Chapter One - Introduction

1.1 General Introduction:

One of the main challenges that architects face during the design process is to assess how well a proposed design will meet the needs of its intended users. Due to their size, cost, and complexity of construction, the systematic evaluation of buildings as far as human behavior is concerned, currently only possible after they are built and used.

Human behavior, experiences and social interactions in public spaces are believed to be the result of the processes of the mind that are influenced by the different features of these spaces. These features may be physical, social, cultural or sensory but what they share in common is the power to affect people's behavior in, and experience of the public realm.

At the same time, the users of these spaces are also capable of influencing their form and feel, by introducing social characteristics and elements such as culture, gender, sexuality, ethnicity and age. These elements, together with the physical and ambient (or non-physical) features of the public space, are capable of having a profound effect on the way that people behave, experience and interact in public spaces depicted in figure (1-1) bellow.
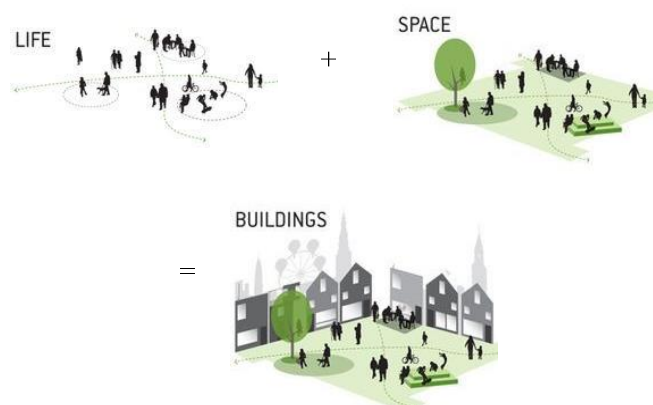

Figure 1-1 life, space , buildings (Source: Pinterest)

This interest in the complex relationship between human beings and their surrounding environment is not new and is referred to as environmental

psychology. It is a field of interest that is not only shared by psychologists, sociologists, geographers and anthropologists, but also by planners, designers and public authorities. Environmental psychology studies how people relate to the built environment, by examining how their mental processes and behavior affects, or is affected, by their surroundings.

The fundamental concern of environmental psychology is that of the quality of life and the quality of the built environment. The role of the planner, designer and public authority in all of this is ultimately to improve human environments, by devising practical methods, policies and planning, design and educational techniques (Zube & Moore 1987) that are receptive to the findings of environmental psychology, figure (1-2) below shows the difference between users experience and design.

Figure 1-2 user experience and design difference (Source: Google pictures)

1.2 The Problem of the thesis:

Despite the fact that people are essentially the most important and only clients of the built environment, the figures who are responsible for designing, producing, and making decisions about the built environment, do so without critical consideration of how developments will affect the experiences of their most important clients – the users of public spaces.

The problem of the thesis is understanding how people respond to their surrounding environment, architects would be better able to think critically and

simultaneously, rather than detachedly, about the impacts of their designs on the behavior and experience of people.

1.3 Research Question:

The curiosity about the interplay of these elements has led to the research question that is central to this study:

What are the physical and ambient features of the built environment that shape public spaces, and how do they affect the behavior and experience of people in public spaces

In order to answer this question, the thesis also explores the following questions:

How do people respond to the physical and ambient elements of public spaces.

How can the design of public spaces effectively take into account the natural human responses to the physical and ambient settings of public spaces, at both the early design stages and the final development proposal stages.

1.4 Objectives of the Study:

The purpose of this study is to explore how public spaces influence human behavior in order to gain an appreciation of the significant role that public spaces play in the daily lives of people. This will enable built environment professionals and public authorities to comprehend the effects that planning, design and development decisions are capable of having on the social, psychological and emotional wellbeing of people.

Also to achieve a meaningful and practical understanding of how spaces can be shaped by the designers in order to be more successful, and provide the psychological needs of people and do not conflict with people's natural responses.

It can be summarized into points:

- To explore the features of public spaces that are significant, incidental or destructive within a social, environmental and physical context.

- To identify and analyze the human responses to the physical and social setting of public spaces in Khartoum city.
- To recommend alternative ways in planning for, shaping and designing public spaces by taking into consideration the behavioral sciences and the human responses to the physical and ambient environment.

1.5 Significance of this Topic:

Considering that people are the most important element of any environment, it is crucial that professionals of the built environment are aware of how people respond to the environment. This study is significant in that it provides professionals with a practical guide that can be utilized to assist in the design of places that are sensitive to the natural responses of people.

Development planners, strategic planners, architects, designers, local governments, councilors, the police, social workers and even psychologists will find this study informative and useful. Individuals who are curious about the processes of their own minds and biological responses will also find this study insightful.

1.6 Research Methodology:

Descriptive analytical method:

This is a descriptive analytical method to gather observations and list the exact description of the human behavior at alqasr & aaltabya intersection, to revile recommendations for the design. The goal is to see what impact the physical environment has on the way people use space

The observation will be conducted in two phases:

Data collection: aims to document the physical environment (components), the users and their activities in different times in the day.

Data analysis: a subjective reading of how people use the space and the impact of the physical environment on the way that users use their space. The observation aims to predict what makes the place utilized.

Analyze the effect of each component will be represented in a subjective scale (range from strong positive effect to strong negative effect).

Many of the underlying ideas that form the basis of this thesis have been drawn from the current literature in the fields of behavioral sciences and built environment.

1.7   Scope and Limitations of the Study:

Due to the given constrains of time and wording there has been effort to narrow its scope.

Research areas such as personal space or the effects of crowding make important contributions to the behavior of people in public spaces, however each are capable of forming a separate research project. Although this might be viewed as a limitation of the present study, at the same time it provides an advantage in that it can lead to future in-depth research on this topic.

This study focuses on the effect of public spaces design on human behavior. By selecting a node in Khartoum City. Visited the site at different times of the day or week to account for variations in users and activities. The temporal boundary is limited to the year on 2018 which is the period that data was collected, the data were collected over 8 months.

1.8   Structure of the thesis:

The structure of the remainder of this thesis will be as follows: Chapter 2 provides a critical review of the literature on urban design and public spaces with particular emphasis given to the concept and significance of public spaces, how public spaces are made, and the design ideologies that have influenced their shape.

The literature on environmental psychology and behavioral sciences is also examined in Chapter 2. The chapter concentrates on the theories of human behavior as well as the ambient and physical features of the built environment.

Chapter 3 provides the study of (alqsr & altabya intersection) using a video simulation for the area.

The methodology, data collection and data analysis also conducted in chapter 3.

Results and Discussion - the impact of the physical components on the user's activities will be discussed in chapter 4

Chapter 5 offers ideas for alternative ways in planning for, shaping and designing public spaces by taking into account the concepts drawn from the literature and the findings from the cases. also concludes the thesis by summarizing the key arguments and findings of the study and recommendations for public spaces design to improve the quality of the built environment.

Chapter two – literature Review:

2.1 The public realm - Introduction:

This chapter begins by exploring concepts of public space, their significance, the urban design ideologies that have affected their evolution and their relationship with the study of human behavior

Now a day's more attention is given on to the human dimension in the city planning and the need for quality in public spaces. Importance of public spaces is universally accepted by one and all. The question is what makes public space more successful. The designer is trying to give best model of good public spaces. However, we find that many times well designed public space also doesn't generate good public response. In this thesis an attempt is made to study a place evolved organic growth through accumulation and flourishes of public at large design public space to know which place is more successful.

2.1.1 Concept of public spaces:

A public space is a social space that is generally open and accessible to people. Roads (including the pavement), public squares, parks and beaches are typically considered public space. To a limited extent, government buildings which are open to the public, such as public libraries are public spaces, although they tend to have restricted areas and greater limits upon use. Although not considered public space, privately owned buildings or property visible from sidewalks and public thoroughfares may affect the public visual landscape, for example, by outdoor advertising. Recently, the concept of Shared space has been advanced to enhance the experience of pedestrians in public space jointly used by automobiles and other vehicles.

This thesis focuses not only on public spaces that are consistent with the definition of 'public', but also examines the external features of private spaces and private buildings where they happen to adjoin, overlook, or have visibility from a public space. This is because public spaces do not exist as separate entities and need to be considered in the context of their adjoining and

surrounding spaces. It should also be clarified that this thesis focuses on outdoor public spaces and not on institutions such as libraries or hospitals that may also be defined as 'public spaces'.

2.1.2   The significance of public spaces:

The significance of public spaces has been widely recognized, mainly from the perspective of improving quality of life through comfortable environment and abundant public life; enhancing urban image through urban vitality; and impelling economic development through investment which is attracted by good image (Aghostin-Sangar 2007).

Most people have a need and desire to maintain links with the rest of the world (Carr et al. 1992). Public spaces are significant because they are able to bridge that link. Carr et al. suggest that aside from bridging this link, public spaces are important because they provide avenues for movement, a means of communication, and a common ground for enjoyment and relaxation. The ability of public spaces to educate and offer knowledge is also a significant aspect, particularly when those spaces play an important role in the history of the city and the social life of its citizens (Madanipour 2003).

2.1.3   How public spaces are made:

The creation of public spaces can be driven either directly as a result of a government decision, or indirectly, as a result of private developments; the need to provide better services; or by urban redevelopment. Direct decisions to create new public spaces occur infrequently (Mossop and Walton 2001; Winikoff 2000). Regardless of what drives the decision to improve an existing public space or create a new one, the figures involved in the complex process will generally be the same.

The process will need to involve communication between planners, designers, builders, place managers, policy makers, and the public users.

The initial stages of the process will include the gathering of information, evaluation and consideration of alternative options. This is then followed by transferring the information into a concept design plan which is

followed by the decision-making (Carr et al. 1992). Accordingly, the early stage of the process is the most critical time for considering and understanding the potential impacts of the designs on the experience of users of public spaces.
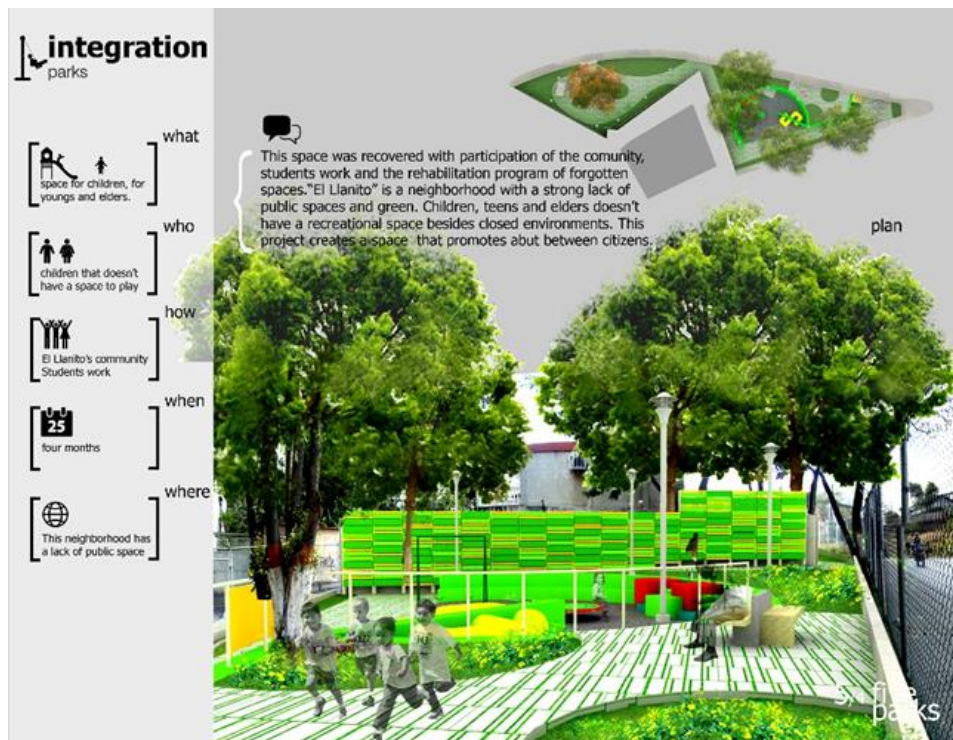

Figure 2-1 how public spaces are made (Source: Google images)

2.1.4 Conception and Significance of "Quality Cities"

The lack of understanding of what people need for space can be an obstacle for designers to create a better urban place, thus, quality cities are places where social life can be stimulated. The aim of this research is to achieve a meaningful and practical understanding of how spaces can be shaped by the professionals in order to be more successful, provide quality for the psychological needs of people and do not conflict with people's natural responses.

"We need to improve the design of public spaces and, as a consequence, the quality of our lives in cities." (Rogers 2010, vi)

Our urban design solutions of Public Urban spaces should prioritize life quality, health, safety and an inclusive environment for all. We regard the

public realm as a place for all people, regardless of ethnic background, age, socio-economic class, disability, religion, or the like. Residents, visitors, students, workers, children, and the elderly are all invited to meet in the public realm.
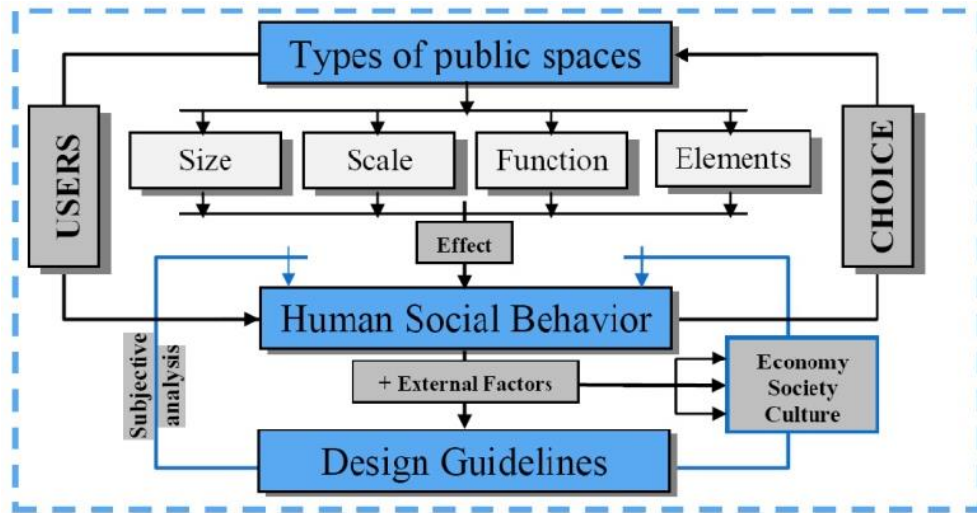

Figure 2-2 Research Detailed Scope (Source: The researcher, 2018)

2.1.5 Evaluation of public spaces:

Despite the fact that public spaces are important for good urban living, question still remains, which places are good or bad. Evolution of public space is a subjective issue and decisions may vary from person to person. Here we are not concerned with the decision form the designer's point of view, but only from the point of view of an individual's on the street. Experts in the subjects have given different parameters for evaluating the success of a public space. However, 'project for public space' after many case studies and surveys propounded four important parameters and they are 'access and linkages, comfort and image, user and activities, sociability'. All other parameters given by others are more or less covered within the sweep of the aforesaid four issues. Therefore, in this thesis, success of public spaces where examined by applying these four parameters only. Accessibility is most important factor which affects the willingness of the users. People are ready and willing if the space is nearby, in the neighborhood or approachable easily. Comfort and images decides the attraction of people.

According to book 'Image of the City' (Lynch, p.9), 'the quality in a physical object which gives it a high probability to evoking a strong image in any given observer'.

