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The Evaluative Image of Designed Open Spaces:
Social Use, Aesthetic Response, and Morphological Configuration

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A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Faculty of Architecture, Design and Planning
The University of Sydney
March 2011
ABSTRACT

Urban plazas and public open spaces play significant roles in the creation of livable cities. The aesthetic and morphological dimensions of public spaces are among the essential visual and physical characteristics that need to be understood for successful social use. A literature review revealed gaps in the theory of how the physical attributes, architectural features and morphological characteristics of the built environment enhance the aesthetic response and social interaction in designed public open spaces. This research sets out to articulate the relationship between physical, visual and morphological characteristics of the built environment of urban plazas and public open spaces that can create interactive social relations.

By using a mixed-method approach involving both qualitative and quantitative methods, this research addresses both the subjective and objective attributes that can influence users' aesthetic response and social use. The overall study was conducted in two stages. The use of photo-simulation in a preliminary study explored naturalistic inquiry to identify the most important aesthetically and socially preferred physical characteristics of designed urban open spaces from respondents' viewpoint. Based on their detailed responses and existing research literature, a list of the salient physical and visual attributes of designed urban open spaces important to preference is developed.

To objectively identify the relationship between the research constructs, eight designed urban open spaces of Dhaka, Bangladesh were selected and the main study involved 280 respondents. By using morphological (Space Syntax) and statistical analysis (ANOVA, Factor Analysis), this research seeks to examine the levels of association between aesthetic response, social use, physical attributes and morphological configurations of designed urban open spaces. The research concludes that the frequency of using urban open space is largely influenced by the morphological configuration of the urban structure. Aesthetic qualities are an additional, rather than a primary property of social interaction in the studied urban spaces. This study proposes a visualization model that illustrates the relationship between the research constructs for the future design of urban plazas and paved public open spaces.
Statement of Originality

This thesis is my original work, and has not been submitted, in whole or in part, for a degree at this or any other university. Nor does it contain, to the best of my knowledge and belief, any material published or written by another person, except as acknowledged in the text.

Farhana Ferdous

Approval of the Human Ethics Committee

The Human Research and Ethics Committee (HREC) of the University of Sydney granted approval for the survey component of this research (Reference No: 03-2009/11611 and 09-2009/12072).
ACKNOWLEDGEMENTS

This dissertation is a result of an arduous process and strenuous journey. Several people helped to improve my work and provided their thoughtful insight during this project. It is not possible to name them all. However, some played special and significant roles in either the dissertation research or my personal development during this phase of my scholarly endeavour. I would like to express my gratitude through this piece of writing.

In this endeavour, first I would like to express my sincere gratitude to two individuals who served as my Principal Supervisor and Associate Supervisor: Dr Duanfang Lu and Barrie Shelton. They brought unique insights from their positions in their respective areas of academic work and with their profound knowledge and expertise; they were constant motivators for me. I am grateful for their constructive suggestions, persistent exertion and enduring assistance at every stage of this research. I am indebted not only for their guidance and thoughtful critique as my mentors during this thesis, but all other aspects of their support for my development as a researcher, scholar and academician.

I would also like to thank Professor Gary T. Moore for his constant guidance and supportive supervision to assist in the initial development of this thesis at an early stage. The early development of this thesis, (especially the environmental design and research methodology section) would not have been possible without the thoughtful comments, insightful ideas and scholarly critic of Professor Moore and the scholars of the Environment Behaviour Society (EBS) Research Group at the University of Sydney. I would like to give my thanks to Dr Chumporn Moorapun, Azman Hassan, Nathalie Jean-Baptiste, Dr Donna Wheatley, Dr Tooran Alizadeh and Durdane Lafci of the EBS Research Group for their scholarly advice. I especially thank Dr Zena O'Connor for a thousand discussions, each one found its way into this study.

I would also like to give my thanks to my research assistants Shejuti, Jayanta and Polash from the Department of Architecture, BUET for their enthusiasm and effort to collect the data from urban open spaces in Dhaka, Bangladesh. I especially thank Mohammad Nazmul Ahasan, NAATI Accredited Professional Bangla Translator for translating the research questionnaire and supporting documents to meet the requirements of the Ethics Committee of the University of Sydney. Another person who has guided me through the ins and outs of editing and fine-tuning the dissertation is Dr Jennifer M. Gamble. She has provided insightful comments and
criticisms on each parts of an earlier draft of this research. I was moved by her profound
knowledge, enlightened personality and without her endless effort it would not have been
possible for me to submit this thesis in a timely manner. I am grateful for her unconditional
support and candour.

Finally I would like to recognize my family. My parents taught me from childhood to look at
the world critically and to enlighten other people through my knowledge. I am grateful to my
parents for a life long of love and affection, my three sisters for their adoration and
appreciation. Lastly, this research is an outcome of the continuous encouragement and moral
support of my husband Farhan Sirajul Karim. His endless emotional support, perseverance
and cooperation inspires me to move forward in every aspect of life.

I owe my very special thanks to all of them.

Farhana
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CHAPTER 1
INTRODUCTION
1.1 Introduction

The role of public space is essential for the well-being of communities and societies in general. Outdoor open spaces for example, parks, plazas, squares and other public open spaces, provide a vital connection with natural processes and improve the quality of life (Marcus & Francis, 1998). In urban environments, plazas and other public places serve as successful social spaces. Plazas can be defined as larger urban, open spaces with confined areas of significant space and size, located in any central part of the city, and designed to attract numbers of people for diversified use (Woolley, 2003). However, besides the multi-dimensional factors of the urban environment, aesthetic and visual qualities are essential to creating successful urban space. The design of public space can create a positive impact on the use of urban space, and from this viewpoint the designers of public space have a special responsibility to understand and serve the public good, which is also a matter of aesthetics (Carr, Francis, Rivlin, & Stone, 1992).

Urban design describes the design and functionality of all urbanized spaces and emphasizes the role on public spaces for example, the streets, parks, plazas and all kinds of open spaces that everyone shares (Dobbins, 2009). As the main focus of urban design is the public realm; the quality, workability and appropriate design of public spaces is vital for society. In the world's developed cities, rapid urbanization and commercialization are leaving few urban breathing spaces. Clearly, urban plazas and public open space can play a significant role in creating liveable cities and communities. The literature identifies the visual aesthetic dimensions of urban space as among the characteristics that enhance qualities of public space. Moreover, the morphological dimension and physical properties also influence the use pattern and built environment of urban spaces. However, a gap in the literature exists concerning the precise nature of the aesthetic characteristics of the visual elements that enhance the built environment of urban open spaces. Very little is known about the effects of these visual and physical dimensions of the urban environment on the social use of public spaces.

