

Employing Heritage Elements in Contemporary Architecture. Openings and Windows: The Case of Housing Buildings in Amman - Jordan

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Abstract

This paper reviews different proportional systems created in different architectural styles to assist architects in ordering building and providing an aesthetic rationale for design forms. Proportions can visually unify the multiplicity of elements in architecture design by giving all parts of building the same proportion while providing the feeling of ordered facades and forms. In the 'Sham Region', a system of proportion has developed during different eras, through applying architecture with unique characteristics and distinct proportions. This system of proportions has been neglected after the 1970's and random relations were introduced, leaving the final appearance of the buildings with no special character. This can be noticed through analysing several new buildings in Amman City. Findings reveal a mix of proportion and styles. The research recommends using proportions from the local architectural heritage and evolving that style to maintain the unique style and special features in this part of the world.

Keywords: Architectural proportion; architectural heritage; openings and windows; scale; traditional architecture.

1. Introduction

The use of elements derived from traditional architecture to express cultural identity is evident in many parts of the world, among several architects seeking to relate contemporary architecture to roots of place. In many instances, this involves copying and imitating architectural heritage components in an attempt to mask contemporary architecture with covers from the past. Openings, vents and other façade components are the mostly utilized elements in that manner. Contrary, there seem to be serious attempts aimed at achieving deep understanding of the elements of architectural heritage and developing them in a manner that matches the spirits and needs of the present while maintaining authentic contacts with the past (Mahgoub 2009). According to Langhein (2005) traditional built environment was based on intrinsic expressions of design values, creating an enduring place, adapted to its environmental conditions. Hence, the features of traditional built forms appear in harmony with people's lifestyle and culture, which is generated through a considerate way of design within the cultural environment (Hossenli 2017).

The turn of the 20th century has witnessed a big shift in the architectural thoughts that dominate the globe. The beginning of the 21st century is marked by increasing globalization and affirmation of singular identities. This trend has started after the spread of the international style, during the second half of the 20th century, and amplified as a result of the spread of globalization as a dominating world view at the end of the century. This has resulted in inordinate debates about the phenomenon of expressing local cultural identities in architecture or alternatively, turning ahead towards the contemporary and futuristic trends that better complement the universal vision (Mahgoub 2009; Gospodini 2004).

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In the Arab region, reflecting cultural identity in architecture became significant during the seventies as the influence of modernization started creating architecture that entirely differs from the traditional Arab city architecture. El-Sheshtawy et al (2000) argue that many of the third world cities started moving towards a "co-existence" model that considers forces of modernization and change while concurrently responding to the preservation of traditional elements of the society.

Saleh (1998) pointed out that within this endeavour climatic, social, topographic and economical aspects were important factors in the formulation the new "regional or local" architecture of place. He states that the professionals use their skills in the incorporation of historical and new images of the physical place and structures to enhance their identifiability and recognition of place. In doing so, they employed the direct use of architectural elements to reflect the formal characteristics of traditional buildings, or alternatively focused on the technical and environmental design issues. The aesthetic qualities including sense of proportion and the rationale behind the development of visual and artistic components were the least in terms of significance. As Gangwar (2017) pointed out "*Proportion system has lost its significance due to many more multiple design issues in modern context.*" (P: 4). After the 1970's architects became more oriented towards space utilization, and the increase energy issues, sustainable principle, form oriented buildings and structural design. In doing so, they overlooked the essence of architecture that lies in its aesthetic value; without which buildings lose their identified character and become are more like machines (Gangwar 2017). The new generation of architects are very less interested in geometric proportion of building or do not have enough knowledge about it. Architects are nowadays more interested in evolving form but to forget to detail out these forms in good proportion.

Proportion is undoubtedly the key quality for buildings' aesthetics that visually unifies the multiplicity of elements in architecture design and provides the feeling of harmony and order. As such, it represents one of the most important assets and sources of creativity and excellence in traditional architecture. Hence, there is need to appreciate the importance of proportion in architectural design process, and re-adopting it as a powerful tool of design and a means by which architects can relate to contemporary architecture to its traditional "ancestors".