Good comfort of space also creates good image on the mind. Comfort is the abstract perception in the minds of the user and good seating, lighting, mobility, traffic free environment are the physical criteria. People coming to certain public space have different reasons to come and therefore multiple activity options on the space make it more convivial. Mixed used activities generate maximum public response. If space is used by only one type of users, other users may not find place interesting. Space must provide welcoming environment to all the residents at all the time. Activities in short are the reasons to visit the place, they will interact and communicate with each other. They will love the company and will have sympathy for others. Tolerance, compassion and love are the natural fallout of a good public space.

Public open space construction has become an indispensable part of many of the successful urban regeneration policies of many cities, yet there has been little research that has focused upon it. It should be noted that, changes within major **"city functions"** and illustrated *"activities"* are related to a society shift towards leisure and consumer oriented life styles. In many regions in the world; life in public spaces has not changed materially.

Seen in a long-term historical perspective, there has been a remarkable evolution in the city spaces functions. The main three **"vital"** functions of a city space are: **meeting, market place** and **connection space** (Gehl and Gemzøe, New City Spaces. 2001).

As **meeting** place, the city was the scene of social information exchange.

As **market** place, the city served as venues of goods and services exchange.

As **connection** space, the city provided access to city functions

Within this shift of the city functions, the patterns of user's activities shifted too. According to Gehl and Gemzøe (1996, 2001), the activities within the main city spaces were specifically divided into three main categories of outdoor activities in the public spaces in a city, each of which places very

different demands on the physical environment. Table indicates the comparison between types of necessary activities, optional activities, and social activities.

Necessary activities	Optional activities	Social activities
Include those that are more or less compulsory, such as going to work, shopping, waiting for a bus or a person, running errands. Among other activities, this group includes the great majority of those related to walking. Because the activities in this group are necessary, their incidence is influenced only slightly by the physical framework. These activities will take place throughout the year, under nearly all conditions, and are more or less independent of the exterior environment. The participants have no choice	That is, those pursuits that are participated in if there is a wish to do so and if time and place make it possible—are quite another matter. This category includes such activities as taking a walk to get a breath of fresh air, standing around enjoying life, or sitting and sunbathing. These activities take place only when exterior conditions are optimal—when weather and place invite them. This relationship is particularly important in connection with physical planning. In other words, these activities are especially dependent on exterior physical conditions.	Are all activities that depend on presence of others in public spaces. Social activities include children at play, greetings and conversations, communal activities of various kinds, and finally—as the most widespread social activity— passive contacts, that is, simply seeing and hearing other people. These activities could also be termed as "resultant" activities because social activities occur spontaneously, as a direct consequence of people moving about and being in the same spaces. This implies that social activities are indirectly supported whenever necessary and optional activities are given better con

Table 2-1 Activities Types Comparison according to Necessity Occurring (Source: the researcher 2018, after Gehl, Gemzøe, and Kirknæs et al. 2006).

A social activity takes place every time two people are together in the same space. To see and hear one other, to meet, is in itself a form of contact, a social interaction. The actual meeting, merely being present, is furthermore the seed for more comprehensive forms of social activity. This connection is important in relation to physical planning. Although the physical framework does not have a direct influence on the quality, content, and intensity of social contacts, architects and planners can affect the possibilities for meeting, seeing, and hearing people.

In General, within span of few decades, a work-oriented cityscape has become a city of leisure and enjoyment; mainly because of dramatic changes in living standards, working life and economy have also contributed in redefining new functions of city. However, in previous decades, quality of spaces did not play a thoughtful role, transitioning to a situation in which quality is a meaningful parameter. Previously, people didn't regard using the space however it was its conditions, currently; the space "quality" is an option for some people. (See Figure 2-3) Usually, this "quality" option is for privileged societies. The economic level defines the costumers taste and needs. In raising countries, there is a shift towards leisure. In developed countries, the Public spaces are still dominated by activities necessity.

Type of Activity	Quality of physical Environment	
	POOR	GOOD
Necessary Activities	●	●
Optional Activities	·	●
Social Activities resultant	●	●

Figure 2-3 *Schematic Diagram for Quality of Physical Environment in Relation to Activities Types (Source: the author,* after (Therakomen 2002), based on (Gehl and Gemzøe, Public Spaces, Public Life. 1996).

When the quality of outdoor environment is good, optional activities occur with increasing frequency. Furthermore, as level of optional activity rise, the number of social activities usually increases substantially.

2.1.6 Users and the Urban Image of Public Spaces

The urban image is the way that a city is perceived, both by the citizens and by those outside. Not only is this image a mental picture held in common by a large number of persons, but it also is used as a way of communicating

about the city. Since urban images are based on human perception, they are greatly influenced by sensory elements of the urban form, especially the visual elements (Wagner 1981). People's perception of their environment influences their social interaction within that environment. Users themselves are the intrinsic links to the space they will be living in. In other words, if they cannot have this link, they will simply either move on or destroy the place until it reflects if not their comfort at least their discomfort – and in both cases their state of being. People inherently discern their relationship with others in terms of distances, or spaces, between them. Hall (1966) defines four distinct distances at which interpersonal transactions normally take place. These are categorized as intimate, personal, social, and public. (See Figure *2-4)*
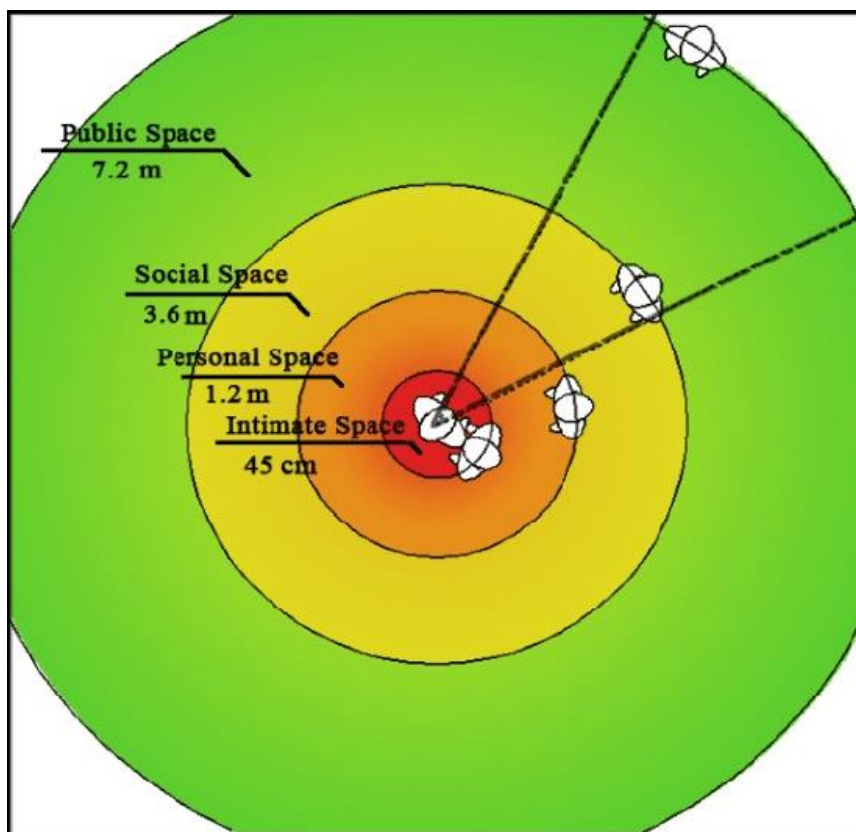

Figure 2-4 User's Levels of Space: Intimate, Personal, Social, and Public (Source: the researcher based on (Hall 1966))

- **Intimate space** is the private area immediately surrounding the individual's body. It involves both physical and emotional interactions. **(45 cm)**

• **Personal space** is that area within which a person allows only select friends, or people with whom personal conversation is mandatory. (**1.2 m**)

• **Social space** is that area within which a person expects to make social contacts on temporary basis. (**3.6 m**)

• **Public space** is that area within which a person does not expect to have direct contact with others. (**7.2 m**)

2.1.7 Users in Search for Quality Urban Spaces

Urban design qualities are different from qualities such as sense of comfort, sense of safety and level of interest that reflect how an individual reacts to a place—how they assess the conditions there, given their own attitudes and preferences. Perceptions are just that, may produce different reactions in different people. They can be assessed with a degree of objectivity by outside observers; individual reactions cannot. All of these factors—physical features, urban design qualities and individual reactions- (See Figure 2-5) bellow may influence the way an individual feels about the environment as a place to walk, stay, enjoy, live and sit (Ewing and Handy 2009).
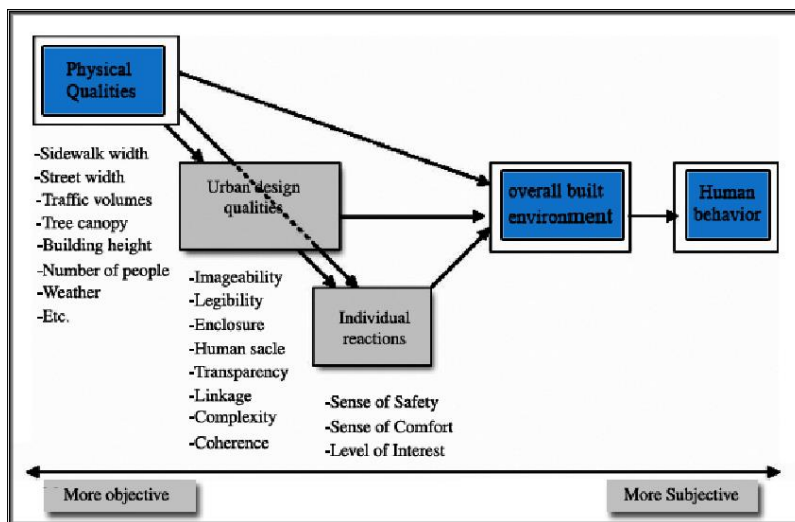

Figure 2-5 Schematic Diagram of Urban Design Qualities (Source: the researcher after (Ewing and Handy 2009)

2.1.8 The Relationship between Public Spaces and Behavior:

People have a significant relationship with public spaces because they use and experience them on a daily basis. The urban ideologies suggest that

the attention given to the form of public spaces has ultimately been driven by the desire to improve the quality of life. As the modernist and post-modernist influence of architecture has shown, this desire has not necessarily always been achieved.

Built environment professionals and public authorities, particularly local councils, recognize that public spaces are significant. They understand that creating attractive, well-designed and maintained spaces that provide a variety of opportunities for users can promote a sense of community as well as generate economic benefits. When these figures refer to the built environment in terms of being 'humanistic' or at a 17 'human scale', it shows that they understand that the environment can have a fundamental impact on how people feel in, and experience the environment.

Terms such as 'feel' and 'experience' convey the complexities of the human mind and emotions. In order to appreciate how the environment impacts how people 'feel' and how people 'experience' the environment, it is necessary to understand people's physiological and psychological processes. Perhaps when built environment professionals and public authorities appreciate how the environment affects people's behavior, only then can a truly 'humanistic' environment be seen.

2.1.9   Invisible Elements of Spatial Ambience Design Cultural Studies:

The visible and the invisible, the physical and the mental, these are the two main groups of elements which affect our perceptions toward a certain designated space ambience. The designers play a major part in it, and these days, it seems that some designers focus more on the aesthetic side of the creations, which fulfills the visible and physical parts for human's pleasures and desires, so what about the invisible and the mental parts? Aren't they as important as the visible and physical parts for the design innovations? "Design thinking", it is a design methodology by Tim Brown, who takes a human-centered approach, along with business and technology considerations of human behavior, needs and preferences, which demonstrates the practice of the important values bring out by the invisible and mental design innovation

throughout the whole process of creating a new design with three main stages, inspiration, ideation and implementation.

So what does it take to influence people's perceptions, behaviors & emotions, we see the things themselves; the world is what we see" (Ponty, 1969). If we ask ourselves what is this WE, what SEEING is, and what the THING or WORLD is, we enter into a series of difficulties and contradictions. It is natural for human beings to be attuned to their surroundings. A physical environment affects various aspects of an individual: physically, emotionally, psychologically and socially. It defines individuality, coming to terms to the human side of our preferences and the choices we make.

In design the designer's choices, preferences and ideas are as important as the client's choices, preferences and ideas. In most cases if not all, the designer needs to come to the terms of the client's needs and wants. The distinction between the terms, needs and wants, is a way of describing the difference between what is that truly necessary for a person's activities against what a person asks for. When this happens the designer is actually creating that solution which answers the various requirements of a human-centered design.

A term commonly used to describe human-centered design is called ambiance. What is ambiance? The general definition of ambiance is, a feeling, tone, character and atmosphere of the environment or surrounding influence; or the mood associated with a particular place, person, or thing. The look and feel of a space is highly relevant to the choices an individual makes in spatial design. This is where the visible and invisible concept in design comes in. Visible is what can be seen and noticed, invisible is what can be felt. These are two basic factors present in human-centered design.

The drastic change of weather and environment as well as global warming has direct impact on human lives so when architecture caused the deterioration of environment, it means it also deteriorate human lives because we cannot be tear apart from our living environment. These are the problems partly contributed by the architects, so it is time for the architect to ponder and produce design that is healthy to both the environment and the people.

The process of spatial information visualization is shaped by various factors including interactive, perceptual, navigational as well as organizational and metaphorical aspects and as such requires an interdisciplinary approach (Buagajska, 2003).

2.1.10 Findings:

- People make places. Unless the space stimulates the overwhelmed response from one and all, the public space meat for them cannot become successful.
- Public spaces evolved by accumulation of adaptations and additions by users themselves are more convivial and people regularly use such places though they are not encouraging from the designer's point of view.
- The success of particular public spaces is not in the hands of the designer. His best design model can fail if people do not respond favorably.
- Design exercise fails if it does not uphold the sentiments of the people using them.
- Evolved public space can be easily made more comfortable and lively by the efforts of the designer who keeps in mind the sentiments of the users.
- The need to rethink and adapt urban design practices to an increasing changing public life is probably the most important. That is to say, urban design needs to be much more sensitive to all locations and the favorable spatial, experiential and social conditions people make use of and which can provoke positive interactions. It is in those locations and with those elements that public life is being made, negotiated and contested.
- To summarize, increased concern for the "human behavioral dimension" of city planning reflects a distinct and strong demand for better "urban quality". There are direct connections between improvements for people in the city space and visions for achieving lively, safe, sustainable and healthy cities.

2.2 Intersection Design

2.2.1 Introduction:

An intersection is the area where two or more streets join or cross at-grade. The intersection includes the areas needed for all modes of travel: pedestrian, bicycle, motor vehicle, and transit. Thus, the intersection includes not only the pavement area, but typically the adjacent sidewalks and pedestrian curb cut ramps. The intersection is defined as encompassing all alterations (for example, turning lanes) to the otherwise typical cross-sections of the intersecting streets. Intersections are a key feature of street design in four respects:

- Focus of activity - the land near intersections often contains a concentration of travel destinations.
- Conflicting movements - Pedestrian crossings and motor vehicle and bicycle turning and crossing movements are typically concentrated at intersections.
- Traffic control - at intersections, movement of users is assigned by traffic control devices such as yield signs, stop signs, and traffic signals. Traffic control often results in delay to users traveling along the intersecting roadways, but helps to organize traffic and decrease the potential for conflict.
- Capacity - in many cases, traffic control at intersections limits the capacity of the intersecting roadways, defined as the number of users that can be accommodated within a given time period.

2.2.2 Intersection Users:

All roadway users are affected by intersection design as described below:

- Pedestrians. Key elements affecting intersection performance for pedestrians are: (1) amount of right-of-way provided for the pedestrian including both sidewalk and crosswalk width, accuracy of slopes and cross slopes on curb cut ramps and walkways, audible and/or tactile cues for people with limited sight, and absence of obstacles in

accessible path; (2) crossing distance and resulting duration of exposure to conflicts with motor vehicle and bicycle traffic; (3) volume of conflicting traffic; and (4) speed and visibility of approaching traffic.