This research will explore the ideas that aesthetics of urban plazas and other designed open spaces not only depend on the physical characteristics and visual attributes, but the use pattern is also influenced by the morphological configuration of the surrounding street network. To achieve the research aims, this research will first explore the physical, visual and morphological features of three different types of designed urban open spaces. Therefore, to identify the most important attributes that influence aesthetic response to and social use of
those spaces i.e. pedestrian malls, squares and plazas. These findings are further corroborated in Dhaka, Bangladesh to test the ways in which the morphological dimensions, spatial configuration and other visual attributes can influence the aesthetics and social use of the built environment. It is apparent that the design and management of the physical environment can have an impact upon the opportunities of social use and other activities (Woolley, 2003). Moreover, by improving the aesthetic qualities of the built environment, urban designers and city design-related authorities can improve city form. Therefore, this research suggests, morphological properties, physical and visual characteristics are an essential dimension that can be used to evaluate the aesthetic response and social use of urban open spaces.

1.2 Definition of Different Urban Open Spaces and Research Terminology

Among the various types of urban open spaces, this research includes the following types of paved public open spaces for detail study. Moreover, this section also provides a short understanding of the research terminology used in this study.

1.2.1 Urban Open Space

Different authors, researchers and thinkers have used a wide range of definitions and classifications to define *urban open space*. They classified urban open space based on different activities i.e. single-minded (single activity), open minded (mixed use/ activity) and necessary, optional to social, legal ownership and boundaries i.e. public, semi-public, semi-private and private, open and enclosed etc (Carmona, Heath, Oc, & Tiesdell, 2010; Gehl, 2006, 2010; Madanipour, 2010; Shaftoe, 2008). In this research, urban open space can be defined as publicly accessible mostly hard surfaced, outdoor open spaces, which are designed and built for human activities and enjoyment. It should be open and accessible to the public without any restriction on public use (Francis, 1991). People usually share these urban open spaces with strangers in addition to friends and family to expresses public life and civic culture and allows for different types of activities (Gehl, 2006). For further clarification (Figure 1.1), this research classified designed urban public spaces in the following ways:
This research will consider the following three types of predominantly hard surfaced designed urban open spaces for further study.

**Pedestrian Malls**

The *pedestrian mall* can be defined as a street completely closed to traffic with pedestrian amenities such as benches, planting and other permanent design detailing. Malls are often located on the main street in downtown areas and comprise a number of continuous blocks along the shopping streets. This space is predominantly used by people on foot and design detail may include different street level furniture and landscaping without much provision for food (Marcus & Francis, 1998).

**Squares**

The *squares* are one of the oldest types of open space and usually exist in the older parts of cities. It is often an historic space and centrally located with major thoroughfares intersecting it. Although most squares are clearly defined by the surrounding built form or bounded by streets, sometimes the square is also linked to the street pattern of the city centre (Woolley, 2003). It often encompasses one or more complete city blocks on all four sides. Most squares in the USA are shaped within a square of the grid systems of the city that may be the result of the omission of buildings (Woolley, 2003). However, in European cities and medieval towns,
squares may be purposefully designed within the city fabric around which major public buildings like church or town hall are located. Squares can symbolize the community and larger society or culture of which it is a part (Carr, et al., 1992). Different political and social activities can usually take place in the squares when social unrest, events of national or state significance exists. Sometimes squares contain major monuments, statues or fountains to attract a variety of users and activities where hard-paved surface and planting or soft-green surface are often finely balanced.

Plazas

Plazas are larger urban open spaces than squares and are significant spaces in size (Woolley, 2003). Plazas are predominantly hard surfaced, centrally located and highly visible. Plazas have been identified as large, ceremonial and monumental urban spaces, which are often the settings for programmed events or gathering spaces (Marcus & Francis, 1998). To increase public access to waterfront areas many urban spaces in cities developed waterfront plazas that may also contain major monuments, sculptures or fountains. The significant difference is that waterfront plazas are predominantly hard surfaces and do not necessarily belong to any historic spaces like the squares (Marcus & Francis, 1998) however, may composed with market centre, different commercial or recreation activities.

1.2.2 Aesthetic Response

The operational definition of aesthetic response comprises a bundle of responses that includes emotional reactions, affective appraisals and cognitive judgements (Nasar, 1994). Although aesthetic response and experience is partly cognitive, sensual and affective qualities influence this perception. Therefore, the central concerns of aesthetic response are how people feel, sense, perceive and experience something (O'Connor, 2006; Taylor, 2009). To define the construct of aesthetic response, only four variables: pleasant-unpleasant, beautiful-ugly, like-dislike and desirable-undesirable were used in this research.

1.2.3 Social Use

The definition of social use is the way in which people use any space. It occurs spontaneously as a direct consequence of people moving about and being in the same spaces (Gehl, 2006). The term social use in this research refers to spontaneous activity and use pattern of people in publicly owned civic urban open spaces. The respondents or user group of public urban open spaces categorizes the variables used to define social use for this research. Factor analysis is
used to identify the components and variables linked to the construct of social use. This construct is further divided into two sub-constructs, active and passive social use.

1.2.4 Urban Morphology

In the late 1960s, urban design replaced the term civic design and city design. The earlier terms implied a focus on city hall, civic buildings, overall nature of the city and their relationship to open spaces. However, urban design theory is based on an enhanced understanding of the person-environment relationship (Lang, 1994, 2007). It is a creative, collaborative process that involves shaping the forms of the city, enhancing the experience and improving the functions of human life (Stevens, 2007; Wall & Waterman, 2010). Urban morphology is a branch of urban design that involves the form and structure of urban space. The urban morphology of Dhaka, Bangladesh is characterized by its unique high density structure and compact urban pattern. In this research space syntax is used as an analytical tool to measure the morphological characteristics and configurational properties of the urban system (Hillier, 1996; Hillier & Hanson, 1984). In addition to analysing the evolution and changes of urban structure of Dhaka city, the layout and configurational analysis of urban form and the morphological, spatial structure of the urban open spaces of Dhaka has been focused.

