HUMAN PERCEPTION IN THE LIBYAN BUILT ENVIRONMENT: AL-KHUMS AND BANI WALID CITIES AS CASE STUDIES

Fawzi Agael*, Özlem Özer

Keywords

perception; mental maps; Space Syntax; axial analysis; Libyan cities

Abstract

This paper is concerned with the identification of different influences on the built environment, and those which have a physical and psychological impact on people. The aim of this study is to analyze the impact of the built environment on the lives of people. The interrelationship between people and built environment is based on human perception. This research will explore this relationship further in order to develop a clear understanding of the ways in which architecture may influence peoples’ perceptions and experiences. Additionally, the research entails a comparison between two important theories: the first is an Image of the city derived using the Mental Map Theory; the second is related to Space Syntax Theory. The two theories will be applied in two different cities in Libya with the aim of assessing the importance of their interrelationship and how it may be understood more clearly. The paper will also provide guidelines for improving urban design and planning standards with the end goal of producing a high quality perception by those who actually use the space. Moreover, it concludes with a number of research avenues that should be pursued to answer how the properties of built environment affect human perception.

F. Agael*, Ö. Özer

F. Agael*, Institute of Natural Sciences, Architecture Department, Okan University, 34000, Istanbul, Turkey
Ö. Özer, Architecture Department, Okan University, 34000, Istanbul, Turkey

*Corresponding Author's email address: emailaddress@domain.com
INTRODUCTION

The design quality of the built environment is reflected in the actions of people, and hence in the type and intensity of their various economic, social, leisure, cultural and family activities. Individuals invest a great deal of energy interacting with man-made situations, from the locations where they live and work to the locations where they relax and socialize. It is a fact that built environments are integral in all aspects of life and play a significant role in shaping their daily activities. A center of this human-environmental interrelationship is perception and experience of place. People's immediate awareness of the environment is given through the process of perception (Norberg-Schulz, 1965). This process allows people to understand, translate, and draw relationships with their surrounding environments. Various Environmental Psychologists like Rapoport (1990) believe that architecture has the potential to arouse people's thoughts, feelings, and emotions: people are affected both physically and emotionally by the built environment which surrounds them.

Urban psychology is the study of the reciprocal relationships between human beings and the built environment. This relatively new field entails components of studies related to urbanism, conservation of resources, and quality of life issues. Most environmental problems are caused by human perception, which makes the changes in these perceptions necessary in order to address such problems. Urban psychologists therefore focus not only on understanding the relationship between humans and the built environment, but also what motivates humans to improve these relationships.

The relationship between environment and behavior covers important topics such as beliefs, meanings and values, which are concerned with various environmental aspects, such as neighborhoods, transportation, routes, devices, recreational areas, and cities. The purpose of studying this relationship is to evaluate the effectiveness of environments that have been designed to achieve specific objectives. Planning and design aims to control and develop the environments in order to influence positive behaviors. This study will emphasise the fact that there is a strong relationship between urban spaces, the built environment, human perception, and human behavioral studies. Understanding human perception is essential towards improving the performance of the built environment economically, socially, and culturally. The interaction between the structures of spatial systems, mental maps, physical urban form, and changes in activities leads to changes in the method of human perception, which will consequently produce different behaviors. The differences of typologies, sizes and shapes of the elements comprising the built environment evoke different human perceptions. The relationships can be described as strong and direct. However, those built environments are shaped by human beings and will be shaped again, depending on the changes in people’s perceptions of their built environments. Certain characteristics create an understandable environment which affects the behaviors and reactions of the people within that environment. This relationship between the human being and his/her environment is linked to experiences and human perception (Rapoport, 1995).

Individuals see their surroundings in a fluid manner. This perception fluctuates in accordance with their changing feelings, state of mind, memories, and other factors such as age, sex, race, and culture. This research considers the perception of two distinct built environments: one was established by a tribal society, while the other includes various groups of people who do not necessarily belong to the same clan. The differences in the perception of these built environments can be identified, and an understanding of these differences can be used to develop an appropriate design approach for a built environment that suits the physical, social and emotional needs of the users.
BUILT ENVIRONMENT AND HUMAN PERCEPTION

Built environment is a relatively new term to describe a holistic and integrated concept, encompassing the creative (and not so creative) results of human activities throughout time. This term first appeared in the 1980s and was used extensively in the 1990s (Boyer and Mitgang, 1996). The term 'built environment' forms a significant part of the new definition of landscape architecture approved by the International Federation of Landscape Architects in 2003 to cover their work of planning, designing, administration, and upkeeping. It helps to check the functional and aesthetic formats of any built environments and it highlights the identification and the development of the appropriate solutions that concern the quality of the built environment in urban, suburban, and rural areas (Kilbert, 1999).