- Bicyclists .Key elements affecting intersection performance for bicycles are: (1) degree to which pavement is shared or used exclusively by bicycles; (2) relationship between turning and through movements for motor vehicles and bicycles; (3) traffic control for bicycles; (4) differential in speed between motor vehicle and bicycle traffic; and (5) visibility of the bicyclist.

- Motor vehicles .Key elements affecting intersection performance for motor vehicles are: (1) type of traffic control; (2) vehicular capacity of the intersection, determined primarily from the number of lanes and traffic control (although there are other factors); (3) ability to make turning movements; (4) visibility of approaching and crossing pedestrians and bicycles; and (5) speed and visibility of approaching and crossing motor vehicles.

- Transit. When transit operations involve buses, they share the same key characteristics as vehicles. In addition, transit operations may involve a transit stop at an intersection area, and influence pedestrian, bicycle, and motor vehicle flow and safety.

Owners and users of adjacent land often have a direct interest in intersection design, particularly where the intersection is surrounded by retail, commercial, historic or institutional land uses. Primary concerns include maintenance of vehicular access to private property, turn restrictions, consumption of private property for right-of-way, and provision of safe, convenient pedestrian access.

2.2.3   Definitions and Key Elements:

The major street is typically the intersecting street with greater traffic volume, larger cross-section, and higher functional class. The minor street is the intersecting street likely to have less traffic volume, smaller cross-section and lower functional classification than the major street.

The term intersection encompasses not only the area of pavement jointly used by the intersecting streets, but also those segments of the

intersecting streets affected by the design. Thus, those segments of streets adjacent to the intersection for which the cross-section or grade has been modified from its typical design are considered part of the intersection. Exhibit (2-6) summarizes the extent and terminology used to define an intersection.
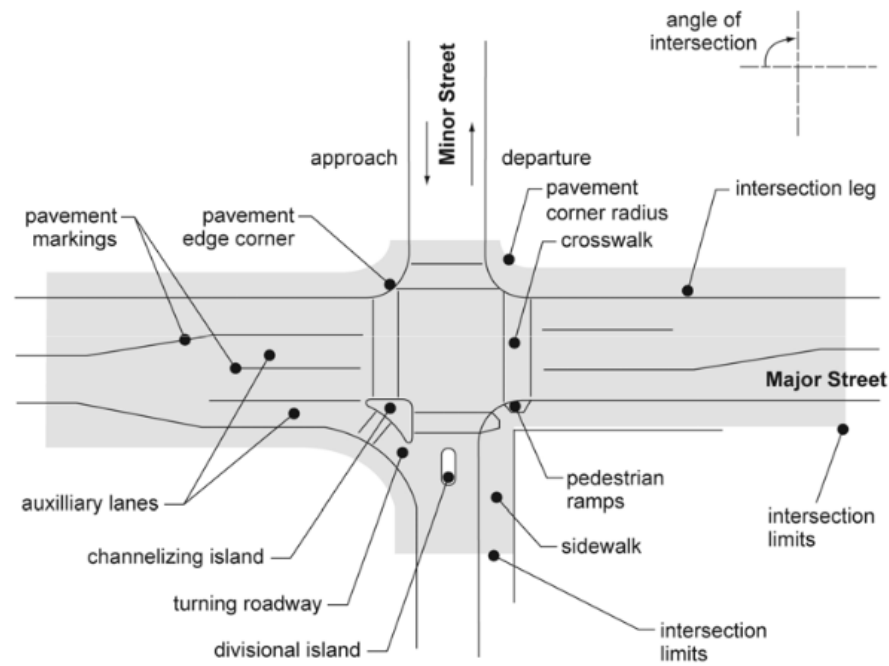

Figure 2-6 intersection terminology (Source: Adapted from A Policy on the Geometric Design of Streets and Highways, AASHTO, 2004).

Two geometric features are common to all intersections. The angle of intersection is formed by the intersecting streets' centerlines. Where the angle of intersection departs significantly (more than approximately 20 degrees) from right angles, the intersection is referred to as a skewed intersection.

Intersection legs are those segments of roadway connecting to the intersection. The leg used by traffic approaching the intersection is the approach leg, and that used by traffic leaving is the departure leg.

Sidewalks, crosswalks and pedestrian curb cut ramps are considered to be within the intersection. The pavement edge corner is the curve connecting the edges of pavement of the intersecting streets. In addition to the basic geometric design features, options may be added to improve service for various users. Auxiliary lanes are lanes added at the intersection, usually to accommodate

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turning motor vehicles. They may also be used to add through lanes through an intersection.

Channelizing and divisional islands may be added to an intersection to help delineate the area in which vehicles can operate, and to separate conflicting movements. Islands can also provide for pedestrian refuge. A turning roadway is a short segment of roadway for a right turn, delineated by channelizing islands.

Turning roadways are used where right-turn volumes are very high, or where skewed intersections would otherwise create a very large pavement area.

Traffic control devices assign right of way, to both motorized and non-motorized traffic and include traffic signals, pavement markings, STOP signs, YIELD signs, pedestrian signal heads and other devices (such as raised pavement markings, flashing beacons, and electronic blank-out signs).

2.3 The Nature of Human Behavior:

2.3.1 An Examination of the Behavioral Sciences:

This chapter examines the literature on environmental psychology and theories of human behavior. It also explores the ambient and physical features of the built environment. In doing this, the chapter addresses the central research question: what are the physical and ambient features that shape public spaces, and how do they affect the behavior and experience of people? Rather than discussing behavior in relation to public spaces, the chapter refers to behavior in terms of the 'environment'. This mirrors the way in which it is discussed in the literature. The final parts of this chapter draw together the behavioral theories and discuss how they can be affected by the features of the environment.

2.3.2 Environmental Psychology:

The relationship between the environment and human behavior has been recognized for a long time. In order to explain its significance, psychologist Kurt Lewin (1951) argued that behaviors (B) are not only a function (f) of personal factors (P), but also of the environment (E) in which they take place. Lewin expressed this relationship in the formula $B = f(P, E)$. At its core, the study of environmental psychology is concerned with understanding the dynamic relationship between human and environmental factors (McAndrew 1993). The study of environmental psychology does this by drawing from the research Findings of behavioral scientists, psychologists, sociologists and ecologists who have been able to demonstrate that the built and natural environment can facilitate, Modify or hinder certain human behaviors (Speller 2006; Canter 1977). The Relationship between people and the environment is examined by focusing on how the physical and ambient stimuli (or features) of an environment affect behavior and emotions (Mehrabian and Russel 1974).
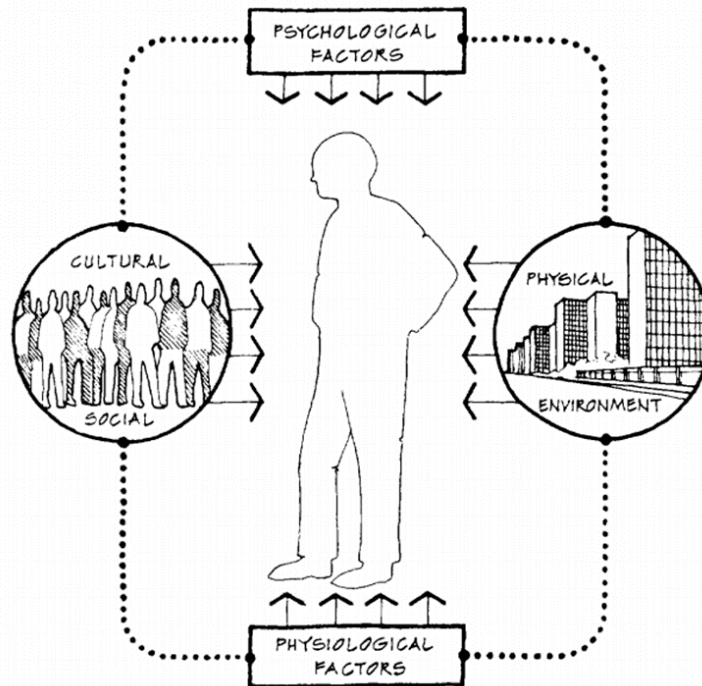
Figure 2-7 psychological factors

2.3.3 Theories of Human Behavior

In contrast to most other scientific fields that are based on theories and scientific Models, the study of environmental psychology lacks a unifying theory that can be applied to all types of environments consistently (Gifford 2002; McAndrew 1993; Bellet al. 1996; Pomeranz 1980). The term 'environment' alone is so vast, and the techniques that are used to study it so varied, that it is considered to be resistant to any theoretical unification (McAndrew 1993). In spite of this, behavioral theorists and psychologists have speculated on various Environment-behavior models. A review of the literature suggests that these can be summarized as five main theoretical perspectives. These are as follows:

a. Arousal theory,
b. Stimulus load theory,
c. Behavior constraint theory,
d. Adaptation level theory,
e. Environment stress theory, and
f. Perception or cognition theory

These theories are relevant to the query of this thesis and will be briefly examined in the following section.

2.3.4   The Arousal Theory:

Arousal theories relate to how psychologically aroused people are as a result of Environmental stimulation. Bell et al. (1996) explain that "arousal is a heightening of brain activity by the arousal center of the brain, known as the reticular formation" (Bell et al. 1996:116). It is characterized on a scale which features sleep at one end, and excitement at the other end (McAndrew 1993; Mehrabian and Russel 1974). Theories of arousal have generally been concerned with the relationship between a person's state of arousal and their behavior or performance. This relationship is referred to as the Yerkes-Dodson Law and is usually depicted as a curvilinear relationship as in Figure 2-2 below (McAndrew 1993). According to this Law performance is at its best when arousal levels are at a moderate level. Performance progressively worsens as the arousal levels either fall below, or rise above the optimum level.
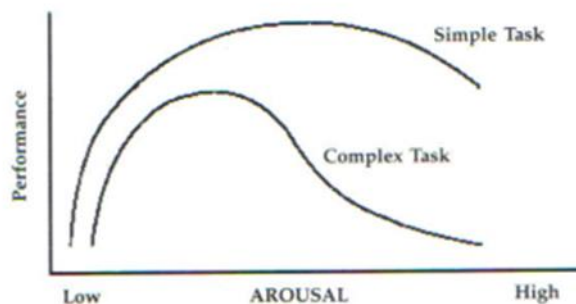

Figure 2-8 Yerkes Dodson Law – arousal above the optimal leads to

The relationship between arousal levels and behavior and performance has been shown in various studies (Bell et al. 1996). In a study of personal space (the comfortable distance between people) in the men's lavatory, it was found that where personal space invasions occurred, close interpersonal distances caused delays in urinating (Middlemist et al. 1976). This study suggested that arousal associated with personal space invasions produced physiological changes in heart rate, respiration rate, blood pressure and adrenaline secretion (Middlemist et al. 1976; Mehrabian and Russel 1974).
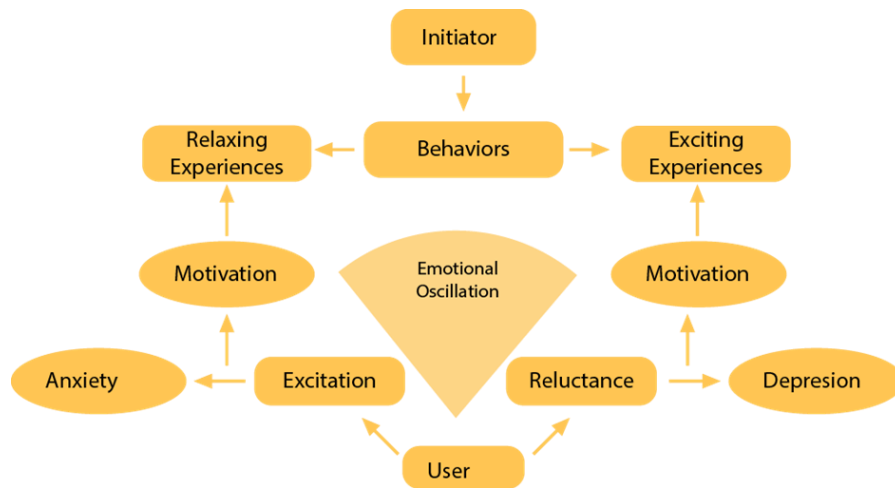
Figure 2-9 The Arousal Theory

2.3.5 The Stimulus Load Theory:

The Stimulus Load Theory conceptualises the environment as a source of sensory information (referred to as stimulus or stimuli), that provides people with psychological stimulation (Gifford 2002; Veitch and Arkkelin 1995). These stimuli can range from simple ambient features such as light, sound or temperature, to complex physical features such as buildings, streets, land forms and the presence of other people. The Stimulus Load Theory is based on the notion that people have a limited capacity to process environmental stimuli. When faced with an excessive amount of stimuli, or 'stimulus overload', people have a propensity to ignore some features and give more attention to those that are perceived as more important to the task at hand (Bell et al. 1996; Veitch and Arkkelin 1995). In a physical environment, a similar situation may occur when a person is in a crowded situation, in an unfamiliar city with towering buildings and lost. Attempts at trying to find the way may be hindered by an overabundance of stimuli such as signs, street patterns, people, cars and buildings. In situations where the more important stimuli are ignored, in this case finding the way, rather than concentrating on getting through the crowd, a person's performance is rendered suboptimal. Veitch and Arkkelin (1995) explain that the behavioral after-effects may include errors in judgement, decreased tolerance and frustration, and ignoring others who may need assistance. In contrast to environments with stimulus overload, monotonous environments that are stimulus-deprived lead to boredom and

behavioral deficiencies (Bell et al. 1996). This suggests that under-stimulation can be just as detrimental as overstimulation. Figure 2-10 below illustrates types of environmental stimulation.

Figure 2-10 Examples of environmental stimuli in the streets of Hong Kong in the form of buildings, streets, buses, signs, colors, signs, images and other people (Christopher DeWolf 2007).

2.3.6 The Behavior Constraint Theory:

The focus of behavior constraint theories is on the real or perceived restrictions that are imposed on people by the environment, and the perceived degree of control that people have, or want to have, on an environment (Gifford 2002; Veitch and Arkkelin 1995). these theories posit that the environment is capable of preventing, interfering with, or limiting the behaviors of individuals (Speller 2006; Veitch and Arkkelin 1995). Where people perceive that they have lost some degree of control over their environment, their first experience is of discomfort, which is then followed by an attempt to reassert their control (Bell et al. 1996). This reaction is described by Veitch and Arkkelin as psychological reactance. It can occur in different situations. For example, to avoid crowding, people may erect physical or social barriers to shut others out (Bell et al. 1996). In dark and deserted streets people may alter their movement patterns or avoid such places altogether. When attempts to regain control of the environment are unsuccessful, learned helplessness can develop (Gifford 2002; Veitch and Arkkelin 1995). This is

where people begin to believe that what they do has no effect on the environment and that whatever happens is out of their control. This can result in a sense of despair and feelings of alienation about the environment. In contrast, when people perceive that they have some control over their environment, it has been found that environmental problems such as littering and graffiti are reduced.

2.3.7 The Adaptation Level Theory:

The adaptation level theory maintains that excessive environmental stimulation, or too little environmental stimulation, can have a detrimental effect on people's emotions and behaviors (Gifford 2002; Bell et al. 1996; Veitch and Arkkelin 1995). This suggests that a moderate level of environmental stimulation is the most desirable. Adaptation level theorists assert that the relationship between people and their behavioral response to the environment is comprised of two processes – adaptation and adjustment (Veitch and Arkkelin 1995). People either adapt by changing their responses to the environment, or adjust by changing the environment where they are (Veitch and Arkkelin 1995). Either way, the process results in bringing the person back into equilibrium with his or her environment. To illustrate this concept, an example of adaptation to an extremely noisy street may include physiological responses such as tinnitus ('ringing ears'), constriction of blood vessels, neuromuscular tension (nerve and muscle tension), or vibrations in the ears. An adjustment to the environment may include wearing earplugs or building soundproof walls or windows as a barrier to the noise.