1.3 Research Aims, Objectives and Questions

1.3.1 Research Aims

This research is an empirical and spatial study of visual, physical and other morphological features of the built environment and configurational properties of urban grid to evaluate aesthetic response to and social use of designed urban open spaces (Figure 1.2). The purpose of this research is twofold. The first is to identify the visual and other physical characteristics of the built environment of designed urban open spaces, aesthetically and socially from users’ perspectives and to evaluate their levels of association. The second purpose of the research is to investigate the morphological structure and spatial configuration of the selected designed urban spaces in Dhaka, Bangladesh and their position in relation to the wider city context to ascertain how their configurational properties affect the uses of the selected spaces. It also includes determining users’ movement rates along the grid in order to find out a relation between the morphological properties and social use of urban plazas and designed open spaces. To achieve the above research aims; in the following section the specific research objectives are outlined.
The Evaluative Image of Designed Open Spaces: Bangladesh

Figure 1.2 Graphical representation between research constructs and variables

1.3.2 Research Objectives

The major objectives are:

a. To identify the visual and physical characteristics of designed public urban open spaces that contribute to aesthetic response and social use
b. To ascertain the levels of association between physical characteristics, aesthetic response and social use of urban plazas and designed open spaces.
c. To determine the pattern of the relationship (if one exists) between aesthetic response and social use of urban plazas and designed open spaces
d. To reveal the spatial morphological configuration of the surrounding grid of designed open space, its relationship with users' movement rates and to corroborate the effects of that grid configuration on social use

1.3.3 Research Questions

1. How do the physical characteristics of the built environment of urban open spaces affect people's aesthetic response and social use?

1a. What are the most salient visual and physical characteristics in terms of their effect on aesthetic response?

1b. What are the most important visual and physical characteristics in terms of their effect on social use?

2. Are variations in overall aesthetic response and social use associated with the most salient physical characteristics of designed urban open spaces in Dhaka?
2a. What are the levels of association between aesthetic response and the most salient physical characteristics of designed urban open spaces in Dhaka?

2b. What are the levels of association between social use and different types of designed urban open spaces in Dhaka?

3. What kind of relationship exists between aesthetic response and social use of designed urban open spaces in Dhaka?

4. Are variations in social use associated with the morphological configurations of designed urban open spaces in Dhaka?

1.4 Scope of this Research

This research focuses on aesthetic response, social use and morphological configuration of mostly hard-surfaced designed public urban open spaces. Although urban open space can be broadly classified into various types; for the preliminary study this research only considers pedestrian malls, squares and plazas. For the main study, eight designed public urban open spaces of Dhaka city were investigated. Due to the lack of urban spaces in Dhaka city in terms of diversity and numbers, this research used the broader term ‘urban open space’ and the number of the study areas was limited to eight. However, for statistical and morphological analysis this number was not a limitation as a large number of respondents participated (280 in total) in the main study.

Regarding the term aesthetic response, definitions may vary depending on the focus of various research domains. In addition, perceptual experience may vary over time with diverse situations, place in the life-cycle, seasonal changes and the changing nature of values and attitudes. Aesthetic response therefore, incorporates the interaction of socio-economic-cultural and environmental factors. This research is not concerned with how people perceive and evaluate different visual characteristics in a broader sense; rather the pattern of response is limited to a range of specific variables, which is detailed later in this thesis. Moreover, this research identified patterns of response without delving into the underlying reasons. This is a limitation of the current research but at the same time opens up potential for future research.

Referring to the construct of ‘social use’ in this research, the researcher relied on statements by participants about their use, activity and enjoyment of those selected designed urban
plazas, square and pedestrian malls for photo-simulation. In addition, in the main study there was no physical observation of the ways in which the respondents used the eight urban plazas or designed public open spaces. Therefore, the findings and conclusions are based on the statements of users and respondents, not on the observed use pattern noted by the researcher.

To measure the constructs of aesthetic response and social use, in the preliminary study this research used static visual stimuli as surrogates for the existing physical environment. Using photographic images of different urban plazas, squares and pedestrian malls promoted to a diversity of responses from the respondents to identify the physical and visual characteristics. Furthermore, the logistics of evaluating and exploring different physical and visual characteristics in situ for the preliminary study was beyond the resources of this research. However, in the main study, this research used the existing settings of eight urban open spaces in Dhaka, Bangladesh. Therefore, the generalizability of findings to similar built environmental conditions can be accepted.

For the space syntax and morphological analysis, only the rudimentary concepts and theories are discussed and applied within the urban structure of Dhaka, Bangladesh. Other than the integration, connectivity, intelligibility and pedestrian movement rate, concepts of convexity, spatial cognition, visual field and other advanced syntactic measures have not been applied to this study due to time constraints. This is another limitation of this study, although to investigate these other concepts provides an opportunity for future research.

The research was concerned with the visual, morphological and other physical and visual features of the built environment and the configurational properties of surrounding urban grid to evaluate aesthetic response to and social use of urban plazas and designed open spaces. Therefore, only physical, visual and morphological properties of urban plazas and open spaces were explored without considering environmental, seasonal changes, socio-cultural, economical, historical, life-cycle, demographic and other influential factors of the participants and the surrounding environments. However, it is completely acknowledged that all of these factors can have a significant impact on perception, aesthetic response and use pattern of spaces, each of which is beyond the scope of this research.
1.5 Research Outline and Structure

This research is organized into the following six chapters:

Chapter 1 defines the context of the study, introduces different types of open space relevant to this research as well as different terminology associated with the research topic. After stating research aims and objectives, this section outlines the scope and limitations of the research. This chapter concludes by summarizing the thesis structure with reference to its objectives.

In Chapter 2, the theoretical review and literature relevant to the research is carried out where the visual, social and morphological dimension of the urban environment is highlighted. The first section critically reviews different morphological ideas about successful public urban open spaces. By analyzing and synthesizing the work of previous influential authors, this section presents concepts about the spatial configuration of urban plazas, squares and other urban open spaces. The next two sections introduce the aesthetic, visual and social dimensions of the urban environment and the theory and models related to the research. This chapter also introduces the theory of space syntax (Hillier, 1996; Hillier & Hanson, 1984) that has been used to measure the configuration and spatial properties of urban plazas and designed open spaces. By reviewing the relevant literature this chapter concludes by stating the rationale of this research.

Chapter 3 explains and elaborates in detail the methodological framework that has been executed in this research. The first few sections describe the research design, plan and mixed-method approach by introducing the question and hypothesis of this study. In addition to the epistemological and theoretical concepts, this chapter also describes the sampling process, data collection and methods of data analysis adopted for the preliminary and main study. The findings of the preliminary study and the implications of the results for the main study are also stated at the end of the preliminary study section. This chapter outlines the criteria for selecting the sample spaces, the techniques of the measuring instruments, pedestrian movement analysis and trustworthiness of the research. The last section acknowledges the strengths and limitations of the research process and methodology.