This paper reviews different proportional systems created in different architecture to assist architects to ordering and perception of building and providing an aesthetic rational building elements and form. It reflects on the present experience of designing residential buildings' facades in Amman, Jordan and the extent to which it relates to the traditional architectural of the Sham Region; being the home region of Jordan; to build a better understanding of the relationship between the present and traditional architecture particularly in terms of proportions.

2. Architecture and Proportion

2.1. Defining Proportion

Proportion is defined as the dimensional or harmonious relationship of one part to another or to the whole, described in terms of a ratio. It is the visual effect of the relationships of the various objects and spaces that make up a structure to one another and to the whole. These relationships are often governed by multiples of a standard unit of length known as a "module" (Oxford Dictionary of Architecture, 2006). In nature, each species has distinct proportional relationships among its parts. In the human designed world of architecture, the "right" proportions are those, ancient scholars thought created visual harmony among the parts, based on mathematical ratios found throughout nature, as well as the basic geometric shapes including squares, circles, and triangles. Classical Greek and Roman architecture was obsessed with getting all the parts into prescribed proportions, in the belief that embracing these naturally occurring ratios would harmonize the design with universal, divine truths.

Proportion represents a ratio between two numbers that could have quantitative and qualitative meaning attached to it. Mathematicians are attentive to quantitative facet more while architects are more interested in qualitative aspect of this ratio. The quantitative aspect is termed as "Proportion as ratio" and the qualitative aspect as known as the "Proportion as beauty" (Gangwar 2017). Proportion can be found everywhere in nature; in human body, shapes, artworks, paintings, music, poem, and even in the universe. In architecture, proportion is defined as the relationship between one part to another part of design, or to the whole design, in a fashion that creates a harmonious relationship. Geometric ratios and proportions existed and were employed in the design of ancient sacred and ceremonial sites in all traditional civilizations. They were perpetually built with dimensions that incorporate mathematical numbers, constants and ratios and the use of geometries based on proportional roots and proportional rectangles. In Islamic art, geometric elements have been employed since its origin and were used to create unique geometric formations, serving as the underlying structure of Islamic design process (Dabbour 2012). Proportion and architecture are strongly interrelated and operate as the foundation of standard measurement scale and system of architectural units. Geometric proportions and strongly associated with patterns.

As such, they represent a design language, as words do in a spoken language. They determine the frame works within which elements are arranged into patterns, a relation between one element and another, and a proportional relation within one element. They reflect the natural laws that govern the basic harmonies of nature, being describable by means of mathematics and geometry (Dabbour 2012). Geometric proportion are used in various ways in design of building such as planning, façade, sections, form, space and details of various elements of building. They strongly aid architectural creativity, especially when used in the right context of design (Gangwar 2017).

2.2. Proportion and Beauty

Decades ago, geometry shapes and modular designs ruled the architectural beauty. Beauty is not only a luxury of life, but it is a prerequisite of ecological survival as it supports human life in all grander aspects, and maintains according to Aristotle "the just measure". It is the pre-condition of aesthetic pleasure and is considered as one of the most human and ecologically innocuous capacities of man. It allows our perception to act freely in directing our attention and awareness without noticeable disturbances. (Langhein 2005). Beauty always has holistic qualities. It is constituted by a figurative balance of order in diversity. As expressed by Langhein (2005); beauty lies in the ensemble effects where proportion has a key function in constituting them. Proportion guides the intermediation between order & diversity. Proportion geometry regulates the extensional order of buildings. Together with other unifying principles, proportion draws the bonds upon which elements of aesthetic forms are assembled. He affirms that such statement can be grounded on firm science and fits to establish teachable systematic design principles that must evolve in the future. Hale (1994) expressed the distinctive role of proportion as being the guiding principle of architectural patterns, and the means by which traditional buildings and urban milieus gained its harmony and life. He stated:

"There was a time in our past when one could walk down any street and be surrounded by harmonious buildings. Such a street wasn't perfect..., but it was alive. The old buildings smiled, while our new buildings are faceless. The old buildings sang, while the buildings of our age have no music in them. The designers of the past succeeded easily where most today fail because they saw something different when they looked at a building. They saw a pattern in light and shade. When they let pattern guide them, they opened their ability to make forms of rich complexity." (Hale 1994, 1).