2.3.8 The Environment Stress Theory:

The theory of Environmental Stress focuses on the role of physiology, emotion and cognition within the person-environment relationship (Bell et al. 1996). Environmental features are believed to impinge on human senses, causing a stress response where those features exceed an optimal level (Veitch and Arkkelin 1995; Insel and Lindgren 1978). Pollution, extreme temperatures, traffic, noise and crowding are typical environmental stressors (Gifford 2002; Bell et al. 1996).

Environmental Stress theorists believe that once environmental features are recognized as threatening, part of the behavioral response is automatic and begins with an alarm reaction. This reaction causes the affected person to experience alterations to their various physiological and psychological processes (Gifford 2002; Veitch and Arkkelin 1995). What follows is a resistance to the stress and attempts to alleviate the stress by drawing on coping strategies (Bell et al. 1996). If there is prolonged exposure to stress, coping strategies diminish and a state of exhaustion sets in. This can lead to mental disorders, lowered resistance to stress or diminished interaction with others (Gifford 2002; Veitch and Arkkelin 1995).

The theory also emphasizes the role of 'cognitive appraisal' in a person's psychological or emotional stress response (Gifford 2002; Bell et al. 1996; Winett 1987). The term 'cognitive appraisal' refers to how a person assesses the seriousness of the situation. Further, it suggests that behavioral responses to stress vary from person-to-person due to individual perception. This may be an indication of why some people are better able to deal with stress than others.

2.3.9   The Perception or Cognition Theory:

Cognition theory focuses on people's perception or cognition, rather than the behavior that they overtly display (Veitch and Arkkelin 1995; McAndrew 1993; Low 1987; Canter and Stringer 1975). Unlike the previous theories, Cognition theory is not grounded in science. It concentrates how people perceive the environment according to their learned experience, cultural differences and personality traits (Veitch and Arkkelin 1995). Gifford explains that cognition is how "we acquire, store, organize, and recall information about locations, distances and arrangements in buildings, streets and the great outdoors" (Gifford 2002:32). Jakle et al. (1976) highlight another aspect of the cognition process to do with assigning meaning to the environment. The concept of 'assigning meaning' has been examined extensively by Amos Rapoport (1982).

Seeing comes before words…it is seeing which establishes our place in the surrounding world; we explain that world with words… The relation between what we see and what we know is never settled (Berger 1973:1).

Although this quote expresses the concept of perception literally, it can also be considered figuratively. This is because although sight is indeed a primary indicator in terms of perceiving and cognizing the visual aspects of city form, visually impaired people are still capable of having a perception of an environment, by drawing on senses other than sight. Accordingly, in addition to perception and sight, the relationship between a person and their environment can also be affected by touch, hearing and smell which are facilitated by the physical and ambient features of the environment.
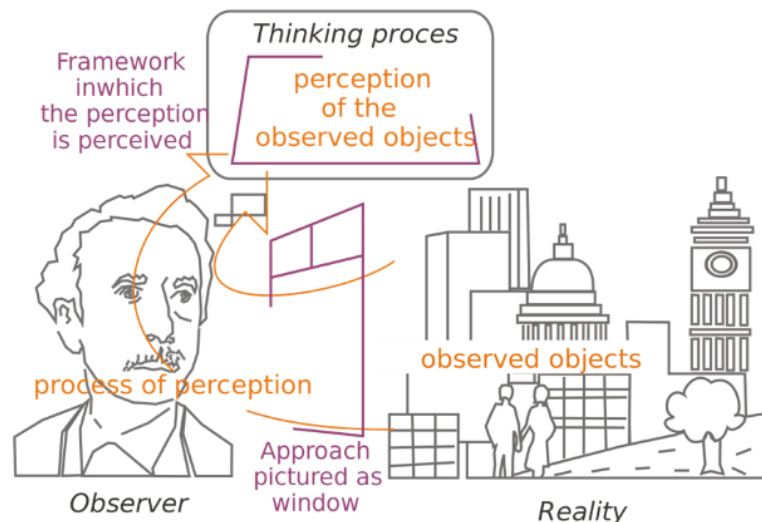

Figure 2-11 thinking process (source: google images)

2.4 The Ambient Environment:

The behavioral theories examined in the previous section showed that the built environment is capable of affecting people's physiological and psychological processes. This section now examines people's responses to the ambient and physical features of the environment in order to understand how behavior and experience is affected by public spaces.

The ambient environment refers to the non-visual and non-physical elements of the built environment such as sound, smell, temperature and illumination. These are experienced through the sensory organs such as ears,

nose, skin and eyes. Studies have shown that these elements are capable of having profound effects on mood, behavior, and physical wellbeing (Gifford 2002; Veitch and Arkkelin 1995; McAndrew 1993; Canter and Stringer 1975; Mehrabian and Russel 1974). This suggests that people's relationship with the ambient environment is three-fold and is linked with the emotions, thought or cognitive processes and physiology.

2.5 The Temperature of Spaces:

The influence of temperature on human behavior is evident from the review of literature and an assessment of everyday experiences. Changes in the weather such as rain, wind, cold and heat affect people's choice about where they will go and what they will avoid doing. A cold, grey sky can render some feeling depressed and unwilling to get out of bed however the context is important. McAndrew (1993) describes an unidentified study that found that pedestrians walked faster in hot or cold climates as opposed to moderate climates. Veitch and Arkkelin (1995) describe how the English language associates temperature with behavior. For instance, people are referred to as 'hot', implying how attractive they are. Others may be described as 'hot under the collar', 'hot headed', 'warm and loving' and 'making my blood boil'. Sometimes people are referred to as 'cold and cunning' or they give 'the cold shoulder' and sometimes they are asked to 'cool it'. Deep-rooted in the English language is a relationship between temperature and social behaviors that imply positive and negative social tendencies.

A common theme throughout the literature which draws on the behavioral theory of arousal is that arousal is at its minimum when temperatures are moderate and comfortable (Gifford 2002; Levy-Leboyer 1982). As the temperature increases or decreases beyond the comfortable level, arousal is increased. This leads to a range of changes to physiological and behavioural functions (Canter and Stringer 1975; Mehrabian and Russel 1974). Physiological changes can include discomfort, reduced manual dexterity and tactile sensitivity, sweating, inability to breathe comfortably, increase in reaction time, increase in metabolic rate, shivering, muscular tension or changes in thyroid activity and adrenaline output (McAndrew

1993). In terms of behavioral changes, heightened levels of arousal resulting from high temperatures and heat discomfort have been found to conflicts in interpersonal relations, attraction to others, aggression, irritability, and a range of anti-social behavior such as rioting (Gifford 2002; Bell et al. 1996; Veitch and Arkkelin 1995; McAndrew 1993; Levy Leboyer 1982). The United States Riot Commission reported that of all the riots that took place across American states in 1967, all but one began when the temperature was at least 80 degrees farenheight (Gifford 2002). Temperatures have also been linked to crimes such as assault, burglary, and collective violence and rape (Gifford 2002; McAndrew 1993).

2.6 The Sound of Spaces:

The focus on sounds in the environment is often concerned with how sounds hinder speech communication and social interactions, as well as how they cause increases or decreases in concentration levels. While some sounds overload the senses and reduce memory capacity, other sounds are capable of affecting how people process information about the environment (McAndrew 1993). Similar to other ambient elements, there is consistent evidence that while sounds can 'arouse' or distract people, the extent to which they are deemed annoying, a nuisance or pleasant depends on individual sensitivity (McAndrew 1993; Brebner 1982; Levy-Leboyer 1982; Mehrabian and Russell 1974). Brebner suggests that while physiologically, the mechanism of hearing is the same; psychologically it differs based on variables such as the intensity, predictability and significance of the sound and other attention getting factors.

Unpleasantly noisy environments are linked with higher arrest rates, aggression, decreased care for the environment, less social interaction and errors in judgment (Veitch and Arkkelin 1995; Mehrabian 1976). In studies where people were asked to do a simple task such as press a button when certain lamps were illuminated, there were more errors in the presence of noisy settings. Similarly, changes in street and traffic signals were more frequently unnoticed in noisy environments (Levy-Leboyer 1982). Other studies also reveal that people may be less likely to help strangers in noisy environments and are more likely to try to escape by walking faster and gazing straight

ahead, thus avoiding other people (Gifford 2002; Bell et al. 1996; Mehrabian 1976). Pleasant music, as opposed to unpleasant sound is also believed to affect people's behavior significantly (Gifford 2002; Mehrabian 1976). In an unidentified study cited by Gifford, shoppers walked slower when slow music was played than when fast music was played. The most interesting finding was that shoppers bought more items when the tempo of music was slower, supposedly because they did not feel rushed (Gifford 2002).

2.7 The Smell of Spaces

Despite the belief that the ability to smell is the most sensitive of human senses (Brebner 1982), the review of literature indicates that aside from sources such as pollution, little attention is given to the effects of smells on human behavior. Brebner (1982) suggests that while the sense of smell is indeed the most sensitive, it does not function independent of other senses. Indeed often unpleasant smells are first identified by sight, and then identified by their smell (Brebner 1982). Smells can be derived from sources from the natural, built or human environment. Natural smells may include bushfires, earth, fresh air, rain, water, grass, flowers and trees. Smells from the built environment may include pollution, traffic, industries, and the smell of building materials. Human smells may include smells such as food being cooked, bodily odors, and other smells that result from activities such as smoking. The degree to which certain smells are 'acceptable' has been linked to culture and convention by Brebner (1982) who asserts that the degree to which smells can be tolerated is enormous. Although mostly, people steer away from locations that they emotionally identify as 'smelly', it has been suggested that if there is sufficient motivation, people tend not only to accept unpleasant smells but adapt to them (Berglund et al. 1971). Where there is an absence of a motivating factor to encourage people to adapt to the environment, unpleasant odors are linked to negative effects on moods, attraction to others and avoidance of certain environments (Gifford 2002). The interesting point about smell is it ability to conjure nostalgic memories and reproduce past moods and events (Brebner 1982; Jakleetal. 1976).

2.8 The Illumination of Spaces

The belief that sunlight can help regulate people's biological rhythms, alter moods, improve performance, reduce feelings of depression and improve emotional wellbeing is not new. Studies on people suffering from depressive disorders suggest that illumination can indeed have profound effects on people (McAndrew 1996; Veitch and Arkkelin 1995). It has also been suggested that under the cover of dark or dimly lit settings, people tend to release their social inhibitions, more so than they would in brightly lit settings, by engaging in acts of intimacy, aggression or impulsive behavior (McAndrew 1996; Mehrabian 1976). This is interesting in that it may explain why people tend to avoid dark public places at night time. Perhaps there is a conscious or unconscious recognition that strangers may behave differently under the cover of darkness and that personal safety may be compromised.

2.9 The Physical Environment

The physical environment refers to the endless visible and tangible features that are largely controlled by planners, designers and built environment professionals. Not unlike buildings, outdoor public spaces can be enclosed by three representational planes: floor, wall and possibly ceiling (Lewis 1996; Beattie and Lehmann 1994; French 1978). The floors can be represented by street and footpath layouts or by a variety of ground surfaces such as grass, dirt, concrete or paving. The walls can be represented by the buildings that adjoin the space or the existence of any vegetation, significant land form or topography. The ceilings of a public space can be represented by the sky, a canopy of vegetation or natural phenomena such as a persistent fog or shadow (Lewis 1996; Mitchell et al. 2004). Accordingly, the relationship between people and the physical environment is linked not only to vision, but to all the human senses including smell, sound and touch (Gifford 2002; Lewis 1996; Veitch and Arkkelin 1995; McAndrew 1993; Mehrabian and Russel 1974). Although the enclosure of space is perceived three dimensionally through vision, perception is not independent of other spaces and can be modified when other senses respond to the physical surroundings. This notion of space as a relationship between the physical surroundings and the person

who perceives it was first introduced by Kevin Lynch (1960). Lynch, a planner and seminal thinker in this area identified five types of elements of the built environment that are capable of influencing how people experience and evaluate their environment: landmarks, paths, districts, edges and nodes. Lynch described these elements as follows:

- Landmarks are reference points that can be either large scale, such as a mountain, or small scale such as a letter box.
- Paths such as streets, footpaths and cycle routes are the channels for movement.
- Districts are the segments of the cities that are recognizable by a common feature or perceived identity that is distinguishable from other precincts, such as Chinatown in Sydney.
- Edges are the boundaries or barriers such as walls or coastlines.
- Nodes are the focal points of intense activities to where people travel such as a park or commercial center (Lynch 1960).
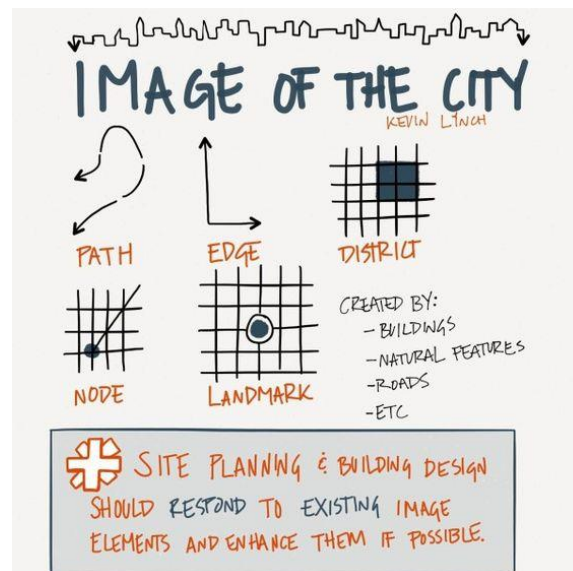

Figure 2-12 elements of the city (Source: image of the city book)

These elements which have been studied across different populations and cities have confirmed their consistency (Nasar 2004). This is significant in that it provides an insight into the processes of the mind as it suggests that peoples response to their surroundings are dependent on two aspects, namely the visual aspects of city form, and the evaluative response that results from

the human senses (Nasar 2004; Bell etal. 1996). French (1978) who concentrates on the effects of 'edges' on human behavior argues that while enclosure is the prime function of architecture, most of the time it is only perceived subconsciously. It is the size, scale and quality of spaces represented by shapes, colors and other details, that affects people's psychological reactance to spaces.

French (1978) describes that people feel comfortable only on the edges of spaces, or near areas that offer psychological protection (such as a fountain, sculpture or umbrella). This shows that there is an interconnection between the elements of 'edges' and 'landmarks'. French (1978) further asserts that the walls of public spaces represented by tall and impersonal buildings with glassy facades can evoke a fishbowl feeling in the center of the space they form. On this basis, French argues that public spaces need other means of enclosure or edges, to provide users with a sense of scale and intimacy that is consistent with their psychological needs.

French (1978) suggests that this can subtly be achieved in public spaces through a step down, a change in pavement, umbrellas, awnings, trees, freestanding screens or benches. He notes that it is not the enclosing walls that direct activities but the arrangement of the space and the ambient features such as lighting and sources of noise.

2.10 Conclusion:

The reviewed literature on environmental psychology has shown that the discipline is concerned with the interactions and relationships between people and the physical and ambient features of the environment. The emphasis has been on how human behavior and feelings are affected by the environment through the theoretical perspectives of arousal, stimulus overload, behavior constraint, adaptation level, environment stress and perception or cognition.

