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A Theoretical Framework for the Evaluation from the Traditional Mashrabiya to Modern Mashrabiya

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ABSTRACT

Finding a favorable trade-off between saving the architectural heritage, and assuring the development of modern architecture is a delicate and precise task, due to the lack of knowledge in the original criteria for the re-thinking of traditional architecture. As a tentative answer to this challenge, this paper attempts to shed light on Mashrabiya (traditional Arab oriel window) as a powerful environmental element in modern architecture, with regard to the important functions that it provides, such as light control, airflow regulation, humidity control, temperature regulation and visual privacy. Due to these functions, Mashrabiya achieved widespread popularity around the old world and it has been revived again in many contemporary projects by different modern versions. The objective of this study also is presenting a general evaluation for the modern Mashrabiya to observe the misconceptions of using the Mashrabiya and to call for stop ignoring of the proper standards of Mashrabiya design and to preserve the original name of this element "Mashrabiya".

Keywords: Mashrabiya, Arab identity, Functions, Re-thinking, Traditional architecture.

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INTRODUCTION

The Mashrabiya is an Arab architectural element, which always had something magical that attracted the western orientalist's attention and has subsequently been revived in many contemporary projects. Mashrabiya in its traditional version had many important environmental functions and specific parameters for design through recognized patterns. Unfortunately the modern versions of Mashrabiya don't abide by these aspects (functions, design parameters and patterns).

This paper seeks to submit preliminary information about functions of the optimal traditional Mashrabiya to can evaluate the modern versions and determine the errors of pursuance. The scope of study pinpoints to four contemporary projects as examples to clarify the misconceptions of using Mashrabiya by modern copies.

In general some of new epochal projects have used the correct design criteria, some of them implemented the design using the latest technology, but with very high costs, and some projects, especially outside the Arab region, used it without even acknowledging the original name "Mashrabiya". There might even be a marginalization of the original name of the Mashrabiya in projects in the Arab region too, and that began to pose a threat to the identity of Mashrabiya and its design integrity and standards. These misconceptions are attributable to the lack of sufficient knowledge of the history, functions and design parameters of Mashrabiya.

HISTORICAL BACKGROUND OF MASHRABIYA

Mashrabiya is the prominent window that overlooks the street or the courtyard of traditional Arab houses. In the past, Mashrabiya was the name given to space which is enclosed with wooden lattice openings where jars of drinking water were put to cool (Fathy, 1986). Later, the name Mashrabiya was only given to the lattice screen which is made of wooden balusters with a circular section as a perfect condition to provide smoother airflow which contributes to the evaporation factor. This screen was completely hand-made and the design of the balusters was varied in different artistic ways.

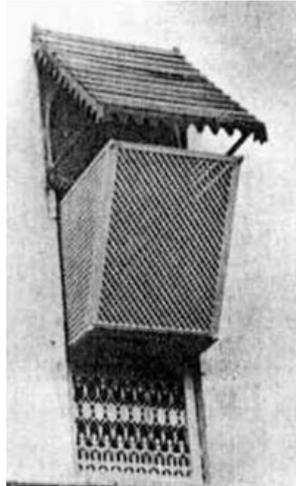


Image 1. An old Mashrabiya in Cairo, Egypt 1640's (Source: Ashi, 2010)

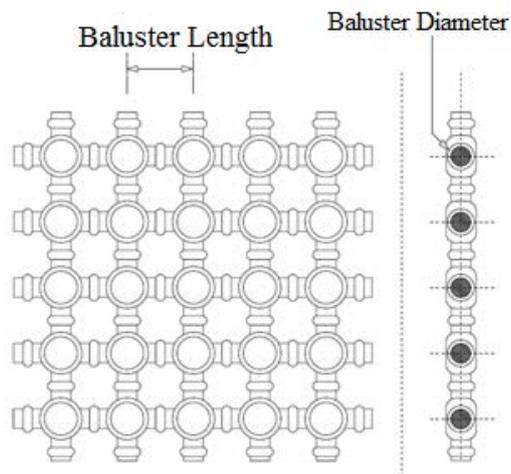


Image 2. Traditional Mashrabiya typology (Source: Samuels, 2011)

The word Mashrabiya came from an Arab root meaning a place where the jars of drinking water were being put to cool, and Mashraba is the noun form of a verb in Arabic “yashrab “ meaning “drink”.