Proportion is strongly linked to geometry. Geometric ratio and proportions was very important tool used for aesthetic of building in ancient civilization. System of proportion has been used to fulfill the technical and aesthetic requirement of design throughout history of architecture. Together, geometric ratios and proportions have built structures with dimensions derived from unique mathematic constant and ratio such as golden mean, golden triangle and the golden rectangle (Gangwar 2017). This comprised applying key principles for the proportion system as follows:

- a) Ensure the repetition of key ratio throughout design;
- b) Have additive properties so that the whole could be divided into different parts easily; and
- c) Be adaptable to architect's technical means.

It is argued that in order to design a building that belongs to a human, there must be a strong consideration for the human in all the physical and psychological aspects in a responsive manner that is centered on the human scale. The importance of human figure in architecture has been notified long time ago. Many theories proved the impact of human geometry and proportions architectural design and the interaction between human beings and their surrounding environment (Gangwar 2017; Porto 2013). Any successful artificial works would always contain proportional relations between all the parts of it as what in human bodies.

2.3. Proportioning System

Historically, architects and builders realized that proportion system can assist ordering and perception of building and provide an aesthetic rational building elements and form. They can visually unify the multiplicity of elements in architecture design by offering all parts of a building the same proportions, in-addition to providing the feeling of order in facades and forms of architecture (Borson 2013). Practical geometry in the building crafts were almost self-guiding methods of regular and statically proved design (Langhein 2005). There are number of theories of proportions developed throughout history:

Golden section: The proportion that has uniqueness and beauty is known as divine proportion or golden section. Divine proportion has been widely used in architecture since a long time ago (Marina, M., et al. 2016). This ratio is defined as the ratio of the sum of two quantities to the large quantity is equal to the ratio of the large quantity

to the smaller one, which equals to approximately 1.618. This ratio originated by the Greek and is described as the “law of beauty.”

Regulating lines: The lines that indicate the common alignment of elements used to control the proportion and placement of elements in buildings. They reassure the perception of order and fix the fundamental geometry of work. Le Corbusier named them as the inevitable elements of architecture and important for order.

Classical order: This order is distinguished by its characteristic columns details and type of column used in the building. The three ancient Greek columns and the 4th Roman column: “Doric, Ionic, Corinthian and Tuscan”. The basic unit of the dimension of the diameter of the column and the dimensions of all building elements are derived from it. This order represents the perfect beauty to Greek and Roman architects.

Renaissance theory: Renaissance’s architects believe that buildings had to belong to order the Greek mathematical system of proportions, and the building is mathematics translated into spacious units. Developed by Pythagoras; application of the proportion system (which is considered to be a musical scale) develops progressive ratios that form the basis of their architecture.

Modular: “Le Corbusier” developed a proportion and dimension style based on the Golden Section and human body. According to this system he developed two series of dimensions, according to the full height of the man and the second according to the height with lifted hands. He applied this system in his architecture to determine the height of spaces and furniture.

Ken: This is a Japanese system measurement unit. It designated the interval between columns and it was standardized for residential buildings. It is used also as aesthetic modular that order the structure, materials and spaces of the Japanese architecture. The Japanese also developed another modular called the “Tatami” which is the traditional Japanese mat; it is proportioned to accommodate two persons sitting or one person sleeping. One smaller side of “Tatami” is equal to the size of ken, and two kens equal to the length of “Tatami”.

The Square and the circle: This system is developed by Muslim architects and artists and is applied widely in architecture and ornament. The ratio of the square length to its diameter is: $1: \sqrt{2}$; i.e. 1:1.4. This ratio is applied in plans, elevations and sections. Windows and entrances apply the same ratio. The circle is considered to be the basic unit for Islamic ornaments. (Dabbour, 2012)

Anthropometry: This term refers to the dimensions related to human body, all human spaces, building dimensions and furniture must be related to human as they are design for human living. The British system of dimensions measures the inch (one human finger, 25mm), one foot (human foot, 305mm), and yard (three foot, 915 mm). The Arab measurement dimensions are related to human arm, which is approximately 640 mm.