Chapter 4 presents the results of the main study for aesthetic response and social use from statistical analysis. By using the statistical program, SPSS (Statistical Package for the Social Sciences), different statistical analyses such as, factor analysis, correlation, analysis of variance for aesthetic response and social use are identified. Analysis of variance (ANOVA)
compares the mean scores between different groups and within each of the groups (Hinton, 2004; Kinnear & Gray, 2009; Pallant, 2007). By using the SPSS analysis, this chapter determines the levels of association between physical characteristics of designed urban open spaces, aspects of aesthetic response and social use.

The objective of Chapter 5 is to investigate the morphological and spatial analysis of urban layout as well as the eight study areas of Dhaka city. The first section describes the historical evolution and spatial configuration of the total urban system of Dhaka. By using space syntax (Hillier, 1996), different configurational measures of the urban layout are conducted. This spatial analysis conceptualizes the evolution and growth pattern of the urban spatial network. The following section highlights the spatial structure of the eight study areas in relation to the most important space syntax measures such as, global and local integration, connectivity, intelligibility, the presence of attractors and movement. The last section emphasizes the spatial function, social use and activity pattern of the eight urban open spaces in relation to the morphological configuration. It also highlights the interrelationship and comparative analysis between accessibility, spatial structure and use pattern of the study areas.

Chapter 6 concludes with a general discussion by distilling the findings of the above discussed chapters. Through understanding the relationship between aesthetic responses, social use, pedestrian density and morphological properties of designed urban open spaces, this study aims to examine the interrelationships and factors that may influence the types and frequency of use of the spaces. Finally this research proposes a model by analysing the factors that may lead to design aesthetically soothing and socially usable urban plazas and designed open spaces. This concluding chapter further outlines the design principles and suggestions for future studies of designed urban open spaces.
CHAPTER 2
THEORETICAL BASIS AND LITERATURE REVIEW
2.1 Introduction

To determine the pattern of aesthetic response and its relationship to social use, this study focuses on the effect of urban grid configuration, physical characteristics and natural movement in and around the selected designed public urban open spaces. Therefore, for the purpose of this study, it is important to identify what physical, visual and morphological characteristics influence the aesthetic and visual dimensions of the environment and how they are related to the social use of that space. To understand the spatial configuration of the urban street network, it is also necessary to understand the theory of space syntax, natural movement, urban attractors and their relationship with the use pattern of that space.

This chapter is divided into five sections where, the first three sections are concerned about different concepts and approaches appropriate to the physical and morphological features, aesthetic and social dimensions of urban plazas and open spaces. The first section concentrates on the work related to morphological and spatial quality of traditional urban plazas, squares and open spaces. The second section focuses on the aesthetic visual dimensions, affective appraisal and perceptual components of the environment. The third section reviews literature related to the pattern, types of social use and behavioural studies focusing on the use of public urban open spaces. The fourth section introduces the manner in which the configurations of urban street networks are analysed by using space syntax techniques. In this section, different configurational measurements and the theory of natural movement portray the spatial measure of urban grid. The last section is based on the above review and argument, highlighting the gaps in related domains and the rationale for this research.

2.2 The Physical and Morphological Features of Urban Plazas and Designed Open Spaces

For the purposes of this research, *plazas* can be defined as 'mostly hard surfaced, publicly accessible outdoor open spaces', which are designed and built for human activities and enjoyment. Plazas are facilities designed to act as an activity focus at the heart of intensive urban areas from which cars are excluded, and which function as places for strolling, sitting and eating and watching various activities (Marcus & Francis, 1998). A number of authors emphasize the spatial and morphological features of urban plazas and squares to develop different ways to improve the visual quality, and the social and functional performance. Among them, Camillo Sitte (1889) is known as the 'father of the modern urban design',
whose artistic ideas and aesthetic approaches to the morphology of traditional urban squares and plazas have influenced the work of modern designers. He identified enclosure and asymmetry of the surrounding buildings, in addition to the size and proportion of the urban square as contributing to the success of any urban space (Sitte, 1889a, 1889b, 1898).

Raymond Unwin (1909) investigated several medieval squares and identified enclosure and proportion as the most important elements of those traditional urban spaces. The ‘irregularity’ of the surrounding buildings, no matter whether they result from unconscious growth or conscious design, contributes to achieve a picturesque effect. In addition to offering a sense of completeness, Unwin believed that the enclosure of the surrounding buildings provides a ‘proper frame’. He also pointed out that the congregation of people in a square depends on the importance and identity of the surrounding buildings and the location of that square. Ideally a square should be located at the focal point of the main traffic line with long vistas from and to the square to attract people (Unwin, 1909).

Paul Zucker (1970) focused on the morphological analysis of squares and identified enclosure as an important element of townscape. The form, uniformity, variety of the surrounding buildings, the dimensions and proportions of the square, the position of monuments, sculptures or fountains in addition to the angle of the entry street are important morphological aspects of traditional squares. The visual effect of ‘townscape’ is another important spatial morphological aspect that emphasizes towns’ and cities’ morphology. In regard to this, Gorden Cullen (1961, 1971) highlighted visual survey or ‘serial vision’ to observe group composition or picturesque effects of urban spatial features in a series of diagrams. To describe the urban environment, visual delight and aesthetic, the visions of urban spaces are represented by sketching the streetscape, a series of serial visions (Cullen, 1961, 1971, 2007).

Frederick Gibberd (1967) also emphasized that enclosing elements, visual and architectural characteristics of the surrounding buildings such as, vista, entrance, arcades etc. could enhance varied and continuous activities within a square. He pointed out how the position of enclosed buildings could achieve a coherent, harmonious composition within an urban square. Moreover, the size and proportion of a square can contribute to achieve a sense of spatial enclosure. This enclosure concept is further highlighted by the argument of Jere Stuart French (1984). According to French, to create a sense of well being, comfort, intimacy and safety, enclosure plays an important role. The inner dimension of a square and the quality of the
enclosing elements i.e. wall planes are the primary elements that ultimately create a sense of enclosure.

Joarder and Neill (1978) examined ten public plazas in downtown Vancouver and identified different landscaping elements as significant for the perception and use of urban space. Other than these landscape elements for example, trees, fountains, monuments, colour of pavement, seating arrangements and configuration of space also significantly influence human perception of space (Joardar & Neill, 1978).

Crowhurst-Lennard and Lennard (1987, 1995) state the necessity of public open spaces for the liveability of any city and identify a sense of enclosure, presence of surrounding enclosure and the position of focal points as the most important elements for creating successful urban plazas and squares. The authors identified a list of socio-morphological design principles to accommodate social functions and visual experience. According to Crowhurst-Lennard and Lennard, public space should be accessible to the pedestrian, should be located at the heart of the city or neighbourhood, and the size, shape and visual enclosure should be proportionate with appropriate enclosure, natural elements and a sufficient number of seating arrangements.