The history of Mashrabiya is dating back to the period when Arabs entered to Egypt, but when it first became used in particular, it is difficult to pinpoint because of the ever-evolving nature of architecture.

The British architectural historian author Briggs speculated (1974) that the origins of Mashrabiya could be found in the Coptic churches in Egypt. In a detailed explanation by the French Egyptologist Maspero (1914), (Manual of Egyptian Archaeology and Guide to the Study of Antiquities in Egypt) he discusses the process of the development of Mashrabiya and

he points out that the Mashrabiya began to flourish during Tulunid era (868- 905) where they used a considerable amount of wood in their buildings, and Arab manufacturers benefited at the beginning of the industry, from the experience of the Copts, who were excellent woodworkers. The growth of this construction continued during the Abbasid era (750-1258), especially during the time of the Ayyubid (1171-1250). Thereafter, during the Mamluk era (1250- 1517) the Mashrabiya industry grew and flourished artistically. The privacy requirement was a core value of the Islamic religion, so the Mashrabiya had widespread popularity throughout history, especially during the Islamic Ottoman era (1517- c1805) and it also continued later in various Arab regions, helping to adorn the streets, by giving it a beautiful artistic character (Maspero, 1974).

Mashrabiya spread to the cities of Syria, Arabian Gulf, Lebanon, Sudan, Iraq and in the Maghreb countries, as well as to India, Pakistan, Iran and Spain. And the spread of it in these countries coincided with the Egyptian periods, but the Egyptian Mashrabiya remained the most famous and professional version (Dayyob, 2001).

Furthermore Egypt still preserves the heritage of Mashrabiya, possibly due to the income generated by tourism, as well as to the Maghreb countries, Pakistan, India and Spain do. While on the other hand, there are some countries which neglect the Mashrabiya heritage, for example: Saudi Arabia, and some countries which have lost their valuable heritage due to wars, like Syria and Iraq.

The common traditional places of Mashrabiya were as façades of traditional houses, or in mosques, tombs, agencies and caravansaries. Besides, it was used as partition in interior design between rooms to increase ventilation from more than one side of the house (Feeny,1974).

In the early 20th century Mashrabiya started to decline in use due to many factors . For example, the result of cursory modernization, the growth of globalization, and the abandonment of vernacular traditions. Concurrent with this was a changing economic structure, which was born of the industrial revolution that made small craft-based manufacturing redundant. Therefore the reasons for the decline in the use of the Mashrabiya are twofold: due to both cultural and practical influences (Akbar, 1994).

FUNCTIONS OF MASHRABIYA

Mashrabiya did not provide only a decorative and aesthetic element, but also it was designed to perform many environmental functions like adjustment of lighting, humidity and air flow control, reducing the heat, and playing an essential role in securing privacy, as Architect Hassan Fathy asserted.

Mashrabiya is able to control when and how much direct daylight could enter the building during summer or winter according to the parameters of Mashrabiya design which the architect determines. It blocks the troublesome sun, decreases internal heat gain during summer and allows for a good amount of light to enter during winter. And even if there is a need to block direct sunlight in the troublesome times, the users still need enough natural internal light for regular daily activities. Mashrabiya is an important element that allows ambient light to pass through spaces without letting in direct sunlight. While with regard to glare, it doesn't raise the temperature of the room, but it causes an optical inconvenience. To solve this problem Mashrabiya is one of the best effective choices. In this case, the architect has to choose a Mashrabiya with a circular section for the balusters as the main condition (Fathy, 1986).