These were the state goals of a profession that was, for a long time, considered to only focus on yards and gardens. This is different from the profession in its current state, which is more community-based and is comprehensively applicable (Crowe, 1997). Current knowledge and understanding is derived from whatever is left in the built environment from previous civilizations. Similarly, current cultures will be judged through what they have created (Bartuska, 1981).

Many studies have been conducted to analyze the impact of the built environment and its diverse impacts; built structures, streets and recreational spaces influence the built environment where we live, work, learn, eat, and play. The built environment affects our social decisions, i.e. whether or not to go to a specific destination, whether or not to engage in a particular activity such as walking to work or school, or taking our children to parks. These are all daily behaviors impacted by the structure of how our neighbourhoods and built environments are realized.

Within the various studies that look at human activities (movement & stability), movement activity has had the largest share of these studies. Bandura (1989), in his Social Cognitive Theory, has proved that individual factors and the social physical environment can together impact human perception and behavior. The built environment is complex and multidimensional, and therefore presents challenges in deriving a system of measuring it. In fact, there have been several scientific papers, research works, and books which study the concept of the built environment as an influential factor on the physical, psychological and mental nature of human beings.

For instance, Bandura (1989) claims that the social and physical constructs of the built environment are unavoidably interwoven; that is to say, they are hugely affected by each other. Environments are generally constructed for certain social reasons, and accordingly designs have, intentionally or unintentionally, led to social consequences, and even minor interventions in the built environment still elicit social consequences. Halpern (1995) suggests that the types of environments which affect perception and behavior may be physical, i.e. the weather, the climate, and community resources; the built environment; or environmental and social information such as social support, norms, beliefs and attitudes. Sallis and Owens (2002) add that physical behaviors and activities are shaped by environmental constraints and therefore the environment will be considered as a strong behavioral determinant for them.

Owen et al. (2004) as well as William (2011) argue that the built environment has important effects on mental health and perception, as represented by the influence of crowded, noisy and unsafe places and areas. According to Bandura’s (1989) Social Cognitive Theory, theoretical foundations have proved that environments have broad effects which influence the individual's behavior and may also reflect individual influences on their environment. In
this sense, it is noteworthy to state that the design of ordinary built environments relates purposefully to the use of such settings. Ordinary environments denote places, settings, or surroundings, where individuals commonly carry out day-to-day activities. Built environments are a result of purposeful design, where designers integrate social content with spatial conditions to generate a place that is consistent with its purpose.

In the same research, it is argued that the function of a place is dependent on its use and is a product of shared knowledge between people in a given social-cultural system. According to Lang (1994), ‘perception’ is the active and purposeful process of receiving information from nature by observation. ‘Perception’ is the procedure of observation that incorporates learning and recollection, comprehending, feeling, and depositing data, such as loving and disdaining (Downs and Stea, 2005). According to Hengartner (1999), the first element of city perception depends on material appearance. The next most significant characteristic is utilization. It is normal that these two components are significant impactors in the perception of urban areas and cities.

Perceptual space is a part of the physical environment that is consciously or unconsciously perceived by an individual while evaluating his or her surroundings. Heineberg (1999) believes that one’s evaluation of environment originates from a selective subjective perception of the environment, and is called perceived environment. He offers cognitive and mental maps to investigate the spatial perception of a subjective mental image of the environment. Thus, the perception is related to the events and its process occurs because of the presence of an object (Downs and Stea, 2005). Then, perception can be considered a direct sensory experience and cognition an indirect one.

This perception may be connected with the past or the future. In fact, it is comprised of observation, consideration, and critical thinking alongside the organization of data and thoughts. In addition, Downs and Stea (2005) scrutinizes perception and cognition from a spatial context; according to their idea, cognition happens when the perceived object and event is larger than the field of view (Downs and Stea, 2005) and consequently, is organized mentally. From the perspective of spatial planning, the separation between the built and social spaces is no longer valued. One then has to seek well-balanced compromises.