There is always a relation between scale and proportion, but the difference between them is that proportion defined as a dimensional relation between one part of the whole to the whole and it represented as some terms of ratios. On the other hand, scale is defined as the size of an element to the whole in one piece of art then after to reference measures. For architecture, scale is the size of a building compared with human body then after compared with the nearby contexts. In fact architects and architectural designers deal with many different scales but some of architects and philosophical thinkers have correlated the beauty of any building with the scale of a well-shaped man. According to the main definition for scale human scale would be defined as the measurement of things compared with human body as a reference measurement tool, and scale needs a reference point that is the base to compare with, there are some architectural styles took the human scale and proportions in consideration; the Vitruvian man was the first flame that engaged the man ratios with architectural design.

3. The Architecture in Greater Syria (Sham Region)

Greater Syria, which includes Syria, Lebanon, Jordan and Palestine, was a single geographic and demographic unit until the early 20th centuries. Governed under one policy management, it shares many similarities such as customs, traditions, community life, in lifestyles, construction methods, building forms, and building materials. It is well known that the builders and stones in Jordan were specialized in certain villages in Palestine, such as Beit Fajar, Qabatiya and Hebron. Hence, the architectural character in this geographical area was very similar, whereby architectural characters may have been developed naturally through decades of experience and thus the area a distinctive character. Furthermore, this character has certainly been influenced by the European architecture in one way or another as a result of missionary missions, commercial and cultural exchanges and the British and French occupation of these nations.

Traditional architecture makes serious use of the familiar symbolic forms of culture and place. It considers the styles popular to the region and reflects a commitment to maintaining a link to the past styles of building, reuse of materials or designing homes and building to stay consistent with the overall building design of the area. This created sense of continuity and connection to the past, which helps the area, maintains its traditional look and feel for the residents of the community (EshruqLabin&Aldeek, 2017).

A system of proportion has been developed during different eras, through applying architecture in this area its unique characteristic. Several building facades in this area were examined and conclude that this system is similar and the architect produced a special style. The formation of the traditional interfaces of blocks and architectural elements affirms the principle of simplicity and the depth of its expressive contents. Buildings express the function which they were created for and reflect a great deal of harmony among the different architectural elements. This can be noticed according to (Alsubeh& Al-Rawashdeh 2013) as follows:

- Relationship between architectural elements is harmony and continuous link between these elements.
- Variety in the architectural elements creates a kind of excellence and unity among them.
- There is a rhythm by using elements that are repeated without getting bored.
- The presence of the rule in the overall composition, with the repetition of some elements there is a dominant form of the total for example, most of the holes ending with arcs.

It can be said with confidence that the buildings in these countries shared special characteristics until the early 1970's, were random, multi-shaped buildings started appearing reflecting no sense of belonging to any known architectural style. The reason may be the ease of communication between different civilizations, the multiplicity of engineer educations and the influence of other cultures on local cultures.

4. Methodology

This paper reviews the use of proportional system in architecture and the role it plays in creating aesthetic rational for buildings' forms and elements. It reflects on the present experience of designing residential buildings in Amman, Jordan and the extent to which it relates to the traditional architectural of the Great Syria (Sham Region); being the home region of Jordan; to build a better understanding of the relationship between the present and traditional architecture particularly in terms of proportions. It aims at studying the extent to which contemporary architecture in Jordan employs elements from traditional architecture and thus forms an extension of the architectural heritage in the region. In doing so, the research focuses mainly on the design of facades, being the features that soundly express architectural styles, and the one architects commonly rely on to reflect their design language. Heritage elements of traditional facades can be underlined as openings, arcs, columns, mashrabeyyat and shutter widows, ceiling and balconies (Alsubeh & Al-Rawashdeh, 2019). Openings' proportions are the most important elements that affect the facades design in traditional architecture.

The research adopted apartment buildings as the study case. These present the typology that dominates over 85% of the buildings in Amman, and therefore, studying this building typology would give strong indications over the whole architecture of Amman. A comparative case study analysis has been employed between selected cases of traditional residential buildings from all over the Sham Region (Syria, Lebanon, Palestine and Jordan) covering an area the extends over a radius of 500 km, with selected cases of apartment buildings over a specified areas in Amman. The objective was to study the proportions of the opening in each selected case, and illustrate the similarities between the different cases from the whole Sham Region and the extent to which selected cases from Amman match these proportions.