That means the gradual shadow which is created by rounded balusters, reduces any contrast, unlike the square sectional balusters, or any other similar shading devices. This is a common mistake, which is repeated in some modern projects which use the Mashrabiya without taking into account this important condition, especially when using steel material in the construction of Mashrabiya.

Mashrabiya is used to ensure air circulation inside the building, air is pulled into the room through the small interstices of the Mashrabiya in the lower part and hot air is ejected out through the large interstices of the upper part. This technique not only enhances the air circulation but also speeds it into other indoor rooms.

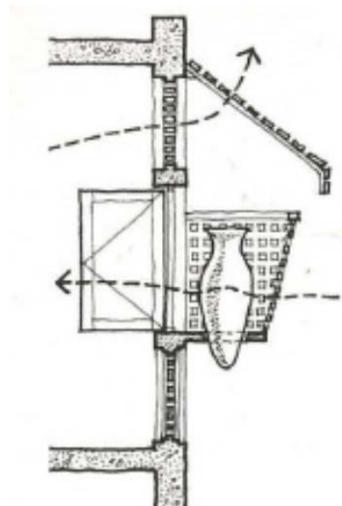
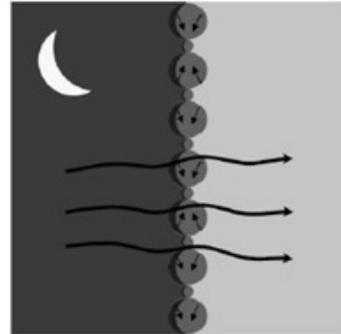


Image 3. An illustration of old Mashrabiya in 1640's shows the porous clay water jar used to cool the air as it passes through the Mashrabiya and into the building behind (Source: Ashi, 2010)

The air which passes through the wooden Mashrabiya loses some of its humidity by the absorption property of the wooden balusters; if they are cold, as usual at night, and when the Mashrabiya is heated by direct sunlight, this humidity is absorbed by the air which flows through the porous wooden Mashrabiya. This technique is efficient in making the dry air more moist in the heat of the day, humidifying and cooling it at a time when most needed. □

At night, Mashrabiya absorbs moisture carried on the wind and passing through the interstices.



When heated by sunlight, it releases the moisture into the air that passes through, thereby increasing humidity within a home and reducing its temperature.

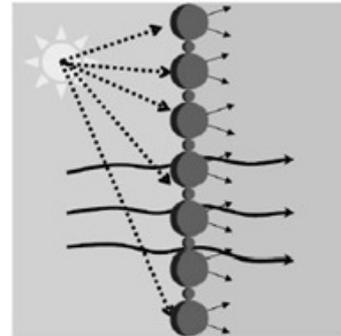


Image 4. The cooling effect of Mashrabiya through the evapo-transpiration process
(Source: Fathy, 1986, illustration by Gelil, 2014)

With regard to the foregoing, it should shed light on the importance of the wood chosen for the construction of Mashrabiya, and take into account that new alternative materials should have properties which are more or less similar to wood, in relation to absorption and evaporation matters. Mashrabiya is considered as an important environmental component due to it works as a mediator between all of the techniques that adjust the temperature of buildings; it regulates the light, provides a continuous and steady airflow, and also facilitates the evaporative cooling.

All architects aware that direct sunlight is the reason for high temperatures, and the Mashrabiya limits the solar gain by shading the inner spaces during the hot summer months but is able to supply some heat in the cooler months of the year, by allowing direct daylight to enter the building during winter. The cooling and heating processes rely on specific features of the lattice in terms of its sizing and porosity; a more porous lattice will allow for more

direct light in the cold days but also raise the airflow through space, and change the capacity of the evaporative cooling systems.

Mashrabiya provides privacy for occupants from the outside while allowing them, at the same time, to look out through the lattice. If the Mashrabiya is overlooking the street the distances between the balusters are preferably small at eye level, except for the upper part above eye level.