Regarding the morphological aspects, Marcus and Francis (1998) highlight the importance of visual complexity of design elements and emphasize variety of forms, colour, vegetation, seating spaces, monuments, sculptures, water body or fountains and public arts as the essential elements that contribute to the success of urban plazas. They further indicate the significance of the transition and edge treatment of open space in addition to well-organized internal spatial layout to create pleasing, comfortable and usable ‘public places’ for users (Marcus & Francis, 1998).

Cliff Moughtin (2003) argues that urban form is usually composed of buildings, streets and public squares. According to him, public squares could be compared with ‘outdoor rooms’ therefore; enclosure is the purest expression of a sense of place, where corner treatment of the enclosure is the vital issue. After investigating a number of European squares Moughtin identified the height of enclosing buildings, size and shape of the squares, presence or absence of visual elements, and a variety of spatial compositions as important factors to determine the enclosure of urban squares (Moughtin, 2003).

To understand the relationship between circulation, accessibility and urban design, Steven Marshall (2005) highlighted the role and structure of street layout in designing urban space.
Marshall stated that road-grounded and urban design theories are grafted with each other and good urban structure is necessary to create good urbanism. He explored different kinds of streets and patterns to take up the challenge to create better urban places without compromising the functionality of circulation space. The route structure of urban layout is analysed and different kinds of hierarchical structure are explored to underpin today’s streets-oriented urban design and urban morphology agenda (Marshall, 2005).

By reviewing the extensive literature, it is clear that physical and morphological characteristics are the key determinants for the functionality and use of urban plazas, squares and open space. The success of traditional urban space is largely associated with the social need, use and function of the space. Therefore, the design and functional dimensions are the key factors contributing to the aesthetics, accessibility and use of urban open spaces. The following section highlights some aesthetic-visual dimensions of the environment. Therefore, exploring the relationship between environmental aesthetic qualities and social interaction of urban plazas and open spaces are imperative, given that urban space serves as urban relief for city dwellers in urban environments.

2.3 Aesthetic and Visual Dimensions of the Environment

According to this research hypothesis, there is a strong relationship between the built environment, aesthetic dimensions and the social use of urban space. Camillo Sitte (1889) recommended two primary elements, nodes and paths in addition to the artistic elements i.e. fountains and monuments as the most important features for planning and designing of urban forms (Sitte, 1889b). Kevin Lynch (1960) further developed this essential characteristic of urban forms and identified paths, edges, nodes, districts and landmarks as the vital components to define the quality of the city image. According to Lynch (1960, 2007) the environmental image is comprised of three components: identity, structure and meaning, where identity refers to object recognition as a separate entity, structure represents the pattern of relationship that inherently exists within an environmental image, and meaning relates to the practical and emotional meaning that the environmental image holds for the observer. Nasar (1998) stated that the third component, meaning, infers the concrete (denotative), emotional (connotative) and abstract (higher level with broader values) meaning of the environment and these feelings and meanings are also central to our perception and reaction to the environment. He argued that the evaluative image also represents some psychological constructs that involve subjective assessments of feelings about the environment. Affective
The Evaluative Image of Designed Open Spaces: Bangladesh

Appraisal is one aspect of how someone interprets an environment in terms of psychological arousal. For example, it may be pleasant, interesting, exciting, stressful etc. Russell focused on the emotional appraisal of the physical environment and found four dimensions of emotional reactions: pleasant, arousing, unpleasant and sleepy (Russell, 1988) (Figure 2.1).

![Figure 2.1 Categorical descriptors of the affective quality of environments (Russell, 1988, p. 122)](image)

Kaplan and Kaplan suggested an *environmental preference* framework to evaluate the physical environment (Figure 2.2). In this diagram, 'coherence' and 'complexity' imply the immediate appreciation of an environment while 'legibility' and 'mystery' refer to longer term evaluation (Kaplan & Kaplan, 1982). Exploring the environment extensively to acquire more information is the most important criterion for future longer-term evaluation of the environment. These four factors act as interactive mental constructs between the observer and the environment.

<table>
<thead>
<tr>
<th>PRESENT or IMMEDIATE</th>
<th>Making Sense</th>
<th>Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COHERENCE</td>
<td>COMPLEXITY</td>
</tr>
<tr>
<td></td>
<td>Environments easy to organize or structure</td>
<td>Environments with enough in the present scene to keep one occupied</td>
</tr>
<tr>
<td>FUTURE or PROMISED</td>
<td>LEGIBILITY</td>
<td>MYSTERY</td>
</tr>
<tr>
<td></td>
<td>Environments suggesting they could be explored extensively without getting lost</td>
<td>Environments suggesting that, if they were explored further, new information could be acquired</td>
</tr>
</tbody>
</table>

![Figure 2.2 Environmental preference frameworks (Kaplan and Kaplan, 1982, p 81)](image)
The traditional definitions of aesthetics often refer to the perceptions of beauty in the arts and implies intense feelings that are sublime (Lang, 1987). Lang defined the visual aesthetic dimension of the urban environment as one of the essential criteria for the environmental evaluation of urban space. Ulrich defined aesthetic response as favourable emotional appraisals or evaluations (1983). According to Smith (1980), intuitive capacity for aesthetic appreciation has been influenced by four distinct components that transcend time and culture. These are: sense of pattern, appreciation of rhythm, recognition of balance and sensitivity to harmonic relationship. Other researchers suggest that the use, meaning and order of a city design can be determined from existing social situations and use, instead of through visual arguments and orders (J. Jacobs, 1962; Jarvis, 2007). Regarding the aesthetic of townscape, Ashihara (1984) and Goakes (1987) describe different architectural aspects, which relate to the design of cities and townscapes. Goakes identified different components of the townscape by explaining the visual character and aesthetic treatment while Ashihara analysed aesthetic concepts of Japanese spaces from a Western viewpoint (Ashihara, 1984; Goakes, 1987). Therefore, aesthetic preference of the observers or users not only depends on the building attributes but is also a complex process with a combination of affective qualities of the environment and the environmental preference framework. Aesthetic preference can be also understood as favourable emotional appraisals of the environment, which are mediated by the affective quality and interactive mental constructs of the environment.