The theory of Arousal has demonstrated that when there is a heightening of brain activity as a result of either pleasant or unpleasant environmental stimuli, such as personal space invasions, it can cause negative emotions in people. Similarly, the theory of Stimulus Load, Adaptation Level

and Environment Stress suggest that when the environment produces an overload of stimulation, lacks any stimulation, or produces stressors, it can reduce people's ability to process environmental information – unless they can appropriately adapt or adjust to the environment.

Finally, certain physical features and ambient features such as illumination, sound, smell and temperature that have been found to cause psychological and physiological responses in people can be explained by way of these behavioral theories. The fact that many of these elements can be controlled by built environment professionals in their design and decision making processes should encourage professionals to attain a better understanding of them. Understanding the effects of these features on people can assist in finding better solutions to address their effects on people in public spaces.

This chapter has addressed the central research question of the thesis by examining how the environment imposes on people. It discussed the theories of human behaviour and identified how people respond to the ambient and physical features of public spaces.

From studying the theories of human behavior the researcher takes the adaptation level theory as a method in the case study.

Chapter Three – Methodology

3.1 Case Study - Introduction:

The case study is to observe the impact of street elements on the human behavior in the intersection of Elqasr and Tabya Avenue. Using observation to investigate the street problems and propose possible solutions.

3.1.1 Historical background:

This intersection has historical value as it was gateway to the city of Khartoum via the railway, this gate formed by school of medicine building from the western side of alqasr avenue and the stac laboratory building from the eastern side (sfigure 3-1).
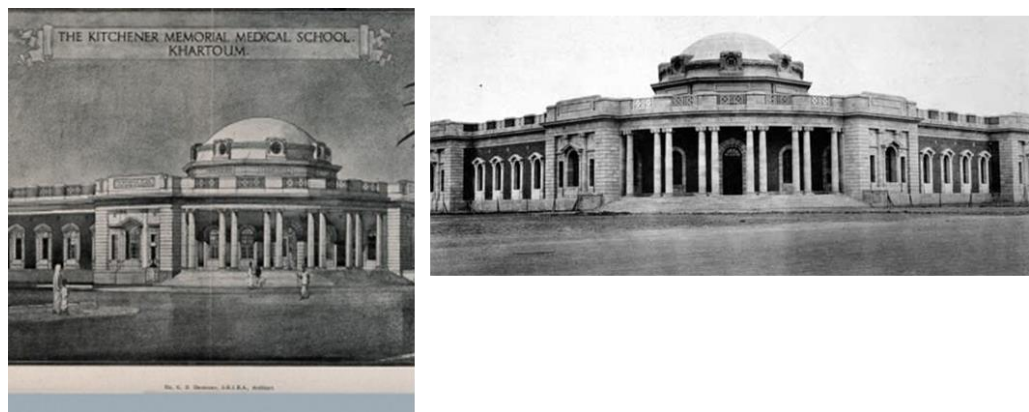
Figure 3-1 medicine school (source: google pictures)

3.1.2 About AlQasr & Altabya intersection:

Alqasr avenue and Altabya intersection located in western Khartoum which is almost center on Khartoum city, the surrounding suburbs contains public facilities and healthcare centers and educational buildings, the historical buildings of medicine school and Stac laboratory added a great value for this node, also it can be considered as a link between two main transportation stations (sharwani & Jackson), that caused the important of this node.

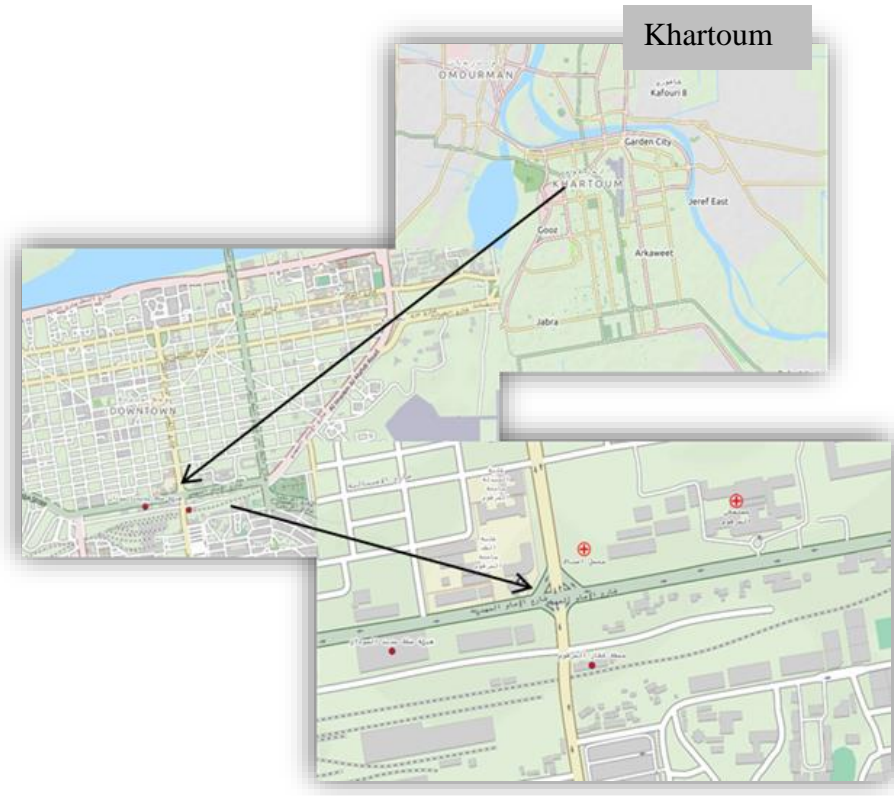The maps bellow represents and AlQasr Avenue & altabya intersection location:

Khartoum

Figure 3-2 map represent the location (source: streetmap)

- Educational
- Public Facilities (Hospitals, Laboratories, health centers,...)
- Commercial
- Residential
- Public Facilities (Club)
- Public Facilities (Cafés)
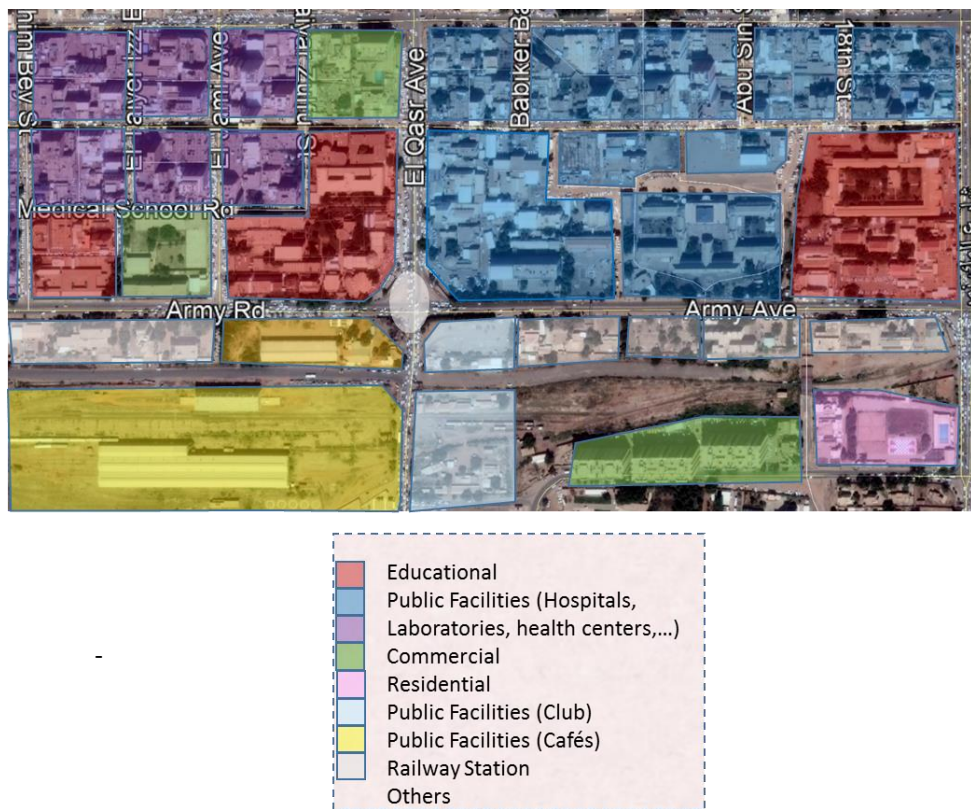- Railway Station
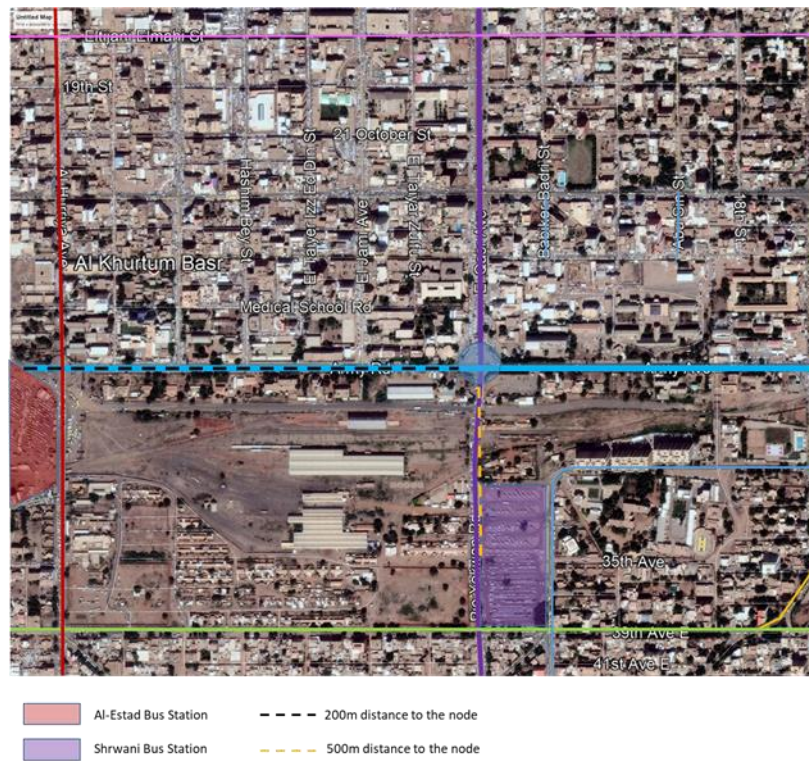- Others

Figure 3-3 the land use (source: google map)

Figure 3-4 street leveling (source: google map)

3.1.3 Street typology:

Street levels in the study area.

Level 1: ALQASR avenue 40 m.

Level 2: ALTABIYA avenue 20 m.

Level 2: PIO YOKWAN street 20m.

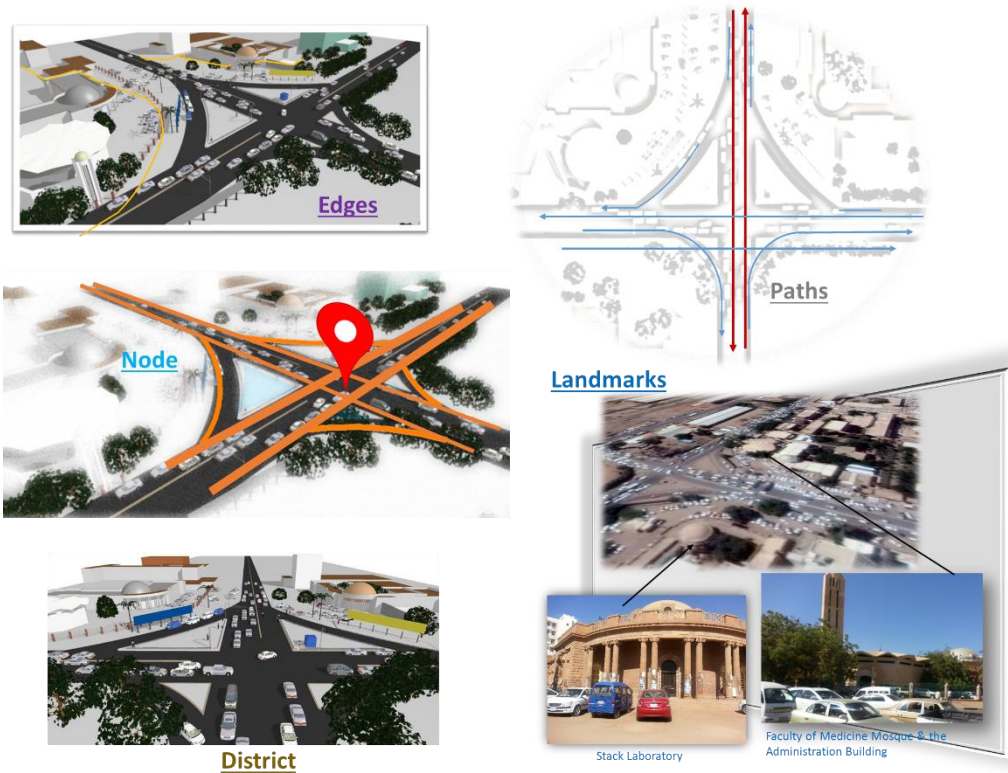### 3.1.4 The urban design elements of the intersection:

Figure 3-5 the figures clarify the physical elements of the district which includes edges, Node, Paths and Landmarks. (source: by researcher).

3.2 Methodology

This is a descriptive analytical method to gather observations and list the exact description of the human behavior at alqasr & aaltabya intersection, to revile recommendations for the design.

3.2.1 Data collection - Document the Physical Objects About the physical environment:

Illustrate the main activities in the Alqasr & Altabya intersection during one working day at peak hours using the following tools:

❖ **Observation notes and Pictures** – Inspect the area and observe location, traffic, pedestrian movement patterns, activities and estimates of people at different intervals.

Car washing   Selling   Waiting

Figure 3-6 activities in the intersection (source: by researcher).

Car park in the middle of street   Crossing the road

Figure 3-7 activities in the intersection (source: by researcher).

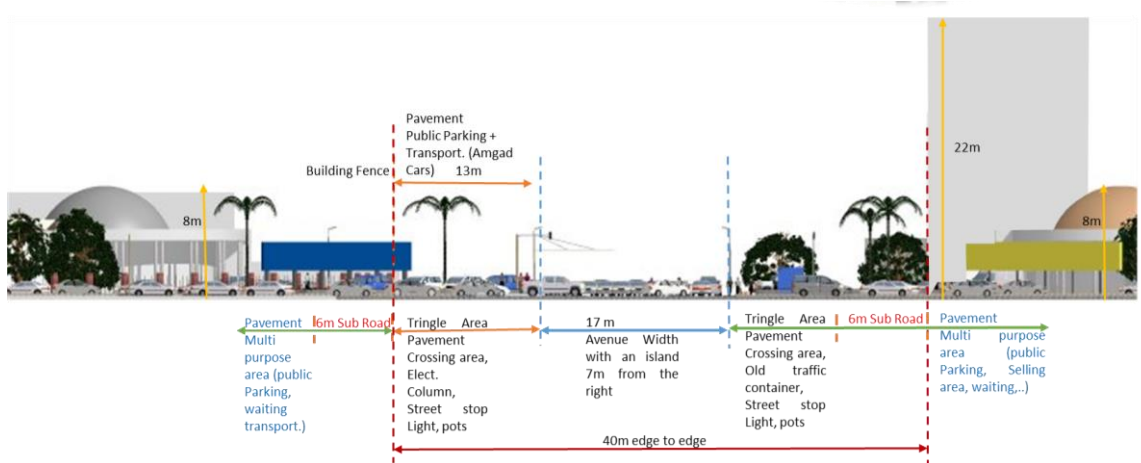❖ Sketches - sketch diagrams to illustrate what noticed.