5. Research Findings

5.1. Proportions of windows in the traditional architecture of Great Syria Region

Figure (1) presents examples of some buildings with emphasis on the windows ratio in traditional architecture in Great Syria including: Syria, Lebanon, Jordan and Palestine. From these windows it is possible to conclude the followings:

- These buildings are constructed within a 500 km radius.
- The great similarity between the form of openings, either separately or in a set of two or three window.
- These windows are rectangular and their height is more than their width.
- The ratio of height to width is mostly 1: 2, although it was built in different places and at different times as well.
- Window designs can be rectangular or end with an arc, half circle, pointed or part circle.

- In a single elevation; windows can be seen of different shapes but with same ratio.
- This similarity confirms the presence of architectural style in this geographical area that are common in climate, building materials, social and economic conditions, religion, language, customs and traditions, and social thought.

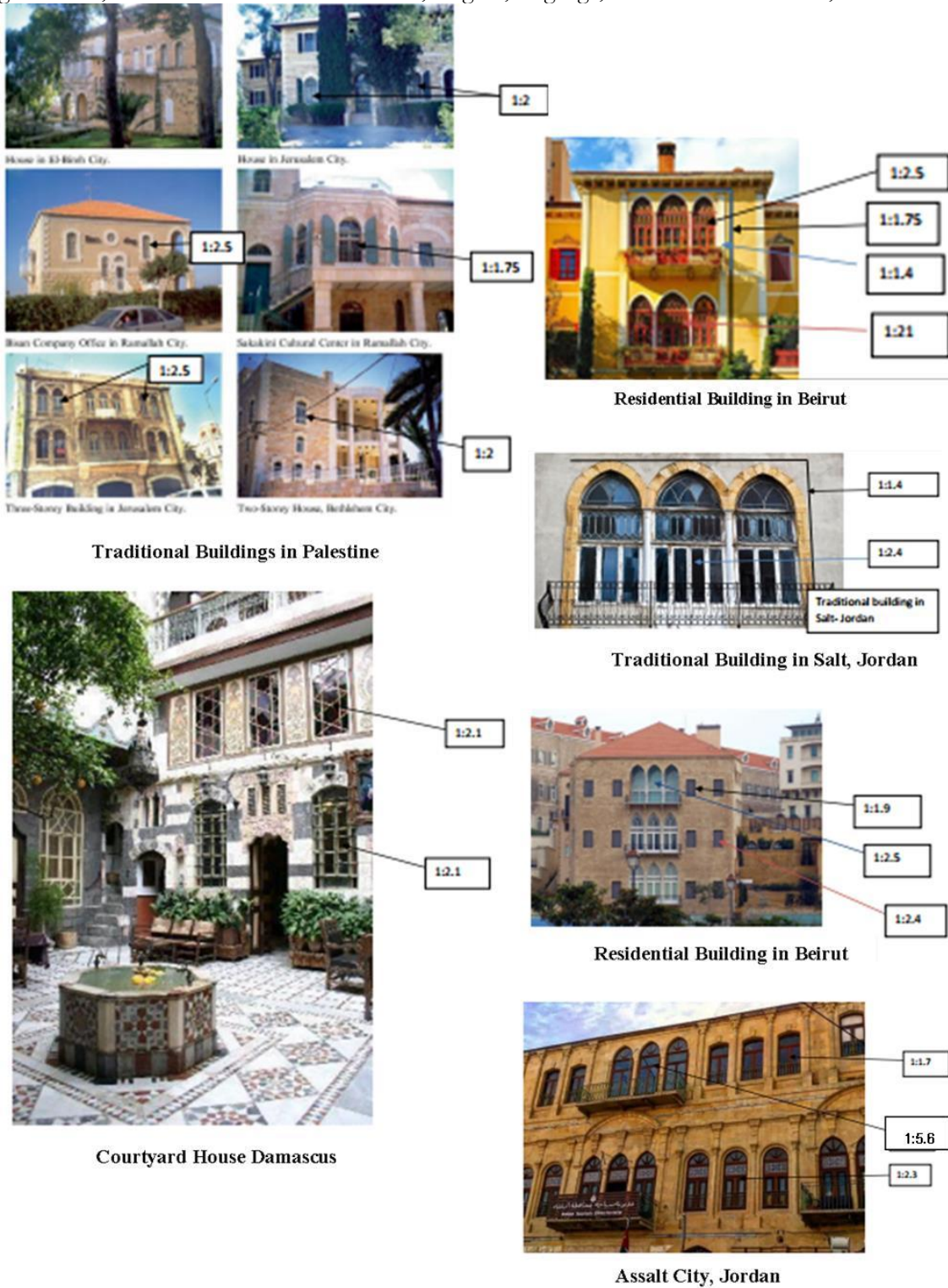


Figure 1: Traditional buildings in Greater Syria

5.2. Architecture of the city of Amman

Amman city is considered to be a modern city that does exceed 100-year-old, since it became capital of the emirate of Jordan, then capital of the Hashemite Kingdom of Jordan in 1945. The city experienced significant population growths in 1948, 1967 and 1990 as a result of forced migrations and has now reached a population of 3 million, which forms approximately one third of the country population (Gharaybeh 2011). Its character was influenced by the architecture of the Greater Syria (Sham Region) until the early 1970's where this character was influenced by modern architectural movements as a result of the openness to architectural movements by engineers who graduated from different countries in the World.

By the end of the 20th century the country had witnessed a comprehensive development accompanied by expansion of urbanization in most of Jordanian cities, including Amman. This encompassed wide openness to global architectural trends, which made shifts in the Jordanian architects' thought and contributed in the re-formation of the Jordanian urban environment and the emergence of strange architectural styles and new types of buildings that barely consider the traditional architectural styles stemming from the rich and multi-cultural heritage of the region (Rjoub 2016).

As a result of the growing demand for housing; many housing companies appeared and contributed in building thousands of residential buildings without controls or specific legislations to conserve heritage architecture or the traditional architectural style that has evolved naturally in the city and the region. On the contrary, the majority of buildings built on the traditional style have been demolished to construct new residential buildings to fulfil the need for housing.

The general character of the city is random and does not take into account the basic principles of design, specific ratios or criteria, whereas the single building contains different forms and ratios, none of which have any common ratio or proportion. Figures 2 and 3 show samples of these buildings built within the last 5 years, according to which the following points can be noted:

- All the buildings are stone facing, and set back from the street is respected,
- The floor percentage is also respected and the heights from the middle of the street are also respected. These are governed by the regulation of Amman municipality.
- None of these buildings have a certain ratio between the size and height of the windows and the ratios are random and are governed by the designer's mood and contractor's way of thinking.
- There is no principle of unity between the building, street or the adjacent buildings.
- It is clear that the architects didn't appreciate the importance of ratios which is derived from the previous experiences of architecture inherited or even the knowledge of famous World architecture, who produced beautiful buildings which were appreciated by architects all over the World.



Figure 2: Openings' Proportions for five new buildings in the same location within 200m distance in Amman



Figure 3: Openings' proportions for six adjacent

How to explain the similarity of buildings in Sham area, within a radius of a 500km, while buildings within small area in street are completely different. Although these buildings are well constructed and use the latest building materials, they have little knowledge of their properties. It can be said that these building are similar in using stone cladding of limestone in their facade, which is available in the Kingdom, but this not reflect the real knowledge of their characteristic, when compared to the use of stone over the past centuries. There is no harm in using inherited opening ratios, as long as the windows and opening have the same function?

The negligence of the city heritage resulted in losing its unique architectural identity and its urban relationships have been disrupted the result reveals more composite patterns with more than one identity (Mahgoub 2009).

It seems, as stated by Alsubeh (2013) that modern architecture in Amman reflects architects' trails to emphasize the concept of production mass; to avoid the past and produce architectural works with feeble or no connection to the site or its identity; to achieve a new vision of the new age. It may be appropriate to return to the domestic architecture that prevailed until the seventies of the twentieth century and the use of some elements that have not changed their function, such as vents and doorways. Instead of using random ratios and unbalanced relationships, these ratios can be used in windows and entrances.

6. Summary and Conclusion

Architects, throughout ages, used geometric ratios to control measurement of various openings and doors and manipulate the relationship between different parts of the building. The Greek and Romans used the Golden Ratio's, which were inherited from Greece and the ratio of the columns and both civilizations produced beautiful architecture. Similar to other human civilizations; different proportions were taken to govern relations between different elements of the building. These proportions evolved throughout history and produced buildings of their own style.