A number of studies have been carried out to search for the affective meaning that people attribute to their environment. Several subjective attributes of physical environment can influence the aesthetic response to urban plazas and open spaces. An understanding of the relationship between affective variables and aesthetic response may lead to an understanding of how human responses are related to perceptual qualities of stimuli. From previous studies it has been observed that some affective variables as well as cognitive judgements are included to measure the aesthetic response (Abu-Obeid et al., 2008; Devlin & Nasar, 1989; Kunawong, 1986; Nasar, 1992; O'Connor, 2006, 2008; Taylor, 2009). Several perceptual, cognitive variables can measure the visual properties of a physical environment and arousal, evaluation and preference have been used to measure affective variables. Nasar stated that there are several visual characteristics, which can act as mediators for the urban environment, such as order, naturalness, openness, upkeep, historical significance etc (Nasar, 1998).
Over the last few decades, using empirical approaches to address environment behaviour studies of urban open spaces has become common. This research sought to examine the interface between the physical characteristics of urban plazas and aesthetic response and Nasar's (1994) probabilistic model of aesthetic response to the built environment provides a useful framework for this study and to understand the theoretical frameworks. From Nasar's model of aesthetic response, it has been clear that affective variables as well as perceptual, cognitive variables influence the aesthetic response of observers (Figure 2.3). Nasar considered that overall aesthetic response is a combination of perception, cognition, affect and affective appraisal by the observer. Aesthetic response involves perceptive and cognitive judgements of building attributes as well as the emotional reactions in terms of psychological response and connotative meanings of affective appraisal. Further, Nasar's model acknowledged that affect, cognitive judgements and affective appraisals of building attributes are highly inter-related and complex. Hence, his model is probabilistic rather than predictive, due to the influence of individual characteristics, personality, affective state and cultural experience of individual observers. Nasar also argues that the evaluative process, which may involve two kinds of variables, results from a complex process between observers (people), the cityscape (environment) plus an interaction between the two. Designers can improve the evaluative image by shaping the observer or shaping the city form. As such, the evaluation process involves psychological constructs that also reflect subjective assessments of feelings about the environment (Nasar, 1998). Nasar (1994, 1998) also stated that denotative meaning refers to the fundamental meaning, concrete or evaluative variables that are related to the physical attributes of any settings. Connotative meaning is associated with affective responses to the quality and emotional content of the formal organization, building and its users. Aesthetic response to a style depends on the characteristics of formal organization.
From the review of related literature, it is apparent that there is a growing demand and need to measure environmental aesthetics as well as the response towards the aesthetics of built environments. Although there are various operational measures and factors of aesthetic response, only few attempts have been made to measure aesthetic response towards the built environment as well as to gauge the overall evaluation of environmental aesthetics. The model of aesthetic response provides ways to represent and investigate the aesthetics of the built environment that may also act as a reference framework for future research work.

2.4 The Public Open Space and Social Use

The literature on urban design emphasizes the role of, and need for, meaningful public spaces that will enhance public life and social interaction (Carr et al., 1992; Gehl, 2006; Holland et al., 2007; J. Jacobs, 1962; Lynch, 1981; Skjæveland, 2001). The Latin word *public* refers to people therefore, public space can be interpreted as a space open to people as a whole (Madanipour, 2010). According to the various definitions of public space, it can be defined as a "space that is not controlled by private individuals or organizations and is open to the general public. This space is characterized by the possibility of allowing different groups of people, regardless of their class, ethnicity, gender and age to intermingle" (Madanipour, 1996, pp. 144-145). ‘Accessibility’ and ‘permeability’ identified as the key features of public space, make it more public and usable to urban dwellers in different forms (Loukaitou-Sideris & Ehrenfeucht, 2009; Madanipour, 2010). In another way, public spaces are “publicly accessible places, where people go for group or individual activities” (Carr *et al.*, 1992, p. 50). Civic
urban open spaces or public spaces in the urban context are those in which people not only meet relatives and acquaintances but a whole range of people from other neighbourhoods within the metropolis (Woolley, 2003). Urban open space is a publicly owned space, where people regularly meet their friends, watch daily life and it plays a critical role in peoples’ lives (Low, 2000; Low & Downe, 2002). Low and Smith also defined public space predominantly as urban space in which, the urban and the city remains the privileged scale of analysis and site respectively in many current treatments of public spaces (Low & Smith, 2006). At the same time, there has been a growing demand and resurgence in the use of existing and new pedestrian orientated streets, squares, plazas and other traditional types of public spaces in cities (Carr et al., 1992; Gehl & Gemzoe, 1996, 2001; Whyte, 1980).

By reviewing different models of human needs, Jon Lang (1994) tried to redefine the relationship between human needs, the built environment and the concept of functionalism (1994, 2007). However, by redrawing Maslow’s (1943) hierarchy of needs, Childs (2006) offers an interpretation of social interaction in public place with taxonomy of uses (Figure 2.4). Childs classified human needs and desires in urban public space and replaced Maslow’s psychological needs with ‘social interaction’ and identified it as the second most important aspect of human life after the basic needs (Childs, 2004). Maslow’s psychological needs include a sense of belongingness, love and esteem needs such as prestige and feelings of accomplishment that could be easily fulfilled through social interaction in a public space.

![Figure 2.4 Redrawing of Maslow’s hierarchy of needs (Childs, 2006, p. 49)](image-url)
According to Garba (2010), public space should be accessible to and used by the public as a focus of community social life. She identified the macro and micro level of urban scale activities for socialization and stated that socialization occurs from macro cultural level to micro place practices. Society and public spaces are transformed dynamically in time. Garba also proposed a model of public space by highlighting the cultural context and social life in public places (Figure 2.5).

In the urban environment, plazas have been identified as large urban public spaces with confined areas but significant spaces in size (Woolley, 2003). Kevin Lynch (1981, p. 443) suggested that “the plaza is intended as an activity focus, at the heart of some intensive urban area. Typically it will be paved, enclosed by high density structures and surrounded by streets, which contains features to attract groups of people and to facilitate meetings.” It is a place ‘in its own right’ rather than spaces to pass through that can function for different social activities. Some researchers have described plazas and other public spaces as ‘high-speed footpaths’ and as ‘an architectural device rather than a social device’ (Jensen, 1981). In contrast, Carmona et al. (2010) contend that successful public spaces can be characterised by the presence of people, and they provide for economic, social and cultural transactions. They further argue that besides imageability, accessibility, uses and activity; ‘sociability’ is one of the key attributes of successful public places. The streets, plazas, squares, parks and other
urban public spaces can be identified as the potential to be ‘the stage upon which the drama of communal life unfolds’ (Carr et al., 1992). Therefore, the social use of public space plays a significant role for creating lively urban spaces.