Figure 3-8 the section represent the area usage (sourse: by researcher)

❖ Video record - to record the effect of the intersection physical elements on human behavior in different times during the day, the camera fixed on stand in the top roof of STAK laboratory building (the eastern side of AL-QASR Avenue and the northern side of AL-TABIYA avenue) as shown:

Figure 3-9 camera fix and location (source: by reasercher)

Summarize the activities in activity tables including description, purpose, and time sequence regarding to the street users (their gender and age group).

A matrix of activities – users will be extracted from tables to show the activities patterns and locations of the activities.

3.2.2 Data analysis - study what is the impact of the physical environment has on the way people use the space.

Studying people behavior using video of the intersection, regarding the following measurements: number of people appear or cross the intersection, the type of their activities, and traffic density.

By analyzing the subjective reading report using numerical data and diagrams. Helped to evaluating the way people interact with the space and the future redesigning of the intersection in these following points:

a. Studying the physical components of the intersection.
b. Studying the user's activities within the intersection.

3.2.3 Studying the physical components of the intersection:

From the observations notes mentioned before the researcher studied the physical components of the intersection listed in the figure bellow:
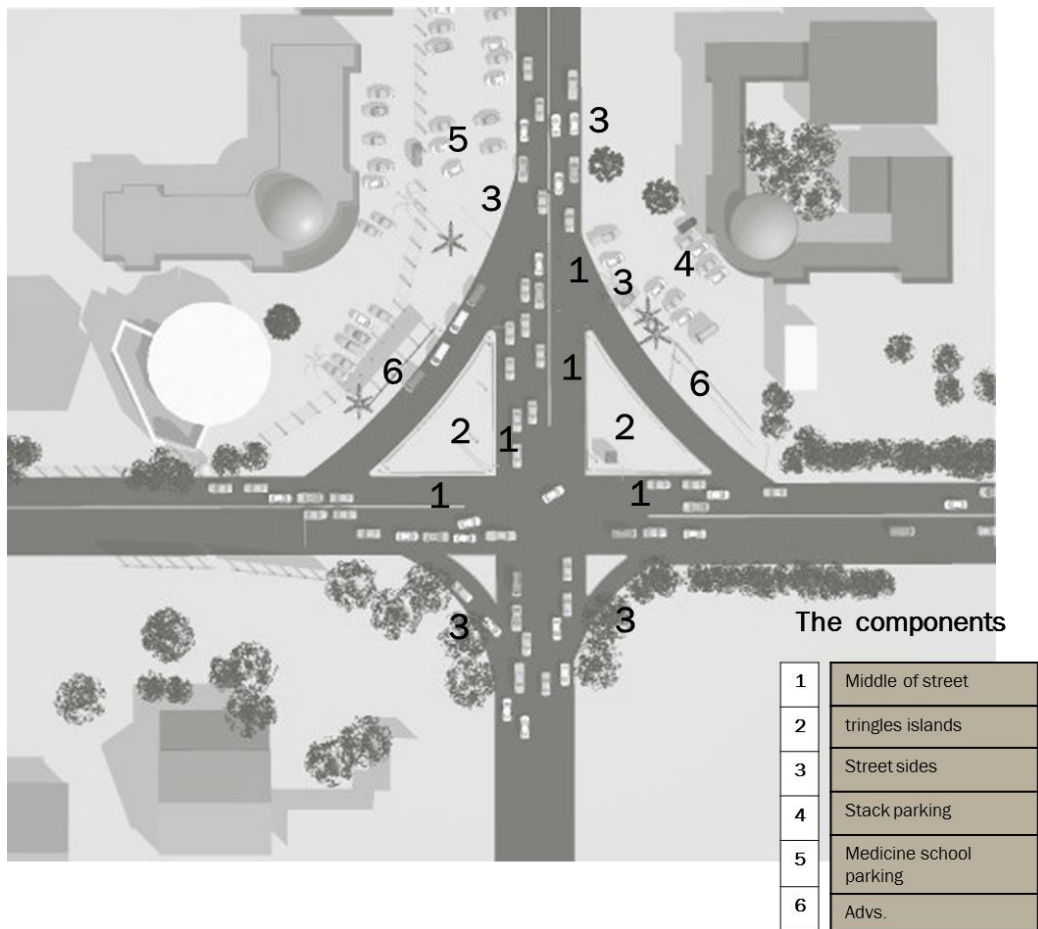
The components

1	Middle of street
2	tringles islands
3	Street sides
4	Stack parking
5	Medicine school parking
6	Advs.

Figure 3-10 physical components of the intersection

3.2.4   Studying the user's activities at the intersection:

From the video record the researcher observed the number and gender of the street users during four time interval daily, shown below:

3.2.4.1   Number of people from 10:30 to 11:00 am:

From 10:30 – 11:30 am the study investigates who, where and what activities are done through the study area. Table (3-1) represent specifically the number of people how are doing different activities in study area different places (10:30-11:00 am).

Table 3-1 time of estimation (10:30 - 11:00 am)

	Total number of people	Male	Female	Children & teenage	Activities	Place
Time of estimation :: 10:30 – 11:00 *average per minute	44	33	9	2	Crossing the road	Islands and street sides
	2	2	-	-	Car washing	Public parking
	9	6	3	-	Tea selling, sitting & drinking	Under trees & shades of buildings
	1	1	-	-	Credit selling	Under trees
	4	3	1	-	Waiting	Under trees and adds
	3	-	-	3	Begging	
	63	Total of people who are doing all these activates in places of study area between 10:30-11:00 am				

3.2.4.2 Number of people from 12:00 – 01:30 pm:

From 12:00 – 01:30 pm the study will investigate who, where and what activities are done through the study area. Table (3-2) represent specifically the number of people how are doing different activities in study area different places (12:00-01:30 pm).

Table 3-2 time of estimation (12:00 - 1:30 pm)

	Total number of people	Male	Female	Children & teenage	Activities	Place
Time of estimation :: 12:00 – 01:30 pm *average per minute	48	34	12	4	Crossing the road	Islands and street sides
	3	3	-	-	Car washing	Public parking
	12	9	3	-	Tea selling, sitting & drinking	Under trees & shades of buildings
	2	2	-	-	Credit selling	Under trees & public parking
	3	-	3	-	Snacks selling	Street sides
	4	3	1	-	Waiting	Under trees and adds
	5	-	-	5	Begging	
	77	Total of people who are doing all these activates in places of study area between 12:00-1:30 pm				

3.2.4.3 Number of people from 2:00 - 3:30 pm:

From 2:00 - 3:30 pm the study will investigate who, where and what activities are done through the study area. Table (3-3) represent specifically the number of people how are doing different activities in study area different places (2:00 – 3:30 pm).

Table 3-3 time of estimation (2:00 – 3:30 pm).

Time of estimation : 2:00 – 3:30 pm *average per minute	Total number of people	Male	Female	Children & teenage	Activities	Place
	45	30	11	4	Crossing the road	Islands and street sides
	3	3	-	-	Car washing	Public parking
	12	9	3	-	Tea selling, sitting & drinking	Under trees & shades of buildings
	2	2	-	-	Credit selling	Under trees
	3	2	-	1	Water & towels selling	In the middle of the stop
	4	1	3	-	Snacks selling	Street sides
	3	3	-	-	Waiting	Under trees and adds
	5	-	-	5	Begging	
	77	Total of people who are doing all these activates in places of study area between 2:00 – 3:30 pm				

3.2.4.4 Number of people from 4:00- 5:30 pm:

From 4:00- 5:30 the study will investigate who, where and what activities are done through the study area. Table (3-4) represent specifically the number of people how are doing different activities in study area different places (4:00 – 5:30pm).

Table 3-4 time of estimation (4:00 – 5:30 pm).

Time of estimation : 4:00 – 5:30 pm *average per minute	Total number of people	Male	Female	Children & teenage	Activities	Place
	43	32	10	1	Crossing the road	Islands and street sides
	1	-	1	-	Tea selling, sitting & drinking	Under trees & shades of buildings
	1	1	-	-	Credit selling	Under trees
	2	2	-	-	Water selling	In the middle of the stop
	4	3	-	-	Waiting	Under trees and adds
	5	-	-	5	Begging	
	56	Total of people who are doing all these activates in places of study area between 4:00- 5;30 pm				

Note:

❖ In the morning the most of people are just crossing the road to get their destinations.

# Chapter Four: Results and Discussion

4.1 The physical components of the intersection results:

From the observations, it was apparent that user's behavior and activity attraction present yet differently according to the design elements in the intersection. The result of the observations and movement tracing verified the initial assumption that design elements setting in the public space was affecting the way people use and moved around the area.

People tend to position and group themselves differently in the area according to the environment that design elements created.

4.1.1 Transportation during the day:

From observation the researcher divides the transportation into three categories public transportation, private cars and ambulance. To indicate the capacity and typology of the transportation during the four periods of time that selected before. The graph (4-1) represent the transportation during the day.
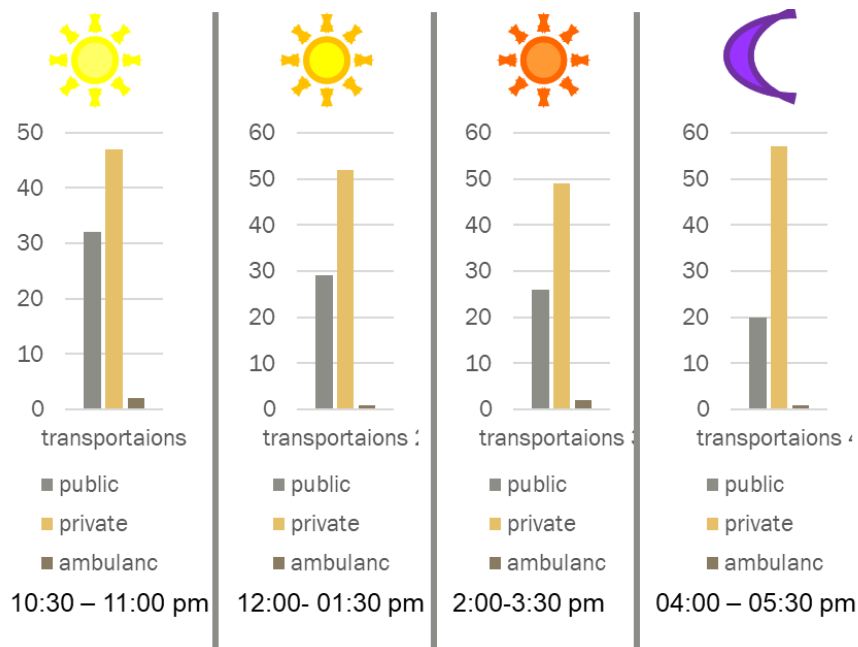
*Graph 4-1 the transportation capacity.*

The public transportation has the highest capacity in the morning during (10:30-11:00am) comparing to other selected times of the day.

The private transportation has the largest percentage of the whole transportation types in the intersection and it has the highest capacity in the evening during (4:30-5:30) comparing to other selected times of the day.

The ambulance shows the lowest percentage of the transportation but it has the highest capacity in the morning.

4.1.2 Street density vs. time:

The graph (4-2) below content all the users and transportation typology to represent the number of people and traffic who are passing through the intersection in different time of the day, and show the time of promotion, which has the largest number of people and cares.
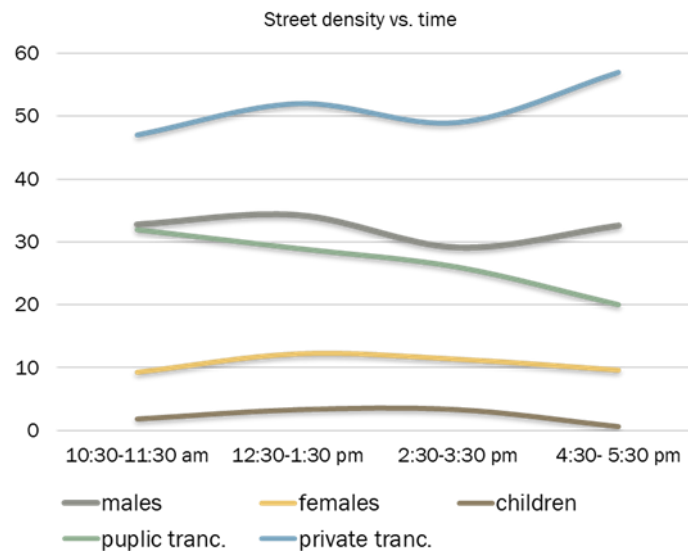
Graph 4-2 street density VS time

4.1.3 Circulation & crossing street map:

As a result, from observing user's behavior in the intersection, to track the human behavior of crossing the road which is the major activity in the intersection a circulation and crossing map can be presented in the map (5-1) bellow :
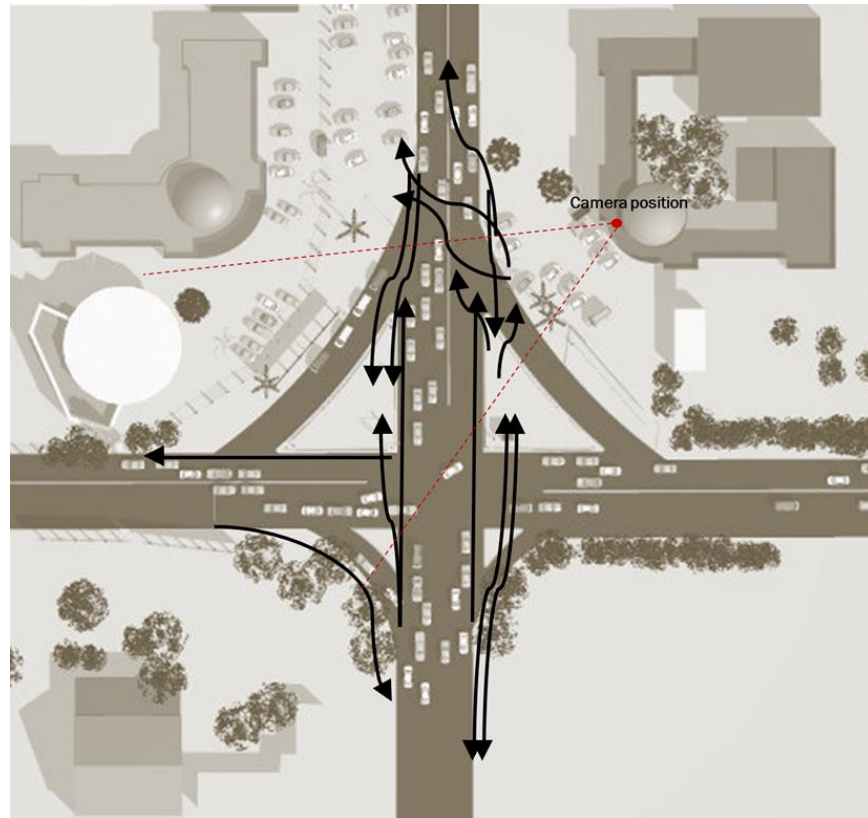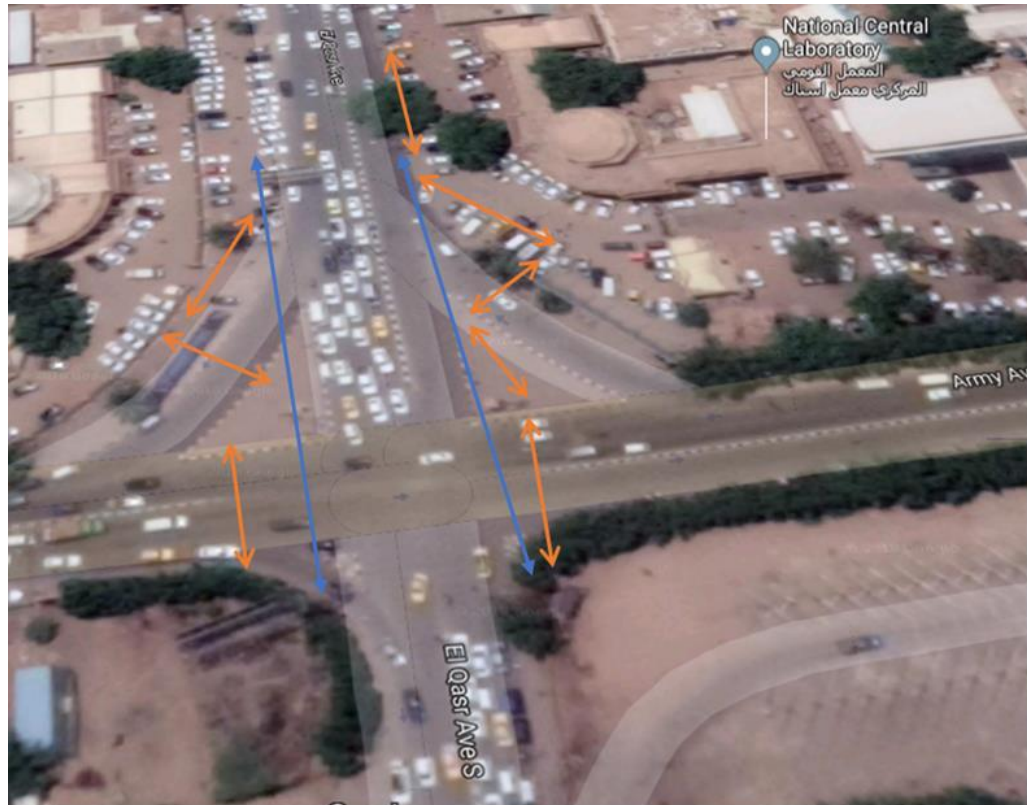
Figure 4-1 represent the circulation of people through the street, from our observation.