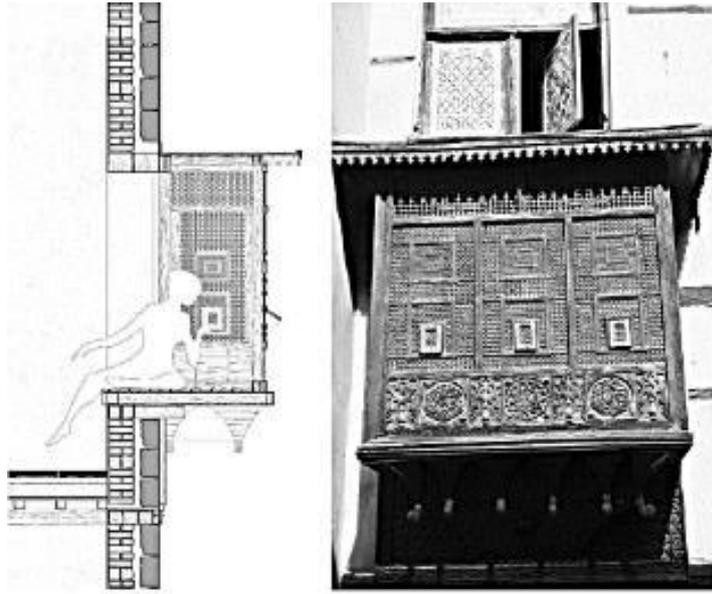


Image 5. The ladies behind the Mashrabiya in Cairo, Egypt in late 19th century
(Source: Ficarelli, 2008)

Additionally, it should not be ignored that the different patterns of Mashrabiya imbued life and vibrancy to the façades of traditional buildings which were previously extremely bare and gave a solid and harsh impression due to the heavy walls.

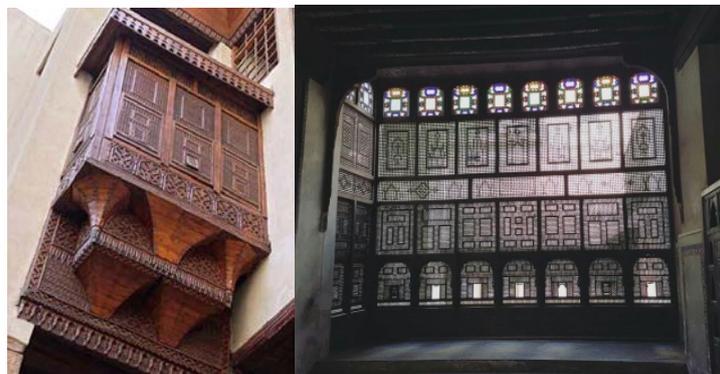


Image 6. Views of Mashrabiya at Suhaimi house in Cairo, Egypt (Source: Marawan, 2016)

MODERN MASHRABIYA

Architecture passed through many notable changes since the beginning of the twentieth century, Some of the changes were helpful and others were unfavorable, in particular with regard to globalization, which damaged the cultural identity of peoples, along with the industrial revolution and the trend for the use of materials and structural systems which were not considered eco-friendly.

In recent decades these issues have forced a lot of architects to find alternative solutions to keep pace with modernity and yet benefit from the cultural heritage. Thus Mashrabiya became one of the leading environmental traditional and architectural elements that have been revived. This has meant a re-focusing on the study of its concept and functions to employ it through the most effective images, and thus adopting it in contemporary projects, by using a high-tech interpretation of the original model, or through a contemporary expression of the original model.

At this point, it is important to point out that the Mashrabiya is presented through contemporary sustainable designs in three ways (Abdelsalam and Rihan, 2012):

Firstly; it is offered in its original traditional style, using the traditional shape, materials, and characteristics.

Secondly; its concept is displayed through a high-tech solution, where the main function is achieved by using advanced technological means.

Thirdly; a contemporary interpretation of the traditional model is presented relying on new materials, styles and features while maintaining its original concept (Abdelsalam and Rihan, 2012).