From the mid 1970s on, several behavioural studies of plazas were published, the focus of which has been upon the social use of Western city plazas however, they lack any cross cultural perspective (Marcus & Francis, 1998). During the 1980s, William Whyte observed 18 representative New York City plazas. He identified the amount of sitting space, the sitting height, shaded-sun, wind, vegetation and water features as important for the successful use of plazas (Whyte, 1980). Whyte further suggested that a comparatively small sized, enclosed urban space, with a high proportion of couples and women, in addition to food facilities, could perform well vis-à-vis the social use of plazas. Scholars also determined the beneficial logic of social interaction among the communities within urban public space. Urban streets, squares, plazas and other outdoor spaces can serve as places for activities and to provide opportunities for ‘short term, low-intensity contacts’. These spaces also constitute easy interactions with other people in a relaxed and relatively undemanding ways (Gehl, 1987; J. Jacobs, 1962). These ‘short-term, low-intensity contacts’ or weak ties are possible beginnings of deeper and more long-term social interactions and engagements between people (Gehl, 2006; Granovetter, 1973; Greenbaum, 1982; J. Jacobs, 1962). Other researchers also suggest that associations with people, places and events contribute to a sense of familiarity and belonging to the community (Hester, 1984; Oldenburg, 1981; Oldenburg & Brissett, 1982). Urban open spaces often serve as places for small local business or informal community gathering places in the neighbourhood that Oldenburg (1981, 1982) has termed third places. Hester contends that these places are ‘public and ambiguously owned private spaces’ and can attain a sense of ‘collective-symbolic ownership’ (Hester, 1984).

Banerjee and Loukaitou-Sideris explored the comparative studies of plazas, their politic-economic influence, patterns of use and levels of success (Loukaitou-Sideris & Banerjee, 1993). On the other hand, Joardar and Neill examined the emotional and behavioural responses of people to urban plazas in Vancouver, Canada (Joardar, 1977; Joardar & Neill, 1978). They indicated that both the natural and man made elements i.e. fountains, sculptures, trees, seating, pavement and so on, significantly affect people’s perception and use of urban space. There is also a growing academic interest represented by the phenomena of unintentional and informal uses of urban public spaces as discussed in recent publications.
Most of the authors are very concerned about the unintended, playful and insurgent uses of urban spaces. These can be identified as uses of space apart from the aesthetically and behaviourally controlled, and acting as non-instrumental, active, unpretentious, playful and informal urbanity, separate from everyday urban public space (Chase et al., 1999; Franck & Stevens, 2007; Hou, 2010; Laguerre, 1994; Stevens, 2007; Watson, 2006).

Cities are all about human activities and successful people-friendly cities facilitate and promote social interaction through public spaces (P. C. Smith, 2006). Therefore, it is clear that the motivation for using public spaces as well as the relationship between physical characteristics, aesthetic settings and social use of urban paved space is an important domain of research. From the above argument, it seems that the need for urban plazas as public space is obvious for a liveable community. It is therefore essential to explore the visual and social dimensions of urban environments in order to ascertain what physical characteristics are needed for the creation of successful public spaces. The aesthetics of the built environment represent yet another factor that to some extent depend on the visual attributes of physical characteristics. Thus, it seems imperative to explore the relationship between environmental aesthetic qualities and social interaction of urban plazas and other paved public open spaces, given that these spaces serve as a form of urban relief for urban dwellers.

2.5 Space Syntax: A Configurational Analysis

Space syntax is a set of descriptive techniques for representing, quantifying and modelling spatial configuration in buildings and settlements. Space syntax theory describes and measures quantitatively the relational properties of urban space (Hillier, 1996; Hillier & Hanson, 1984). In this context, the theory of urban space is described in terms of abstract properties of a topological nature rather than in terms of geometric regularities; and space is conceived of as a relational pattern, which can be explored and understood without being directly visible in its entirety. Above all, space syntax builds a conceptual model to investigate social patterning in spatial content and, spatial patterning in the social content (Peponis, 1989).

According to Marshal (2009), urban order is equivalent to syntax and for successful city design, urban ordering or syntax is essential. A network of pedestrian paths can be described as a hierarchy, such that path segments that are located centrally are more likely to host more people, ‘all other things being equal’. The space syntax model in particular involves a non-
metric transformation of space and suggests that at least some of the variation in pedestrian presence in a network can be explained by topology. Thus, the socio-spatial patterning of the perceived local areas seem most likely to be revealed by the spatial analysis of space syntax. The successful intervention and use of space syntax as a design, planning and decision-making tool is widely accepted by professionals involved in architecture and urban design (Choi et al., 2006; Eyüboğlu et al., 2007; Saif Haq & Zimring, 2003; Hillier, 2004; Moirongo, 2002). It assists the analysis of patterns of connection, differentiation and centrality to characterise and explore the relationships of urban systems. Three transcriptions - axial, convex and visual fields are commonly used to break a layout into its constituent elements. In this research only the concepts of axial lines and axial maps are explored and these are syntactically analysed with different configurational measurements. In order to give a clear understanding of spatial measures, the concept of different configurational measurements and technical terms are discussed in the following section.

2.5.1 Different Configurational Measurements in Space Syntax

2.5.1.1 Axial map

The ‘axial map’ is the basis of layout analysis in urban grid, and this represents the urban fabric as a pattern of spatial relations. It is a network of fewest and longest sets of intersecting lines that pass through all the urban system necessary to cover all spaces (Baran et al., 2008; Batty & Rana, 2004; Jiang & Liu, 2010; Kim & Penn, 2004; Turner et al., 2005). This represents how far observers have an uninterrupted impression of visibility and permeability as they move about town and look into the distance, towards various directions. This means that two individuals will be able to see each other if they stand at each end of an axial line. The map is derived by drawing the fewest and longest axial lines of uninterrupted permeability, which are necessary to cover the public open space of an area or city. Axial maps are used to calculate a set of measurements of syntactic properties of space and the size of a system is measured in terms of the number of lines (Hillier & Hanson, 1984). They are global representations of the spatial structure of settlements. Figure 2.6 represents the natural geometry of people moving in a space ranging from a simple axial line to a complex convex isovist. Where, an Isovist is a two dimensional field of view available from a specific vantage point and a horizontal slice parallel to the ground plane is then calculated at eye height (Dalton & Bafna, 2003).
2.5.1.2 Integration: Global and local measure

Among a number of spatial measures, the most important is ‘integration’, which is the relative depth or shallowness of any spatial system seen from any particular point within it. The integration of a space is a function of the mean number of lines and changes of direction that need to be taken to travel from that space to all other spaces in the system. Integration is therefore about syntactic not about metric accessibility and the word ‘depth’ rather than ‘distance’ is used to describe how far away a space is situated. It is measured in terms of Real Relative Asymmetry (RRA) values - an expression used to indicate a complex mathematical index of depth - which permits comparisons across systems of different sizes (Hillier & Hanson, 1984).