❖ The most of people are crossing the road through the two tringles islands, some of them walk in the middle of the street.

4.1.4 Connectivity and legibility:

The creation of vibrant and active places requires pedestrian activity. This in turn requires walkable street networks that can be easily navigated and are well connected.
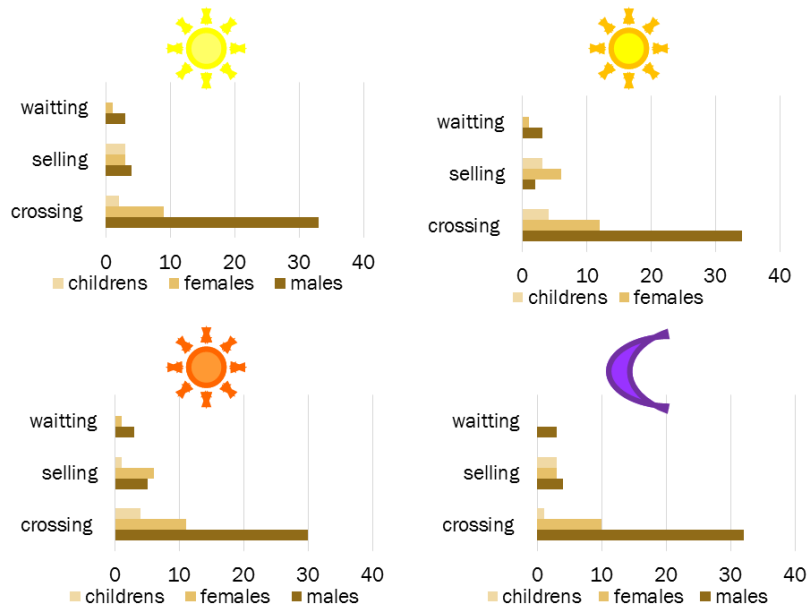
Figure 4-2 Connectivity and legibility (source: by reasercher)

4.2 The user's activities within the intersection results:

As a result of the observing during pick hours in the day it represent the gender, age and number of people doing the main activates in the graphs (4-3) bellow:

Graph 4-3 is represent the gender, age and number of people in different activates.

The waiting activity shows the lowest percentage comparing with the other activities, males has largest percentage and they are the only who wait at the evening during (4:00-5:30pm).

Sailing activity includes all types (credit, snakes, coffee… etc.) female took the highest percentage of sellers.

The road crossing shows the largest activity percentage comparing to other activities. Males has the largest percentage of crossing.
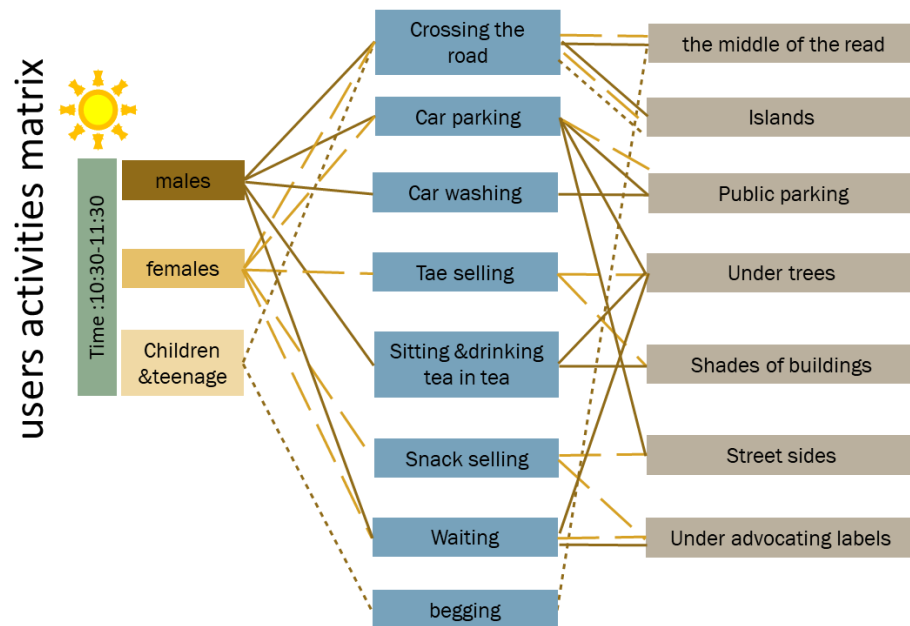
4.2.1 Users, activity and components matrixes:

The graph (4-4) below represent the user's type activities matrix and the place of activities from 10:30 - 11:00 am.
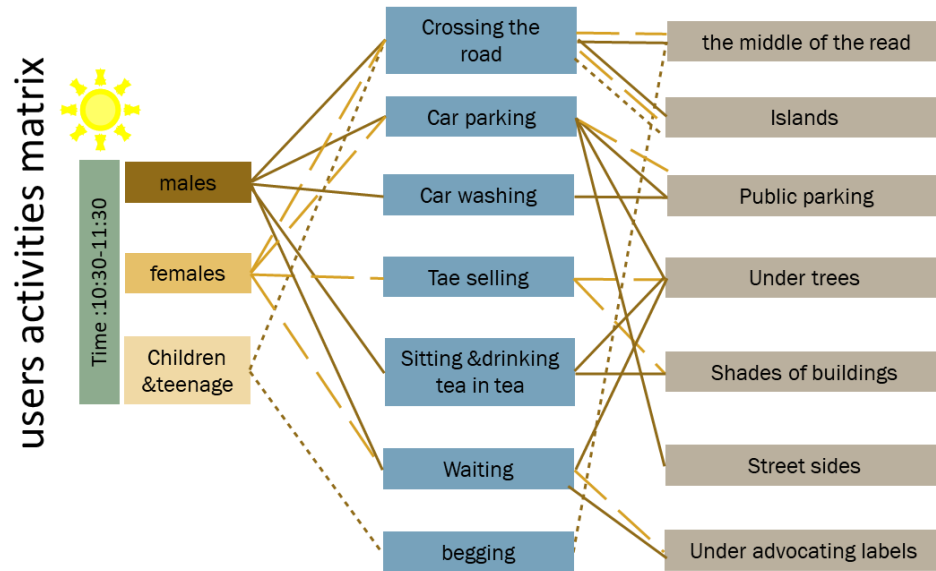
Graph 4-4 matrix (10:30 - 11:00am)

The graph (4-5) below is represent the uses type activities matrix and the place of activities from 12:00- 01:30 pm.

Graph 4-5 matrix (12:00-1:30pm)

The graph (4-6) below represent the uses type activities matrix and the place of activities from 2:00-3:30 pm

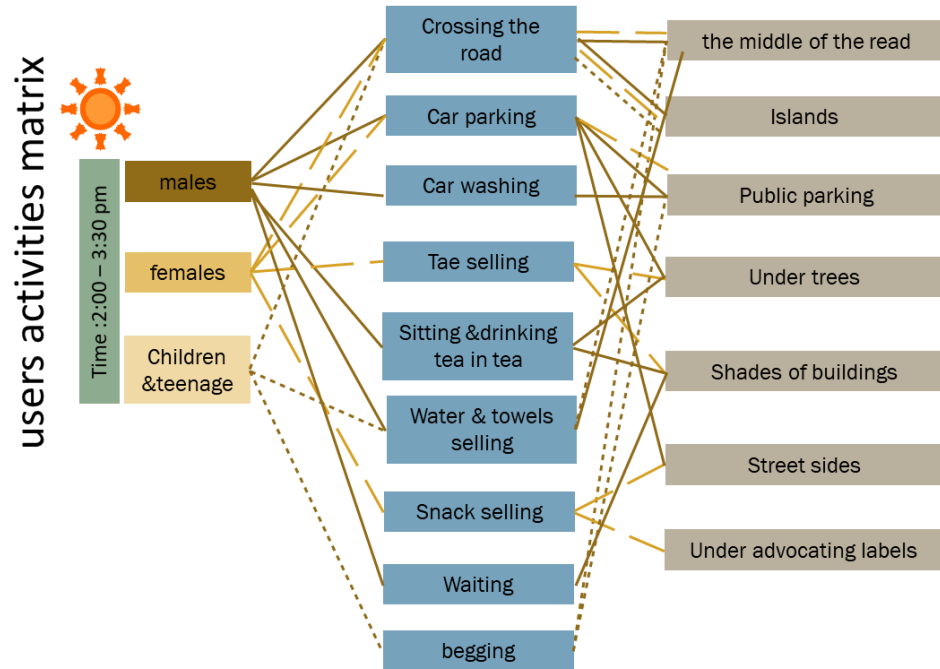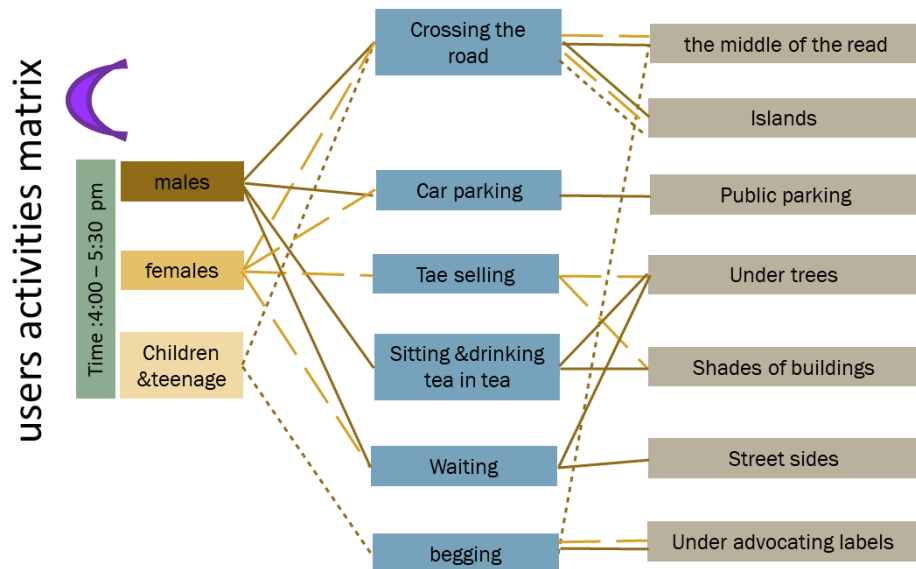*Graph 4-6 matrix (2:00-3:30pm)*

The graph (4-7) below is represent the uses type activities matrix and the place of activities from 4:00 – 5:30 pm

Graph 4-7 matrix (4:00-5:30pm)

- During (2:00-3:30pm) most of activities done
- This result to a clear impact on the intersection components range from strongly positive to strongly negative.

4.2.2   The impact of components on users activities

The figure (4-4) below is showing the impact of components in this interaction point on the activities that happened, by evaluate which is the positive impact, natural one, negative and in between.

- Footpaths they were narrow in comparison to the population density.
- Crossing the street, water selling and begging effected strongly negative in Middle of the street and that because there isn't a clear marked path to street crossing.
- The tringles islands affected negatively on crossing the roads that results from the fence around the tringles.
- The street sides were effected strongly negative by car parking and the snacks sellers because there is no space for side parking and enough area to the sellers.
- The stak laboratory parking effects strongly positive on the car parking, also strong effect on the tea sellers and begging.
- Medical school parking also effects strongly positive on car parking, sellers and begging.
- The advs. Signs in the area effected strongly positive on waiting activity.
- Recognizes these issues of crowding, congestion and density. However, the problem was that physical constraints impeded. The footpath would facilitate pedestrian comfort and allow personal space, it would restrict vehicular movement. Although unfortunately urban design sometimes accommodates the motor vehicle first, and pedestrians second.

The components

#	Components	Crossing the road	Car washing	Car parking	Waiting	Tea sale	Credit sale	Snacks sale	Water sale	Begging
1	Middle of street									
2	tringles islands									
3	Street sides									
4	Stack parking									
5	Medicine school parking									
6	Advs.									

The Impact scale

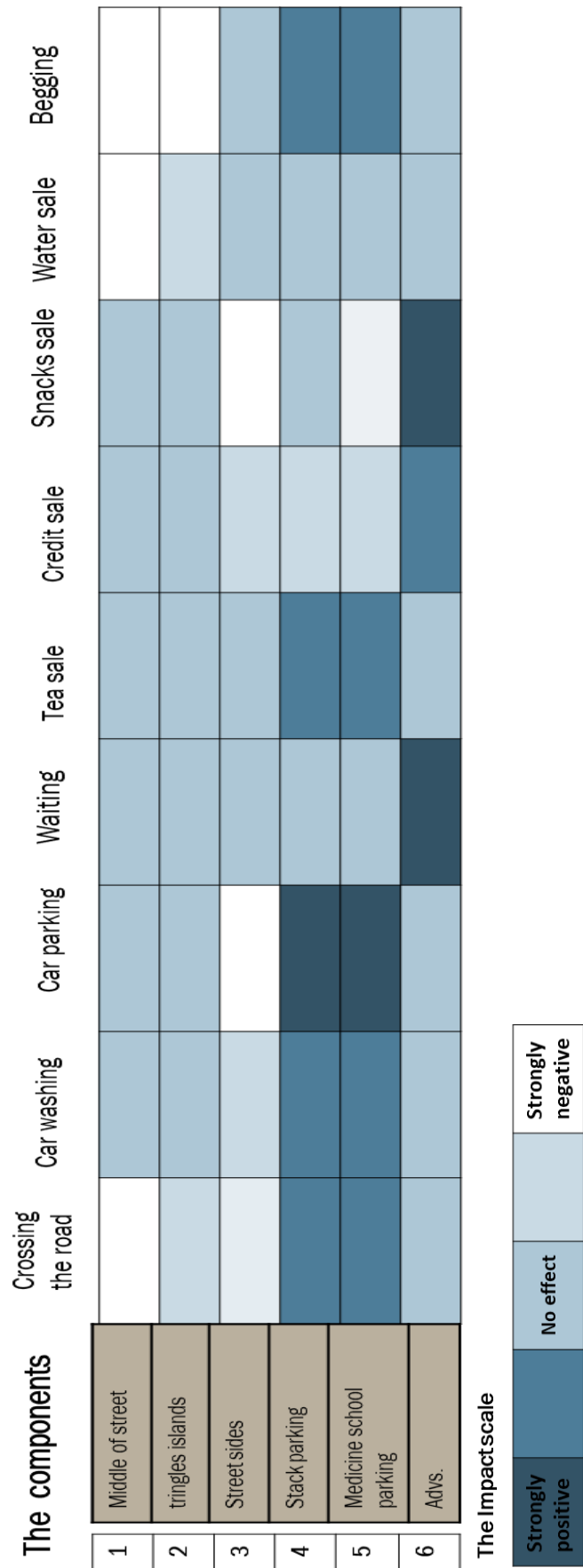| Strongly positive	No effect	Strongly negative

Figure 4-4 The impact of components on activities (source: by reasercher)

4.3 Findings and Recommendations for the intersect urban design:

❖ Provide pedestrian crossing facilities at junctions and on each arm of the junction

❖ The sense of intimacy, interest and overlooking that is created by a street that is enclosed and lined with active frontages enhances a pedestrian's feeling of security and well-being. Good pedestrian facilities (such as wide footpaths and well-designed crossings) also make walking a more convenient and pleasurable experience that will further encourage pedestrian activity.

