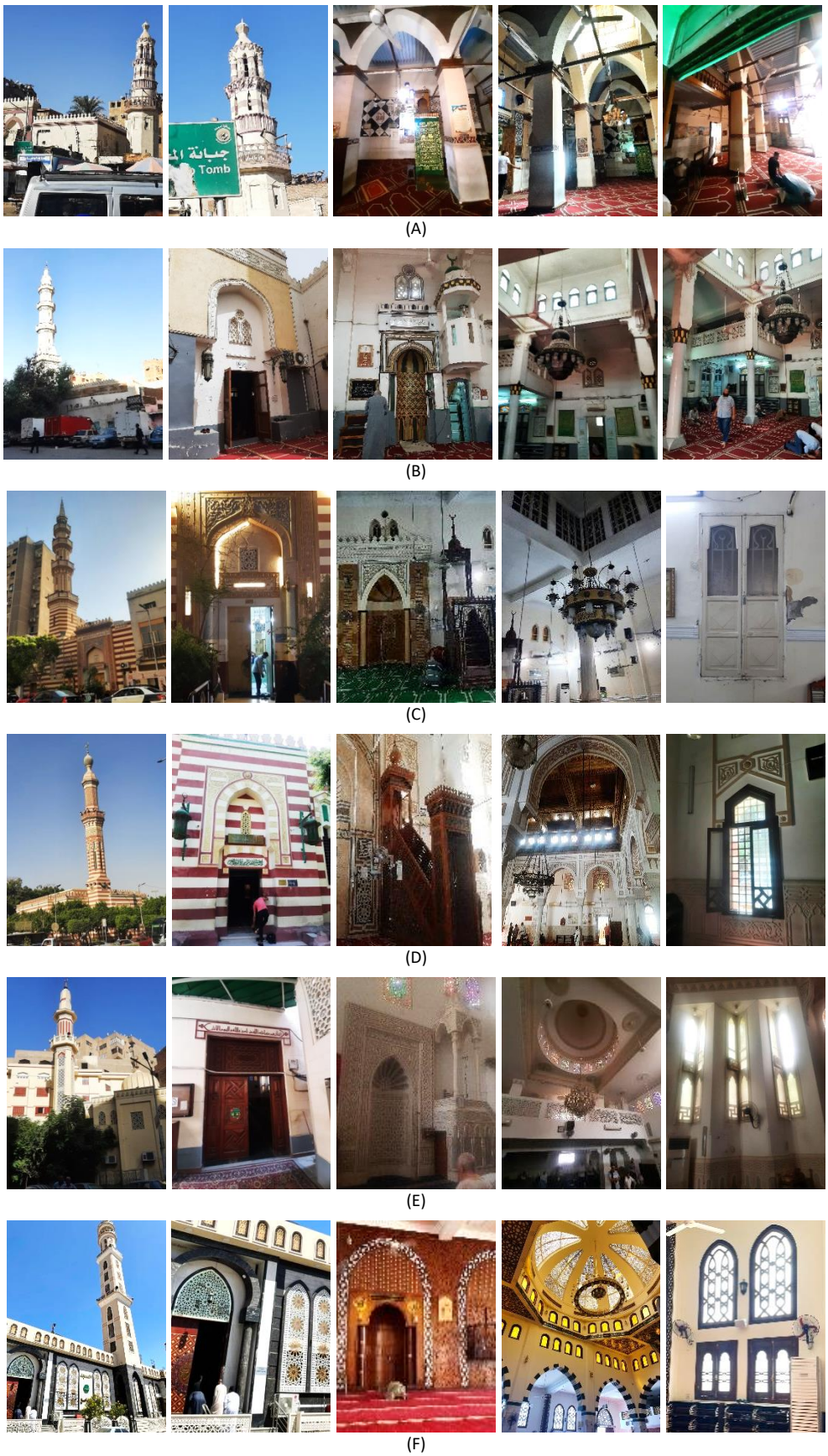


Figure 5: Characteristics of the surveyed mosques; (A) MAG; (B) HEL; (C) KBA; (D) OMR; (E) MEK; (F) BKL.

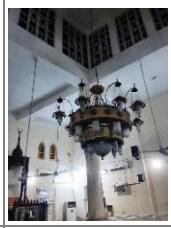
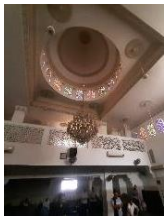
7. DISCUSSION

According to the survey results, certain design elements align with user preferences. Most prominently, aspects relating to visibility are highly compliant, as most mosques were constructed on a monumental scale with visible

minarets and clear entrances. Also, most mosque ceilings contained a form of dome or skylight openings, thus increasing visibility. It is possible that the intrinsic spiritual respect for mosques by owners and designers is conveyed through the desire to construct grand and impressive structures, which in turn results in good mosque visibility. Furthermore, the utilized construction materials were appropriately robust, which is a characteristic of both old and modern buildings. This aspect is potentially driven by the desire to construct long enduring buildings.