Downs and Stea (2005) cite the architecture magazine ‘Arch Plus’ that discusses in its articles how important it is to adopt a new perspective in the field of urban planning quality. The magazine invites designers and planners to rethink their archaic planning dogmas; the meaning of space should be appreciated. On one hand, the spatial structure should be understood, while on the other; the designer should reflect his own dominance by identifying himself with the residents of the area. It is of particular importance to allow the inhabitants to participate and to design with them their new living environment. Through this participation, the life and identity of space will be designed in a sustainable way. A city and its components is produced by a complex creation process influenced by the overlap and interaction between the physical and social environments. This urban interaction, according to Hengartner (1999), consists of different factors. He argues that the built and designed world (buildings, streets, rows of houses, roofs, landmarks, gardens, and green spaces) is the localization of human influence in the city, and that the physical environment attains its importance only through social interaction in the space.
CASE STUDIES

Al-Khums City Location

AL-Khums City is situated in the Tripoli area. It has a key location on the Mediterranean Sea and covers an area of 374,000 sq. km, about 22% of the total area of the country. It has a population of approximately 3.6 million people, accounting for about 57% of the total population of Libya. The region is made up of seven sub-regions known as BalaDiyas, including Tripoli and AL-Khums (McKenna, 2011).

The AL-Khums sub-region is located in the northeast part of the Tripoli region and has a coastal location (See Figure 1). The city has Phoenician and Roman roots, and became the capital of the Roman province of Africa under the reign of Emperor Septimius Severus. The ancient Roman city of Leptis Magna is located approximately 3 km (1.9 mi) to the east of the AL-Khums city center. This coastal site is located 10 kilometers to the east of Tripoli, and is one of the largest archaeological sites located on the Mediterranean Sea (McKenna, 2011).

The tiny Phoenician port of Leptis was established around 1000 B.C. to establish trade links with the Germents people. Similarly the other trading posts on the Gulf of Sidra, such as Sabratha, had a distinguished purpose in the second century A.D. In the era when the Libyan Septimus Severus was chosen to the throne of Roman Emperor, Leptis became one of the most attractive cities in the Roman world and remained a good example of urban development. Leptis Magna was like Palmyra and Ephesus: it was a normal city that had an historic part, similar to other Tripolitanian urban communities, such as Sabratha and Oea (modern day Tripoli). It was the largest city in the Roman Empire outside of Rome. The modern AL-Khums City was established by the Ottomans as a garrison, and to serve as the main port of the Allies. In this city, only a few of the Ottoman and Roman buildings are left along the eastern part (Abu-Nasr, 1971).

Bani Walid City Location

Bani Walid City is also located within the Tripoli region and in the Misurata subregion. It is a city of one tribe (the Warfalla tribe) and strangers cannot live in, or cannot adapt to, the life of
that city. Now this tribe has become a group of sub-tribes, however, strangers still cannot live among them. All of the lands are divided amongst those sub-tribes with clearly demarcated borders, except the city centre; the city centre is referred to as Asuqe, which means ‘market area’ (Hahn and Muirragui, 1981).

Bani Walid City is situated between the rivers of two valleys, along what has been called Wadi Alblad. Due to the seasonal changes, Wadi Alblad often experiences dry spells or droughts. The dams in Wadi are rather old, and presumably were first assembled when the Romans developed the area in the third century CE as part of the creation of the frontier zone of the Roman Empire (Figure 1) (Abu-Nasr, 1971).

METHODOLOGY

The two Libyan cities utilized as case studies, AL-Khums and Bani Walid, will be used to further the analysis in order to identify the effects of these urban environments on human perception. The two methods used are Kevin Lynch’s mapping methods (Mental Maps and “PENDL elements”) and Bill Hillier’s method of “Space Syntax”. The structure of this process will span three steps: the first step is sketching mental maps. The mental maps are created from the results of interviews and asking people to sketch their mental map of their city. This step will be based on the process of creating mental maps, as detailed in Kevin Lynch’s theory in the book “The Image of the City”. Mental map sketches of both case studies are used to define the elements of the two cities and to record any existing activities and forms that could be used to make the place more legible. The mental mapping will divide the elements of the city into major and minor categories, according to significance and strength of visibility.

The second step is a syntactical analysis of the chosen cities using the Depthmap software. This step aims to understand the underlying relationship between the main open public spaces and the spatial pattern. Space syntax is derived from the hypothesis of the “Social Logic of Space” that introduces a general hypothesis positing that the manner in which an individual identifies space in the built environment affects their social behaviors.

The third step will overlap the first two analyses to understand the characteristics of the spatial formation and the built environment. By comparing the results of using Lynch’s and Hillier’s techniques, we will demonstrate the connections between the visual image and spatial structure of the city.