There are many contemporary projects that have used Mashrabiya again. Some of them used it correctly so that they benefited from its functions and implemented it with proper design standards, while others relied only on the concept or different patterns of mashrabiya without knowing the functions. On the other hand, there are different projects benefited from the Mashrabiya in various respects but without recognizing its original name.

This paper seeks to organize the modern versions of Mashrabiya accordance with three notable forms, including: the primitive form, the sustainable form, and the form provided with advanced technology. The scope of these categories depends on three chosen examples that will be reviewed and supplied with important notes to assist in evaluating the modern Mashrabiya, besides to shedding light on the kind of facades that use the properties and functions of Mashrabiya but by "Geometric panels" name.

Table 1: Notable forms of modern Mashrabiya

Chosen Examples				
Category	Project Name	Architect	Country	Year
Primitive Form	Mashrabiya House	Senan Abdelqader	Palestine	2011
Sustainable Form	Masdar City	Foster+ Partners architects	UAE	2015
The form which is provided with adv. Technology	AlBahar Towers/ Mashrabiya Towers	Aedas Architects □	UAE	2012
Geometric Panels	Birmingham Library	Mecanoo Architects	United Kingdom	2013

Mashrabiya House project in general looks like a primitive project, due to it uses the concept of Mashrabiya; but it does not apply the correct terms which are related to the functions, patterns and design parameters of traditional Mashrabiya. It is much closer to the designs of Tropical Space Architects team that uses terracotta and baked-brick materials, positioning the blocks in irregular spacings.

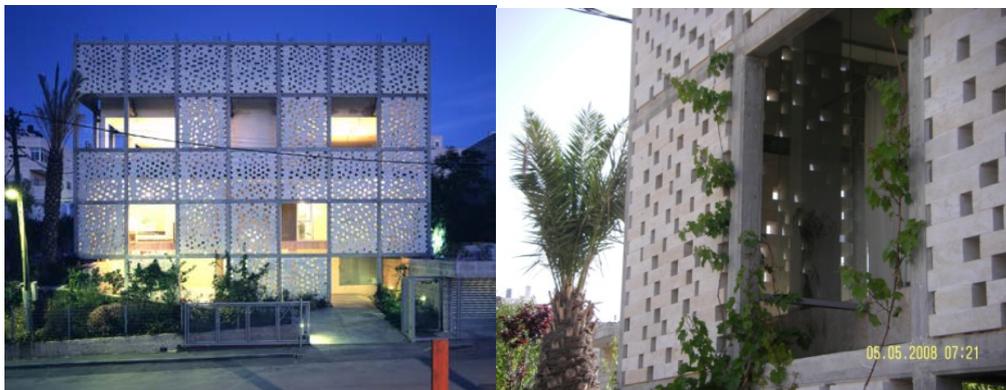


Image 7. The Mashrabiya House in Palestine (Source: Amit, 2011)

While the modern version of Mashrabiya in Masdar City project tries to emulate the traditional version in the environmental functions manner, thanks to the use of palm wood and the terracotta cladding. In addition to a careful study of traditional techniques in cooling was obvious in the modern project, despite using some technological systems, the merging of the methods was creative. Also, the perforations for light and shade in modern Mashrabiya are based on the patterns found in the traditional architecture of Islam, but by using large sized partitions and large spacing, compared to the fine rounded balusters of traditional Mashrabiya. □



Image 8. Terracotta Mashrabiya in Masdar City, UAE (Source: Caine, 2014)

As for Mashrabiya Towers project, it has widespread popularity within architectural magazines, but that does imply that it is a perfect project. The evaluation of any project should not be dependent on popularity alone, but it should rely on its validity and the application of correct design standards, as well providing the required functionality without an exaggeration in construction cost.

The modern version of Mashrabiya in this project succeeded in reducing incoming daylight at all times, but by a solar-responsive dynamic shading screen which was very expensive, due to the advanced technology, compared to the traditional version that has a high efficiency in light/heat control and it is considered a difficult rival in this field (Alothman, 2017).