Despite the previous, a relatively large number of mosque characteristics did not fully comply with users' preferences; All of the surveyed mosques entailed varying numbers of columns situated within the prayer area. This is undoubtedly a result of economic efficiency as large-spanned structures are typically more costly. Additionally, the shape and dimensions of the prayer area were often determined by the shape of the land perimeter, which sometimes resulted in an inadequate praying area that restricted access to the highly sought-after front rows. While economic and physical constraints can justify these non-compliant features, others seem to result from a lack of consideration for user preferences. For instance, the use of floral ornamentation themes, which were highly desired by users, was not followed in most mosques, as calligraphy and geometric designs were favored. Similarly, most Minbars were constructed independently from the Qibla wall, possibly as a result of Islamic traditions encouraging designers to follow early traditional mosque designs. These non-compliant mosque characteristics highlight the disregard for user preferences. TABLE 3 presents examples of compliant and noncompliant characteristic of the surveyed mosques.

TABLE 3: EXAMPLES OF COMPLIANT AND NON-COMPLIANT MOSQUE CHARACTERISTICS FROM THE FIELD SURVEY

		MAG	HLY	KBA	OMR	MEK	BKL
Compliant Characteristics ✓	Characteristic	Standalone structure	Integrated Minbar	Sky light	Visible Minaret	Concrete dome	Monumental scale
	Photograph						
Noncompliant Characteristics ✗	Characteristic	Coulmns in the prayer area	Integrated Minaret	Attached structure	Protruding Minbar	Non-axial entrances	Ornamentation on ceiling and walls
	Photograph						

While it is understandable that older mosques may not align with current user preferences, as user preferences differ over time, it's concerning that both older and newer mosques exhibit similar levels of non-compliance. This suggests that non-compliance of mosques with user preferences is not solely due to outdated designs of older mosques, but rather to a design process that fails to consider user opinions and preferences. It's worth noting that design features that are easily recognizable have been found to be the most compliant, while more personalized characteristics show more non-compliance. It's evident that design features that reflect Islamic traditions are widely accepted by both users and designers. Conversely, features that are based on personal preferences tend to generate the most disagreements. Such findings lead the authors to believe that the sampled mosque designs were performed in isolation from user opinions. Evidently, designers seem to have focused on conveying their desired architectural values and standards with little or no attempt to investigate user requirements. These raises questions about the overall approach to mosque design and whether it adequately takes into account the needs and desires of the users who will ultimately be utilizing these spaces. Further research and analysis are necessary to understand the reasons behind this consistent noncompliance and to identify potential solutions that prioritize user satisfaction.

8. CONCLUSIONS AND RECOMMENDATIONS

The present study shows that mosque users favor the presence of certain design characteristics within mosque designs. According to the users, these attributes create an ideal environment that enhances their practice, spirituality, and convenience. However, field surveys point out that mosque designers have not fully taken these

preferences into account when creating designs; While aspects such as building noticeability, area adequacy, and structural materials have strongly complied with user preferences, other aspects such as Minbar design, location of toilets, and location of entrances have significantly disregarded them. As a result, the variance between user preferences and actual mosque designs becomes evident. This discrepancy raises concerns about the effectiveness and functionality of the mosque spaces. It also underlines the need for better communication between designers and the community. To bridge this gap, it is essential for mosque designers to actively engage with mosque users and incorporate their preferences into the design process. By doing so, mosques can better cater to the needs and desires of their users, fostering a more inclusive and satisfactory religious experience.

Accordingly, from the perspective of architectural practice, the study recommends that designers implement a strategy to involve the community in the mosque design process from the early stages to ensure that their preferences are taken into consideration. Therefore, it is important to establish an active design feedback system that allows mosque users to easily provide input and suggestions for future designs. The suggested improvements which are based on users' feedback, presented in section 5, are useful in this context for architects, designers, and other stakeholders involved in the mosque building process. The study also encourages academics to further investigate and survey the condition of old and contemporary mosques to better comprehend design issues and propose suitable solutions. From a regulatory standpoint, the study highlights the need for retrofitting current mosques to address design drawbacks. This can be achieved through the application of nationwide mosque upgrading projects enforced by municipal and regulatory bodies responsible for mosque management. Additionally, the study recommends modifying mosque design legislation to better align with user expectations. The study's findings can serve as a valuable resource for the retrofitting of current mosques and the design of upcoming ones.

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