The goal of this analysis is to first identify the changes that have occurred in the urban spaces of these two cities; secondly, to identify the behavioral changes and the shifts in human activities that have occurred through the use of these urban spaces in accordance with the larger political, social and economic changes; and finally, to identify the relationship between human perception and the built environment. This study will identify the existence of the relationship between human perception and the built environment in these two cities and will further clarify the negative and positive impacts that the built form in these cities has on human perception.

HUMAN PERCEPTION IN TWO LIBYAN CITIES

Mental Map Method

Kevin Lynch is an important figure in the field of urban studies, exploring the relationship between the built environment and human beings particularly in his prominent work, “The Image of the City” (1960) which opened new perspectives in the field of urban studies. He
devoted himself to producing new forms of cities, both socially and spatially, against the present dynamics of urbanization. Although he believed in the potentials of the urban life, he did not enjoy the very idea of urbanization. According to Lynch (1973), the Earth is rapidly urbanizing and the skin of the Earth has been transformed. In "The Image of the City" (1960), Kevin Lynch says that individuals arrange themselves by a method for mental mapping when they are in urban situations, and he discusses how people orient themselves in these cities.

The theory behind the concept of legibility deals with the degree to which individuals who travel through the city partake in way-finding experiences, entailing a procedure of organizing urban variables in their minds. The mental picture is identified as the outcome of both immediate sensations and the memory of past experiences. To Lynch, these mental maps include five main elements: Landmarks, Edges, Nodes, Paths, and Districts. Through these five components, a generally effective distinction may be made in order to counter the fear of disorientation while conveying a sense of emotional security, and increasing the intensity of human experience in the urban environment.

Lynch says that these elements function as a framework for communication and conceptual organization, providing a clear mental map of the urban environment. This mental map is important because the city is a powerful symbol of a complex society. Lynch divides an environmental image of the city into three important components, identity, structure and meaning, which are connected through urban elements as separate entities and through the relationship of urban elements to other objects. According to Lynch, the city should give three related 'movements': mapping, learning, and forming. People should formulate a clear mental map of their urban environment, they should then learn how to navigate in this environment, and finally people must be able to act upon their environment.

It is the concept of 'legibility' that signifies the extent to which the people move through the city, engage in way-finding, or 'read' their environment. This theory is a valuable tool in understanding how people perceive and move in the urban environment, because urban space cannot be interpreted simply by its physical characteristics, nor can mobility be seen simply as free movement; it is essential to understand these concepts by structuring and identifying the environment through mental maps.

Lynch’s work served as an introduction for others to build upon; Jameson (1991) said that according to Lynch, society needs a means to cope with the complexities of their environment, and a cognitive map is an ideal method to do so. Similarly to Lynch, Lefebvre (1974) has clarified that space is not simply 'out there’ as a mathematical substance or a priori category, but is always a social construct. Waal (2009) has discussed "semantic way-finding" and the element of visibility. Lynch (1960) discusses the components of the city that appear to be obvious to all individuals; he highlights the clarity of the urban zones, investigation of and surprising experiences within new places, and individuals and our capacity for orientation and way-finding as something we learn, because he thought that disorientation is the cause of anxiety and fear.

The most well-known study employing Lynch’s methodology of mental maps, as derived from “The Image of the City", is that in which he analyzes the three American cities of Boston, New Jersey and Los Angeles. In this study Lynch employs his developed a mental map method based on the five essential elements of the urban landscape: Paths, Edges, Districts, Nodes and Landmarks. Lynch describes the degree of compliance between the sketched and the real environment by assuming that most plans look like they were drawn on an elastic table (Lynch, 1960). Figure 2 and Table 1 show the results of the analysis using
Lynch’s mental map method of Al Khums City and Bani Walid City: Figure 2 shows the image of the two cities and Table 1 shows the largest reading elements in these two cities.

### Figure 2. The image – AL-Khums & Bani Walid Cities (Source: Agael, 2017).

### Table 1. The largest readings elements in the two cities (Source: Agael, 2017).

<table>
<thead>
<tr>
<th></th>
<th>AL-Khums City</th>
<th>Bani Walid City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paths</td>
<td>coast road</td>
<td>bridge</td>
</tr>
<tr>
<td></td>
<td>113</td>
<td>10</td>
</tr>
<tr>
<td>Edges</td>
<td>sea coast</td>
<td>valley</td>
</tr>
<tr>
<td></td>
<td>92</td>
<td>153</td>
</tr>
<tr>
<td>Districts/tribes</td>
<td>haraty district</td>
<td>AL-manasla</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>45</td>
</tr>
<tr>
<td>Landmarks</td>
<td>leptis magna</td>
<td>bridge</td>
</tr>
<tr>
<td></td>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>Nodes</td>
<td>the roundabout</td>
<td>Animal market</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>9</td>
</tr>
</tbody>
</table>