Buildings in the area of Great Syria Region evolved through the ages and produced a local building style with its own distinctive architectural character. In the early 1970's, the region was affected by global trends of architecture, and the influence of architects on contemporary architectural led to the disappearance of the local traditional building style. The analysis of the windows in the heritage buildings showed that they have special proportions, merit and special beauty, while that of the ratio of openings in modern architecture in Amman shows, the ratios of openings are random, does not belong to a specific logic, unit or curse. Several building facades in this area were examined according to which it can be concluded that this system is similar and the architect produced a special style. This proportion has been neglected after the 1970's and random relations were introduced, leaving the final appearance of the buildings with no special character. This can be noticed by analyzing several new buildings in Amman City. The finding is a mixed proportion, mixed style, and no style.

The paper recommends using the proportions in the architectural heritage and evolving that style to maintain the unique style and special features in this part of the world. In heritage architecture there is still an appropriate and acceptable reference, which can be taken and developed to give buildings in this geographic area their own character, such as windows width to the height ratios.

References

- Rjoub, A. (2016). The Relationship between heritage resources and contemporary architecture of Jordan. *Architecture Research*, 6(1), 1-12.
- Alsubeh, M. (2013). Architectural and heritage elements and formation characteristics of traditional houses interfaces. *Arts and Design Studies*. 12, ISSN 2225-059X (Online).
- Alsubeh, M. and Al-Rawashdeh, T. (2013). Architectural and heritage and formation characteristics of traditional houses. *Arts and Design Studies*, 12, 9-21.
- Borson B. (2013). Scale and proportion - The architect's domain. <http://www.lifeofanarchitect.com/scale-and-proportion-the-architects-domain>
- Curl J. (2006). *Oxford Dictionary of Architecture*, 2nd ed. Oxford, 606-607.
- Dabbour, L. (2012). Geometric proportions: The underlying structure of design process for Islamic geometric patterns. *Frontiers of Architectural Research*, 1, 380-391.
- EshruqLabin, A. and Aldeek, Z. (2017). "The design elements and building techniques at the traditional Jordanian dwellings. *International Review of Engineering and Computer Sciences*, 2 (3), 12-20.
- El-Sheshtawy, Y. et al. (2000). Sustainable urban development in an age of globalization: Towards a co-existence model in Dubai, UAE. IAPS:16, Paris.
- Gangwar, A. (2012). Principles and applications of geometric proportions in architectural design. *Journal of Civil Engineering and Environmental Technology* 4(3), 171-176.
- Gharaybeh&Khlaif. (2011). The development of history and urban since its creation till the end of the Twentieth century. *University of Damascus Journal*, 127 (3&4).
- Gospodini, A. (2004). Urban morphology and place identity in European cities: Built heritage and innovative design. *Journal of Urban Design*, 9(2), 225-248.
- Hale, J. (1994). *The old way of seeing - How architecture lost its magic and how to get it Back*. Boston: Houghton Mifflin Comp.

- Hossen, E. (2017). Applicability of architectural design features of Malay traditional houses for contemporary Malaysian houses. PhD. Thesis, Universiti Teknologi Malaysia.
- Langhein, J. (2005). Proportion and traditional architecture. International Network for Traditional Building, Architecture & Urbanism, I (10).
- Mahgoub, Y. (2009). Use of traditional elements in contemporary architecture in Kuwait. Paper presented at the First International Conference for Urban Heritage in The Islamic Countries.
- Marina, M., et al. (2016). Divine proportion in Modern Architecture: A case study. Jurnal Teknologi - Sciences & Engineering, 78(10), 15-20.
- Porto, F. (2013). Architecture and the body philosophy essay. University of Lincoln. Proportions in Architecture, Le Corbusier foundation, <https://www.google.co.in/#q=proportion+in+architecture+%2B+le+corbusier+foundaiton>.
- Saleh, M. (1998). The integration of tradition and modernity: A search for an urban and architectural identity in ArRiyadh, the Capital of Saudi Arabia. Habitat International, 22(4), 571-589.