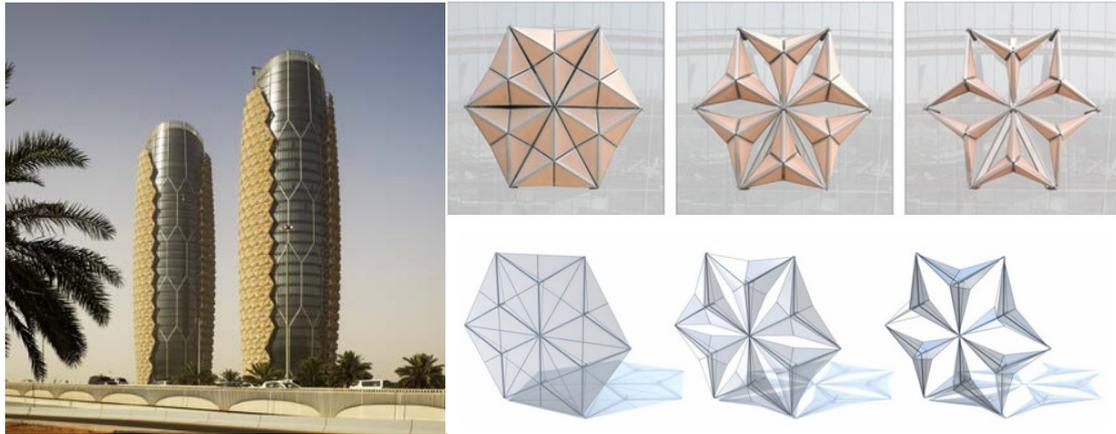


Image 9. Al Bahar Towers/ Mashrabiya Tower in Abu Dhabi, UAE (Source: Aedas, 2012)

Speaking about original name matter, many modern projects have benefited from the concept and functions of Mashrabiya without mentioning it by name, like the Central Market Abu Dhabi, Al-Ghanim Clinic, Manish restaurant, The King Abdullah Financial District Metro Station and the Hotel and Residential Tower in Qatar. The architects of these projects just pointed out that their inspiration for these façades came from traditional local culture. Furthermore, the same façades, with the same functions have been used in countries outside the Arab region using a totally different name such as (geometric panels) and without even any mention of Arab culture, like the façades of the Birmingham Library in the United Kingdom, designed by Mecanoo Architects.



Image 10. Birmingham Library in the United Kingdom (Richters,2013)

By comparing the façades of the previous projects to the Mashrabiya, many critical questions need to be considered in order to distinguish the difference between the real thing and the ‘fake’.

Who is the inventor of the geometric panels? How did the idea start? What is the country of origin? In which year? What are their rules and design criteria?

The absence of any references may give us an answer to these axiomatic questions; it makes the idea of geometric panels closer to being an example of high fashion in architecture, not as an environmental architectural element in itself! However, nothing compares with the authenticity of Mashrabiya, the main reason for this gap in the geometric panels issue, may be due to the fact that they are obviously inspired by the heritage of Mashrabiya, but are not prepared to admit it!

EVALUATION AND CRITICISM OF IMPLEMENTATION MISTAKES

The revival of any traditional architectural element and get benefits of it in a contemporary way by modern versions is a great and powerful idea, but there can be no excuse for an architect to invoke the weakness of the scientific and practical foundations of the Mashrabiya. The knowledge about Mashrabiya is available, and it should be taken seriously, and consequently, there are the following important comments in particular need to be taken into account respecting to the implementation mistakes within contemporary projects that have used modern versions of Mashrabiya (Allothman, 2017):