### Space Syntax Analysis

Space syntax theory was first proposed by Hillier and Hanson in the book “Social Logic of Space” and is generally considered an effective and veritable theory, and methodological analytical apparatus, to examine how space impacts human development, by measuring spatial configuration (Hillier, et al., 1984). The theory of space syntax is founded on the hypothesis of the “Social Logic of Space”, which introduces a general hypothesis of how individuals identify with space in built environments, and the effects of these spaces on perception, social behavior and relationships.

Space syntax is generally considered a significant hypothesis and analytical tool in examining how space impacts human development by measuring spatial configuration (Hillier et al, 1984). In space syntax studies, the basic methodology is to partition space by scale and human visual ability. From this perspective, space is divided into extensive and small-scale spaces (Montello, 1993; Egenhofer and Mark, 1995). The expanse of these
small-scale spaces in the city is beyond the human's visual capacity and cannot be seen from a single vantage point. While small-scale space, for example a part of a room, is bigger than a human body, it may still be understood in its entirety (Jiang et al., 2000). Space syntax has also become a computer language to describe the spatial pattern of urban space. Urban space can be partitioned into two categories from the perspective of human movement: blocked space, and free space. Blocked space is comprised of spatial obstacles such as buildings, and within this space people cannot move freely. On the other hand, free space is the part of urban space where people can in fact engage in uninhibited movement. Space Syntax focuses on the links and syntaxes of space; it measures the patterns, connections and permutations of spaces that cannot be measured through simple Euclidean geometry (Hillier and Hanson, 1984). Space Syntax focuses on the topological relationships of spaces, including interconnectivity and reachability, but not the physical distances.

<table>
<thead>
<tr>
<th></th>
<th>Al Khums City</th>
<th>Bani Walid City</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connectivity</strong></td>
<td><img src="Image" alt="Image" /></td>
<td><img src="Image" alt="Image" /></td>
</tr>
<tr>
<td><strong>Local Integration</strong></td>
<td><img src="Image" alt="Image" /></td>
<td><img src="Image" alt="Image" /></td>
</tr>
<tr>
<td><strong>Global Integration</strong></td>
<td><img src="Image" alt="Image" /></td>
<td><img src="Image" alt="Image" /></td>
</tr>
</tbody>
</table>

Figure 3. Space Syntax measurements (connectivity, global integration, local integration) (Source: Agael, 2017).
A Space Syntax analysis has been undertaken as a part of the analysis of human perception in the built environments of AL-Khums and Bani Walid which is central to this research; the results will be used to help us to measure connectivity, global and local integration, choice, step depth, length of the axis, intelligibility, synergy and other measurements of parts and spaces of these cities. Moreover, it will assist us in explaining why people perceive places differently and why certain places may be meaningful and others may be easily forgotten (see Figures 3, 4 and Table 2). The aim was to characterize the syntactic configuration of AL-Khums & Bani Walid in order to analyze how each space in the spatial structure is related and connected to the others. The maps (longest and fewest axial lines) of the case studies were drawn in AutoCAD and imported as DXF files to the UCL Depthmap program. The idea of Intelligibility was firstly presented by Hillier et al. (1987). Intelligibility is evaluated as a second order measure; it is characterized as the degree of correlation between connectivity and global integration values of the axial lines in a spatial configuration investigation. Hillier

<table>
<thead>
<tr>
<th>Choice Measurement</th>
<th>Al Khums City</th>
<th>Bani Walid City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial Line Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Depth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4. Space Syntax measurements (choice, line length, max depth) (Source: Agael, 2017).
speculated that strong relationships amongst the global network arrangement guarantee that the spatial setup is reasonable and unsurprising for the person on foot or in a vehicle.

**Measurements correlations**

The idea of intelligibility was firstly presented by Hillier et al (1987). "Intelligibility" is evaluated as a second order measure. It is characterized as the level correlation between connectivity and global integration values of the axial lines in spatial configuration investigation. Synergy indicator represents the correlation factor between global integration value and local integration value, and explores whether spatial structures support or impede the flow of movement between local level and global level (inhabitants & visitors) (Hillier et al, 1987). Figure 5. shows the Intelligibility - synergy correlations of AL-Khums & Bani Walid cities.