❖ Investment into pedestrian areas conveyed the importance of these areas. A variety of pavement surfaces, colors, widths, landscaping treatments and new street furniture was enhancing the appearance of footpaths.

❖ Recognition of the Effects of the Physical and Natural Features Landscaping and Greenery.

❖ These four characteristics represent the basic measures that should be established in order to create people friendly streets that facilitate more sustainable neighborhoods.
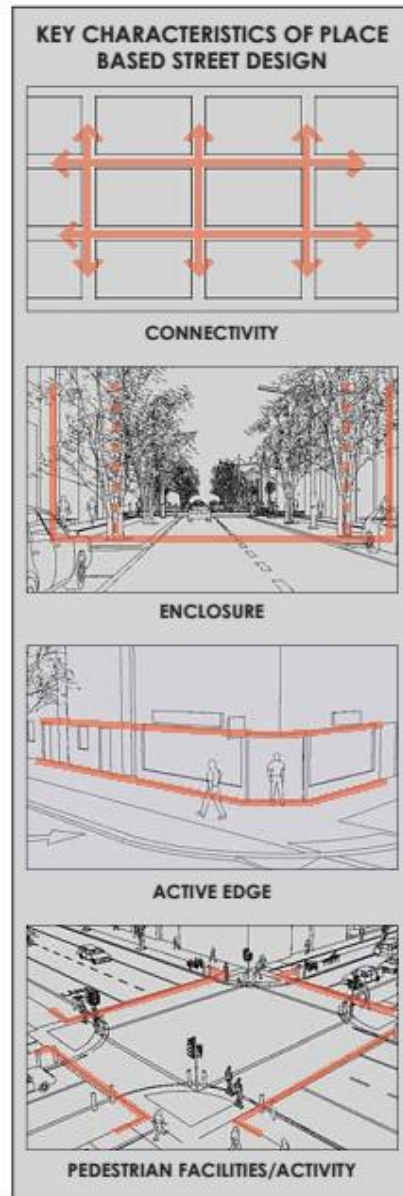
Figure 4-4 The key characteristics of the street that influence its sense of place. A safe, attractive and comfortable pedestrian environment requires all of these elements.

4.4 Other Considerations:

Several other considerations important for intersection design are described in the following sections including: sight triangles; intersection spacing; bus stop considerations; and mid-block path crossings.

Intersection Sight Triangles The intersection sight triangle is a triangular-shaped zone, sufficiently clear of visual obstructions to permit drivers entering the intersection to detect any hazards or conflicts and react accordingly.

Intersection Spacing A primary purpose of intersection spacing guidelines is to minimize the possibility of conflicts in traffic operations between adjacent intersections. Examples of such conflicts are queues of traffic extending from one intersection through an adjacent intersection, or intersection spacing that precludes the possibility of traffic signal progression between intersections. On arterials, intersection spacing requirements are intended to minimize the "friction" arising from signal control and turning movements at intersections. Intersection spacing can also influence the pedestrian connectivity along a corridor since crossing opportunities are often located at intersections.

Transit Stop Considerations From the point of view of bus operations, it is desirable to have bus stops located near intersections so that bus riders can approach easily from both the street carrying the bus route and from the minor streets. Further, it is desirable to integrate bus stops with the adjoining pedestrian system (sidewalks, shared use paths and crosswalks) and also with any adjoining bike path/lane system. With respect to intersections, bus and other transit stops may be either:

- Near side, located on the approach leg of the intersection; or,
- Far side, located on the departure leg of the intersection.

Mid- Block Path Crossings At intersections, shared use paths (for pedestrians, bicyclists and other non-motorized users) are accommodated as intersection crosswalks, Where paths cross streets at locations other than at intersections, they should conform to the following guidelines for "mid-block" crossings (the MUTCD provides further guidance on placement and spacing):

- Mid-block path crossings should be used only where needed. Factors likely to produce this need are existing route of paths, availability of right-of-way for path extensions, distance to alternate crossing locations at intersections, and topography.
- Mid-block path crossings should be installed only where stopping sight distance is fully adequate for vehicular traffic on the street being crossed.
- Mid-block path crossings should provide adequate sight distance for pedestrians, bicycles and other users of the path.

- Where mid-block path crossings exceed 60 feet in length, a median island should be considered. Median islands provide the dual benefit of providing a refuge for crossing path users, reducing the size of gap in traffic needed to cross the street safely, and may help alert approaching motorists and bicyclists to the presence of the crossing.

- Median islands should be at least 6 feet wide, to shield bicycles or more than one pedestrian.

- Trees along the roadside at the path crossing, and in larger medians, can call attention of on-coming motorists to the presence of the trail crossing. However, trees and other landscaping should not be allowed to infringe on the sight distance of pedestrians or motorists in the vicinity of the crossing.

- All median or channelizing islands should have pedestrian curb cut ramps or at-grade cut- through. At-grade cut-through should be sloped gently (maximum of 2 percent in the build condition and 1.5% in design)) to allow drainage.

This chapter has presented a discussion of the observations with the theory found in the literature.

Chapter Five - Conclusion and Recommendations:

5.1 Conclusion:

This thesis has established that human behavior and experience of public spaces can be influenced by the physical and ambient features of the built environment. It has been identified that physical features may include buildings, streets, landscaping, land forms and architectural elements, and ambient features may include sound, smell, temperature and illumination. It has also been identified that other factors such as age, gender, culture and ethnicity are also capable of affecting the way people respond to the environment.

The review of the literature on environmental psychology and the theories of behavior have revealed that the features of public spaces affect behavior because of people's physiological and psychological processes. Mehrabian and Russel (1974) showed that physical and ambient stimuli affect behavior and emotions in predictable ways, but the details of how it does this vary from theory to theory. The prevalent theoretical perspectives suggest that behavior is associated with people:

- levels of arousal (heightening of the brain activity),
- capacity to process physical and ambient stimuli,
- real or perceived degree of control over the environment,
- ability to adapt or adjust to the environment,
- responses to environmental stress, and
- perception of their surroundings

This thesis has focused specifically on public spaces because these spaces by their very nature provide the settings for the freedom of personal and social expressions, for a diversity of people. The features of public spaces are capable of contributing to desirable and attractive places.

Increased concern for the "human behavioral dimension" of city planning reflects a distinct and strong demand for better "urban quality". There

are direct connections between improvements for people in the city space and visions for achieving lively, safe, sustainable and healthy cities.

In conclusion, this thesis has emphasized the importance of attaining a meaningful understanding of the practical implications of design and development decisions, from an environmental psychology perspective. When planers and designers understand the effects of their decisions on the behavior and experience of people, they can apply that understanding to their work practices. It is considered that a deeper appreciation and understanding of the application of environmental psychology to public spaces will ultimately improve the quality of the built environment.

5.2 Recommendation:

"Streets and their sidewalks, and main public spaces of a city are its most vital organs However, there are some guidelines that can set the foundations for a great final design:

To keep it simple, maintain a simple and adaptable design that will allow for future enhancement of the space as funds become available and the community more involved. A good design should be able to adapt to change.

Accessible for everyone, provides ease, safety, and choice to people when moving to and through places. Helping people to find their way around and understand how a place works. Create paths and wayfinding signage to improve accessibility, orientation, and connectivity of spaces and functions. A clear hierarchy of streets and paths should be established to enable pedestrians, cyclists, and people with physical disabilities move around the city safely and quickly.

The character of the city, Protect and enhance the buildings, streets, materials, landmarks and views that are unique and give the city its identity. The appearance of the built environment defines an area's identity and character and creates a sense of place and community belonging.

Plan for people, not for cars, the streets are the interface between the public and the private realm. A street should be designed to accommodate all sorts of functions, not dominated by one, as in our modern society by the car.

Incorporate the local car movement in streets with priority to pedestrians and cyclists

Trust the user experience, when people walk, they tend to prefer straight routes and to use "shortcuts". distances are affected by the length of the street and the quality of the path, considering the sense of safety it offers as well as the diversity of stimuli it has to offer. People tend to avoid long detours from their predefined destination and if this destination is visible, they are heading straight to it.

Sustainability, Make it more energy and resource sufficient and lower the environmental impact of the project. Use materials found in the area that can be replaced easily.

By nature, good public spaces that respond to the needs, the opinions and the ongoing changes of the community require attention. Amenities wear out, needs change and other things happen in an urban environment. Being open to the need for change and having the design flexibility to enact that change is what builds great public spaces and great cities and towns.

List of References

Literature:

- Aghostin-Sangar, Venetin. 2007. Human Behavior in Public Urban Spaces. Msc Thesis, University of New South Wales, NSW, Australia: Faculty of the built Environment.
- Beattie, Nick and Lehmann, Guenter. 1994. 'Special Places: The Nature of Urban Space and its Significance'. Johnson, Louise C. (Ed.). 1994. Suburban Dreaming: An Interdisciplinary Approach to Australian Cities. Deakin University Press: Melbourne.
- Buagajska, 2003
- Bell, Paul A; Greene, Thomas C; Fisher, Jeffrey D; and Baum, Andrew. 1996. Environmental Psychology. 4th Edition. Harcourt Brace College Publishers: Sydney.
- Berger, John. 1973. Ways of Seeing. Penguin Books: London.
- Brebner, John. 1982. Environmental Psychology in Building Design. Applied Science Publishers: London.
- Canter, David. 1977. The Psychology of Place. The Architectural Press: London.
- Canter, David and Stringer, Peter. 1975. Environmental Interaction: Psychological Approaches to our Physical Surroundings. Surrey University Press: London.
- Carr, Stephen; Francis, Mark; Rivlin, Leanne G. and Stone, Andrew M. 1992. Public Space. Cambridge University Press: Cambridge.
- Ewing, Reid, and Susan Handy. 2009. "Measuring the Immeasurable: Urban Design Qualities Related to Walkability." Journal of Urban Design Vol: 14, no. 1 (February 2009): P65–84.
- French, Jere Stuart. 1978. Urban Space: A Brief History of the City Square. Kendall Hunt: Iowa.
- Gifford, Robert. 2002. Environmental Psychology: Principles and Practice. 3rd Edition. Optimal Books: Canada.

- Gehl, Jan, and Lars Gemzøe. 2001. New City Spaces. Copenhagen: The Danish Architectural Press.

- Hall, Edward T. 1966. The hidden dimension. NY, USA: Doubleday, Anchor Books Wagner, James. K. 1981. Creating Your City's Image. Washington DC: National Leaguer of Cities.

- Insel, Paul N. and Lindgren, Henry Clay. 1978. Too Close for Comfort: The Psychology of Crowding. Prentice Hall: New Jersey.

- Jakle, John A.; Brunn, Stanley; and Roseman, Curtis C. 1976. Human Spatial Behaviour: A Social Geography. Duxbury Press: Massachusetts.

- Levy-Leboyer, Claude. 1982. Psychology and the Environment. Sage: London.

- Lewin, K. 1951. Field Theory in Social Science. Harper & Row: New York.

- Lewis, Phillip H. Jr. 1996. Tomorrow by Design: A Regional Design Process for Sustainability. John Wiley & Sons: New York.

- Low, Setha M. 1987. 'Developments in Research Design, Data Collection and Analysis: Qualitative Methods'. Chapter 11 in Zube, Ervin H and Moore, Gary T. (Eds.). 1987. Advances in Environment, Behaviour and Design, Volume 1. Plenum Press: New York.

- Lynch, Kevin. 1960. The Image of the City. MIT Press: Cambridge.

- Madanipour, Ali. 2003. 'Why Are the Design and Development of Public Spaces Significant for Cities?'. Chapter 10 in Cuthbert, Alexander R. (Ed.). 2003. Designing Cities: Critical Readings in Urban Design. Blackwell Publishing: Melbourne.

- McAndrew, Francis T. (1993). Environmental Psychology. Brooks/Cole: California.

- Mehrabian, Albert. 1976. Public Places and Private Spaces. Basic Books: New York.

- Mehrabian, Albert; and Russel, James A. 1974. An Approach to Environmental Psychology. The MIT Press: Cambridge.

- Middlemist, R. D., Knowles, E. S.; and Matter, C. F. May 1976. 'Personal Space Invasions in the Lavatory: Suggestive evidence for

arousal' in Journal of Personality and Social Psychology. Volume 33, no. 5, p.p. 541-546.

– Mitchell, Lynne; Burton, Elizabeth; and Raman, Shibu. February 2004. 'Dementia- Friendly Cities: Designing Intelligible Neighbourhoods for Life' in Journal of Urban Design. Volume 9, No. 1, p.p. 89-101.

– Mossop, Elizabeth and Walton, Paul (Eds.). 2001. City Spaces: Art and Design. Craftsman House: St Leonards.

– Nasar, Jack L. 1998. The Evaluative Image of the City. Sage Publications: California.

– Pomeranz, David. 1980. 'Environmental Psychology'. Chapter 3 in Krasner, Leonard. (Ed.). 1980. Environmental Design and Human Behaviour: A Psychology of the Individual in Society. Pergamon Press: Sydney.

– Ponty, 1969

– Speller, Gerda. 2006. 'A Place of my Own' in Green Places. Issue 26, March 2006, p.p. 18-20.

– University of New South Wales, NSW, Australia: Faculty of the built Environment.

– Veitch, Russell and Arkkelin, Daniel. 1995. Environmental Psychology: An Interdisciplinary Perspective. Prentice Hall: New Jersey.

– Winikoff, Tamara (Ed.). 2000. Places Not Spaces: Placemaking in Australia. Envirobook Publishing: Sydney.

– UrbanGrowth NSW, Landcom Projects, (2008). Open Space Design Guidelines. pp. 1-56

Websites:

- ❖ Google search
- ❖ Wikipedia.com
- ❖ Pinterist
- ❖ Cape Cabarita, January 2007 [www.capecabarita.com.au]
- ❖ David Evans Morris (DEM), December 2006 [www.morrischia.com/david]
- ❖ DeWolf, Christopher. Urban Photo, January 2007 [www.urbanphoto.net]
- ❖ The Artists, December 2006 [www.the-artists.org]