- Any modern Mashrabiya is acceptable even if it doesn't achieve all the functions, but it should provide effective, calculated light regulation with one other environmental function as a minimum. Nowadays there is a prevalent misuse of Mashrabiya through a lot of small, local projects in the Arab region, where Mashrabiya has been transformed into a merely decorative, aesthetic element.
- Modern projects have revived the concept of Mashrabiya but also changed many of its parameters, and it is probably worth noting that the architects have sometimes ignored the implementation of proper standards, especially regarding the baluster section which needs to be circular, or should be based on a derivation of the circular section, to ensure that shadow diffusion is retained (Fathy, 1986).
- For the visual privacy aspect, the relationship between people and the outdoors is no longer evident in the use of modern Mashrabiya, where a glass layer is placed behind the main façade, creating what is known as double skin façades.
- Traditional Mashrabiya covered a space that had functions such as a stand for water jars or a seat for ladies to look outside. But the modern version, in using a double skin façade system, simply creates a narrow space without any function.

- Modern projects mostly rely on the double skin façade system that blocks any airflow and creates static thermal zones, meaning the buildings still need to be climatically regulated by means of cooling devices.
- One of the most difficult environmental issues in the Arab region that must be addressed is the combination of high humidity and steel materials and metal structures which are used to construct the modern Mashrabiya. They do not ensure humidity adjustment, the factor that was efficiently provided by wooden Mashrabiya.
- Projects mostly moved away from the use of wood and turned the Mashrabiya to metal or glass interfaces or other materials that do not have the properties of wood, with respect to various environmental functions. While the most important recommendations made in published research in this field of study, states and stresses that any alternative material needs to have similar properties to wood; it should be strong, easily produced in quantity, able to cope with extremes in humidity and temperature, along with capable of expressing a certain aesthetic value (Fathy, 1986).
- If the use of wood has been ruled out in the new Mashrabiya construction, because of expense, the advanced technology that is used instead, to operate the contemporary Mashrabiya, would seem to cost more money and energy, and the structural details are more complex both in their construction and maintenance. Advanced technology and the modern systems which are used, do not obviate the need for familiarity with the required design parameters of Mashrabiya, bearing in mind the importance of their functionality.

CONCLUSION AND RECOMMENDATION

If the Mashrabiya is considered as an important environmental element, the contemporary architecture has to achieve the ecological advantages of Mashrabiya functions, instead of dealing with it as a mere decorative element. As a result, this paper calls for stopping any misconceptions during the implementation. The theoretical studies and the proper design standards of Mashrabiya have to be taken seriously during the implementation of modern projects, and the architect who chooses to deal with modern Mashrabiya should have full understanding and realization of the environmental functions of Mashrabiya.

Mashrabiya adjusts the daylight, not only reduces it; for example in the winter, the daylight is needed in bulk, and the diversity of patterns within the same Mashrabiya is not for a decorative purpose, it is to provide a good air movement circulation, besides to privacy issue.

The architect has to be aware of these aspects and functions in details during the design process, instead of transform the powerful environmental element into a mere decorative element.

On the other hand, it is preferably to avoid repetition of theoretical discussion about Mashrabiya and focus on the benefit of the studies to find practical results which can serve to contrive the proper construction solutions. Moreover the efforts to design digital systems that use high energy and a lot of money, could be focus on an important process in the field of construction materials and development of their properties, to invent new structural materials that have comparable advantages to wood, and can be used in high altitude, at an affordable cost.

This is in order to make the modern Mashrabiya more dynamic, with the most appropriate cost and safety, and to keep up with the renaissance of western architecture.

In addition, the original name must be preserved and the architect has to recognize it and have a full understanding of all the environmental, social and cultural functions. At this point, two critical points arise:

- Hiring a foreign architect does not provide justification for a lack of familiarity with and a lack of knowledge about Mashrabiya.
- The gap in re- using of Mashrabiya within contemporary Arab projects comes due to do not adopt the new generation of Arab architects who are studying hard to learn about their heritage and they are fully aware of its development methodology.

The East and West are two worlds who should be able to integrate together, without obliterating the identity of one or the renaissance of the other. Architecture represents the finest images of cultural integration, which benefits all sides.

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