![Intelligibility & synergy correlations](image)

**Figure 5. Intelligibility & synergy correlations (Source: Agael, 2017).**

<table>
<thead>
<tr>
<th>Cities</th>
<th>Cases</th>
<th>Axial size</th>
<th>Connectivity C</th>
<th>Local integration R3</th>
<th>Global integration Rn</th>
<th>Intelligibility Rn/C</th>
<th>Synergy Rn/R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL-Khums City</td>
<td>1</td>
<td>486</td>
<td>3.745</td>
<td>1.842</td>
<td>1.293</td>
<td>0.3286</td>
<td>0.7128</td>
</tr>
<tr>
<td>Bani Walid City</td>
<td>1</td>
<td>2907</td>
<td>2.667</td>
<td>1.303</td>
<td>0.348</td>
<td>0.0624</td>
<td>0.2247</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The property of understandability in a distorted network implies the extent to which what we can see from the spaces that make up the framework is what the different spaces are associated with – it is a reasonable manual for what we can't see, that is the mix of every space into the framework as a whole (Hillier, 1996, pp.94). The property of comprehensibility invokes parts of spatial discernment that relate to route, way discovering, movement and...
spatial reference, memory, spatial relations and spatial inductions. The majority of present studies (Chang and Penn, 1998; Conroy and Bafna, 2001; Hillier, 2002) suggest that Intelligibility is a property that relates to spatial comprehension and patterns of usage, and guarantees the predictability of a system.

Although most findings from the mental maps and the syntactic analyses only correlate weakly (see Tables 3, 4), we can find them more correlated if we neglect some of Lynch's elements that are affected by other factors more than spatial factors. Lynch has listed three criteria of legibility for cities (1991). The first one is that the inhabitants should be able to fit the urban components; the structure must be legible not only at a metropolitan scale, but also at a finer scale. The second criterion is that the image of the city must be adopted for new developments and changes in the physical structure.

<table>
<thead>
<tr>
<th>Table 3. AL-Khums (Paths-Landmarks)-(main axial lines measurements) correlations (Source: Agael, 2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration R3</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>.098</td>
</tr>
<tr>
<td>-.044</td>
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<table>
<thead>
<tr>
<th>Table 4. Bani Walid (Paths-Landmarks)-(main axial lines measurements) correlations (Source: Agael, 2017)</th>
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<tbody>
<tr>
<td>Integration R3</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>.156</td>
</tr>
<tr>
<td>336</td>
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</tbody>
</table>

Rapoport argues that the 'material and biochemical aspects' of one's environment are the two most important indicators of the quality of the built environment. Particularly, air quality and environmental pollution reflect the physical quality of the environment (Rapoport, 1997). Similarly, he has mentioned the importance of biological health in defining lively and good environments. This means that good urban places should provide physical and psychological vitality that can be illustrated as per the following: first, consider the Paths in AL-Khums City. Many streets have received high ratings from people in the integrated and connected areas.

For instance, February 17 Street, Entrance Street, Haraty Street, 20th Street, Prison Street, City Stadium Street, Ben Joha Street, and University Street are among those which have received the highest rankings and also represent the more integrated and connected areas of the city. Interestingly, the coastal road that is located in a less integrated and connected area, has received the highest overall rating from people. Also, in Bani Walid city, AL-dahra
Road, Airport Road, AL-jazerah Road, and Tarhuna Road, which are located in areas between high and medium integration and connectivity, have received high scores. Furthermore, the bridge that is located in an area with low integration and connectivity has received the highest rating from people. Figure 6 shows the Paths-main axial analysis measurements relations. Thus, physical features may be more important in defining the Paths as salient elements.

![Diagram of paths in Al Khums City and Bani Walid City]

Figure 6. Paths-main axial analysis measurements relations (Source: Agael, 2017)

For example, the sea can be seen as a strong Edge in AL-Khums City, and the valley as a strong Edge in Bani Walid City (Edge Effect). It means the most integrated roads, which have the highest potential for through movement, are often considered the most perceivable and legible ones. Having a high integration within the whole system (at a global level) makes a
road easily recognizable. Furthermore, Edges can significantly affect both cities so that people in both cities adhere to natural Edges as they become part of their lifestyle.

The sea in AL-Khums City is a source of liveliness, inspiration and love. Likewise, the valley in Bani Walid City is not only a source of livelihood, but also the only place for agriculture. Both those places have scored highly. Besides its Paths and Edges, in AL-Khums City there is what are called ‘Districts’ on or between the more integrated and connected streets that have also received a high rating from people (e.g. the AlHara, Senan District, Kol Al Arab District, Mannubeya District and the 20th street District). The Districts that have received the highest ratings are the Haraty District and the Coastal District. These two Districts are located between the moderately integrated and connected streets and the sea.

Edges also have an increased importance in this city. In Bani Walid City, the circumstance is totally different; everything in the city is related to Districts (sub-tribes) such as Landmarks, places, streets and even some Edges which are themselves defined by tribes. Tribes are social units which have their own privacy, and they are closed. They are distributed by domination and property without any spatial characteristics. Society has a significant impact on life and urban planning; it is clear that many Landmarks in the AL-Khums City have received high ratings from people in the more integrated and connected areas. For instance, the complex administration, gas station, city clinic, police station, Haraty shops, Al-Basha mosque, and many others are Landmarks that are highly recognizable.

Another finding is that ‘Leptis Magna’ and ‘The Port’, both which are located in segregated areas, have received two of the highest ratings. Effectively, these findings indicate that while the location in the spatial configuration is one of the more significant criteria for a building to become a landmark, it is not the primary one. Over time, symbolic, financial or historical factors may prove to be more significant in assessing a building’s significance as a Landmark. Nevertheless, it is completely different in Bani Walid City, where Landmarks are distributed and influenced either by Edge(s), such as the bridge, or Visual and Cognitive Landmarks. These Visual and Cognitive Landmarks, such as mosques, have symbolic and social values that are distributed by tribes.

Another interesting finding in Bani Walid City is that the each tribe forms a mental image distinct from the other tribes. Figure 7 shows the Landmarks-main axial analysis measurements relations. Nodes in AL-Khums city are also influential; the most mentioned Node is the roundabout that is located between more integrated and connected streets. A Node affected by its location on the sea coast is the AL-Khums Park. The city entrance is located at the beginning of the most integrated and connected Path, and the complex square is the place that symbolizes the revolution. This highly-integrated and connected square is referred to as the ‘Animal Market’ or ‘Vegetable Open Market’ in Bani Walid, and represents the place of the most significant economic interchange.

The AL-soque, AL-dahra and Zliten entrance roundabouts are located between the main streets. This likely indicates that not all cities are the results of mental mapping or spatial analysis, but instead depend on the quality offered by their urban environments and may consequently prevent us from analyzing the relationships between the results of these two types of analysis within these particular cities. However, we still must apply these analyzes to complement each other and address their relative degrees of success.

This case study illustrates that while one of the settlements may not appear intelligible in either the local or the global context, the other one is highly intelligible. Moreover, some of the more common features of these settlements, as identified by the mental maps, indicate conceptions of perception and configuration and how people perceive different environments.
They confirm that the structural analysis, or what is called space syntax, is highly important to achieve a clear image of the city elements, and that the mental maps are only limitedly applicable, as was affirmed by Lynch. He observed that while his method appeared to be good at accounting for the most significant elements, it is simultaneously weak in identifying the relationships between these elements.

Lynch was too concerned with individual elements and under-emphasized the relationship between distinctive structural elements that demonstrate how both sets can be defined by himself and through space syntax terminology. As a result, we observed that there must be a complementary dependency between them (Lynch, 1960). In conclusion, there is an observed dependency of the Lynchian elements upon the fundamental space syntax, and that dependency exists in reverse. Therefore, this research does not intend to fuse or overlap Lynch’s theory of neglecting the underlying structure and linking elements with Hillier’s theory of space syntax and choosing to omit the role of differentiated spatial elements, but rather it...
aims to demonstrate the interdependency of both spatial structures and distinctive visual elements.

CONCLUSION

The physical environment influences perception in significant ways. It appears that the cultural and societal needs, types of people, and their mentality in an urban environment is a critical indicator of the general quality of a city. What we have found is that there is a need, in urban design, to direct attention to both the visual and the hidden features of architecture, as well as urban design. The interesting discovery is how these buildings and places combine with other urban elements such as buildings, streets, and open spaces that should in turn be accompanied with the appearance of the buildings and places.

The design of urban interfaces and spatial relations is an important key in forming good urban environments; this is where the conditions for interaction are set. An urban environment designed to support exchange and encounters are also well suited to sustain a wide range of possible social and cultural interactions; the aim for engineers and urban architects is to develop spatial conditions which allow such interactions. In general, through our observations and notes during the research, we have found that in both cities, most people find it difficult to understand the task they are requested to undertake (draw a mental map), which we can attribute to the current events in the country.

There is a strong relationship between human perceptions and built environment; this relationship is determined by a combination of visual and structural factors and influences. For instance, space connectivity, space integration, culture, society, politics, history, natural Edges, lifestyles, types of activities and city form and structure together influence human perception of their built environment. All of these factors have an impact on how places are perceived and the degree to which they are perceived positively or negatively.

AL-Khums City is more visually and structurally legible than Bani Walid City; one can quickly and easily understand its details and features. Bani Walid City is less visually and structurally legible; it is difficult to identify the land details and features. The natural Edges have a significant effect on human perception in the two cities and consequently, mental map sketches in AL-Khums City were more detailed, whereas the mental map sketches in Bani Walid are less detailed.

In AL-Khums City, the most frequently mentioned elements in mental maps were Landmarks, comprising 60% of all mentioned elements, while the least mentioned elements were the Edges, which were only mentioned in 2% of the cases. The most noted factors in mental maps were the historic effect and the Natural Edge Effect as straight, long, and connected axes. The large size of the blocks’ open gradient spaces and the few directional changes results in fewer axial lines necessary to represent the axial space in the city.

It is straightforward to understand why this occurs. It is easy to move from one part of the city to another. There is a strong link to the sea; in addition to being a source of food and a place of work (both currently and in the past), there is a strong affinity with the sea. It presents a very strong Edge, and the sea effect (Edge effect) makes the sea road (the most perceived Path) an element regularly included in mental map sketches, even though it does not signify high values of connectivity or integration.

The second most perceived Path is the 17 February Street; it has the largest value of Connectivity in the city. The third most highly-perceived Path is Tripoli Street.
has a high value of integration and it also has the highest value of choice. The fourth and fifth perceived Paths are most Connectivity values respectively. The Districts share similar properties with almost no differences between them and there is not a clear separation between them. The main roundabout is both the most perceived Node and connected between the two most connected and integrated streets. Its spatial structure encourages a good relationship between inhabitants and visitors. The significance of Leptis Magna has only increased over the course of its history. This city, ruled by the empire of Rome, has deep historical roots (History effects make it a strong Landmark). The main roundabout is the second most mentioned landmark after the sea, as it is connected between the two Streets with the highest connectivity values in the city.

For Bani Walid City, the most mentioned elements in mental maps were Tribes, constituting 39% of all mentioned elements. The least mentioned elements were Nodes, with 6%. The most affected factors in mental maps were Natural Edges and lifestyle affect. The short, curved axes, the small sizes of the blocks, the compact spaces and the high numbers of changes in directions results in a higher number of axial lines representing the spaces in the city.

This result may be more difficult to understand; there is a strong linkage with the valley that serves as a source of food and has a very strong Edge. The valley effect (Edge effect) makes the bridge (the most perceived Path) appears in many mental map sketches, although it does not have high value of connectivity and Integration. Its spatial structure impedes a good relationship between inhabitants and visitors because there is a high level of privacy between tribes.

The second most perceived Path is Al-Dahra road. It has the highest value of Connectivity in the city. The third, fourth and fifth most perceived Paths have the correspondingly highest values of connectivity. The Bridge gains its importance from the valley as the Edge impact makes it a strong landmark. The AL-Manasla mosque is the second most mentioned Landmark after the bridge, primarily due to its location at the entrance to Tarhuna-Tripoli road (Node effect), which has the highest connectivity values in the city.

People know and define all Landmarks, buildings, Edges, and places in terms of their tribes, as opposed to the names of the Districts, except in the central market (Al-Soque) area or in the industrial area. The most important Nodes are associated with the most historic activity in the city, occurring at the Animal Market, which has a strong link with the valley. The valley is the life and it forms a very strong Edge. It is used for agriculture, as a source of food, and it is the source of livelihood for farmers. There are no Districts in the minds of the people in Bani Walid, only tribes and their associated influences. Some Districts are divided into many tribes, while other tribes may be present in more than one District. When asking interviewees about a place or a building, we always receive the same answer; the place or building is described in terms of the tribe, which controls it.

Finally, it is clear that the mental mappings created by the people of AL-Khums and Bani Walid are not exhaustive in the quest to identify their emotional and mental states, however are important when trying to assess the perception of the environment and the extent to which this environment affects the perception of the people. The city should become more diverse, lively, and creative to bring an easy perception. The important aspects omitted from this work are the historical roots of AL-Khums City and how people love the sea, as well as the close link with natural elements in Bani Walid city. It is important to stress that this paper only provides a glimpse into how the method of combining mental maps with axial analysis can help explore the human perception in both physical and social environments.
REFERENCES