Integration is a global static measure in that every axial line is assigned a value, which characterises its relation to all other lines in the grid, thus providing a global index of relative integration or segregation for that line relative to all others. The numerical value is usually a
number varying between 1 and the lowest positive figure (higher than 0).\textsuperscript{1} Integration is an indicator of how easily one can reach a specific line of the axial map. More specifically the higher the integration value of a line, the lower the number of axial lines needed to reach that line (Baran et al., 2008). Clearly, longer lines in an axial map tend to have a higher level of connectivity with other lines, therefore, usually shallower or more integrated than the other lines (Penn, 2003). Integration of any line can be computed in terms of access from all other lines (radius = n, called global integration or R\textsubscript{n}) or those lines that are accessible up to a given number of lines away (for example radius = 3, called local integration or R\textsubscript{3}). Global integration values are calculated based on all depths within a global structure of a system; while local integration indicates a more local structure. Therefore, local integration can be a measure of local syntactic accessibility if the radius is small and global integration can be a measure of general syntactic accessibility if the radius considers all lines in the axial map (Bafna, 2003; Baran et al., 2008; Peponis et al., 1996).

2.5.1.3 Integration core

The axial map as a distribution of integration represents the set of the most integrated lines that are collectively known as an ‘integration core’. This is one of the most important measures treated as a representation of syntactic centrality. The core of a system consists of 10\% of the most highly integrated line applied uniformly in the interests of comparability of the total number of spaces, which take the strongest values (Hillier & Hanson, 1984). This can be shown graphically by drawing ‘core maps’, for example, 10\% of the most integrated lines and the 50\% of the most segregated lines in a system. The nature of the integration core, its shape, size, coverage and so on, depends on the shape, connectedness and geometry of the urban system and on its mode of growth. In most cities or urban areas, integration core maps follow the main commercial or shopping areas as a morphologically deep structure, whereas the least integration follows residential functions or comparatively shallow structures within the overall urban system. Empirically, integration has now been found to correlate well with observed patterns of space occupancy, use and movement in towns and cities in different parts of the world.

\textsuperscript{1} It is calculated by the formula:

\begin{equation}
\text{Int}_{\text{ave}} = \frac{2(\text{MD} - 1)}{k-2}
\end{equation}

Where MD is the 'mean depth' or mean number of spaces from all the other spaces in the system from the selected space and k is the total number of spaces, in the system. A correcting factor is then applied to eliminate the empirical effects of size.
Connectivity (CN) is a local static measure literally means the number of axial lines that connect to or intersect with each line in the system. It is a local static measure. For example, if a straight street segment is connected to five different streets then the connectivity of that straight street will be five. Urban fabric with many streets and intersections direct people to a large variety of routes from which to choose (Haupt & Pont, 2010; Marshall, 2005). Conversely, local control (CV) measures the degree to which a line ‘controls’ access to and from its immediate neighbours taking into account the number of alternative connections that each of these neighbours has (Baran et al., 2008; Klarqvist, 1993). The control value represents the degree to which a line is important for accessing neighbouring lines (Baran et al., 2008). A high control value indicates the importance of the line, which is the most necessary link for the neighbourhood. A street segment with more connections literally will have a higher control than a street segment that has fewer connections. Thus, it gives rise to a local dynamic measure. Control can be expressed as a function of connectivity and is calculated by summing the reciprocals of connectivity between neighbours. High values (values over 1) indicate strong control and values less than 1 indicate weak control i.e. how much more or less connected a space is than its neighbours.

The ‘choice value’ of a space indexes how many of the most direct paths connecting each of all possible lines of other spaces pass through that particular space (Baran et al., 2008; Hillier et al., 1987; Klarqvist, 1993). An integrated space does not necessarily have a strong choice value. For example, a cul-de-sac may be centrally located within a pattern of connections but it does not lead anywhere. The integration and choice values describe each space from the point of view of how it features in an urban system as a whole. Thus, particular spaces are also described in terms of local properties. The most obvious local properties are metric length and the number of connection to each line. In addition to the four first-order syntactic measures, second-order measure – ‘intelligibility’, is the correlation between the local and global properties of space that express the degree to which the local measure is directly experienced in terms of the system as a whole. It is very similar to ‘legibility’ and in terms of public space it represents the visual coherence and permeability of the surroundings (Shaftoe, 2008). Intelligibility and connectivity act as effective predictors of space use and understanding of the surroundings (Saif Haq & Girotto, 2003; Saif Haq & Zimring, 2003; Tuncer, 2007). The relationship of these first- and second-order measures is clearly shown in Figure 2.7.
2.5.2. The Theory of Natural Movement and the Role of Urban Attractors

Cities are shaped as much by movement as they are by buildings, and the character of urban space is often determined by the types, manners and speeds of movement within it (Wall & Waterman, 2010). Pedestrian movement density is sometimes highlighted as a critical factor to ensure a high level of occupancy in an open space (Ying et al., 2008). In the theory of natural movement, Hillier and his colleagues described the configurational properties of space syntax to determine urban morphology and the distribution of pedestrian movement (Hillier et al., 1993). It is conjectured in the theory of Space Syntax that the measure of integration of each line describes a fundamental relationship with urban function, including movement and land use (Hillier, 1996). Martin (1972, 2007) also argued that the framework of a city or grid acts as a generator and controls the influence on city form. Therefore, movement is an important factor of urban experience and generates activities in public space. More specifically, natural movement in a grid is the proportion of urban pedestrian movement, determined by its own grid configuration (Hillier et al., 1993; Hillier & Stonor, 2010).

It is believed that in a spatial configuration, as a consequence of the relative depth distribution (i.e. integration) governing natural movement, relatively shallow spaces tend to carry more movement. Thereby, shallow spaces in a system tend to attract certain types of land use that benefit from the presence of the people (Hillier, 1996, 2001, 2002; Hillier & Hanson, 1984; Hillier et al., 1993; Hillier & Vaughan, 2007; Penn et al., 1998; Read, 1999). The present investigation of the syntactic character of local areas reveals that the global integration core of most of the areas hold a public interface or in Hillier's term assign a 'multiplier effect'. Thus
the most integrated streets or core lines are those most used by people and are also lined with important local functions and shops. As one move into the less integrated streets, the importance of use falls, leaving houses in the most segregated areas. Thus, integration provides an important clue to one of the hidden secrets of the urban open space.

The relationship between the configuration of urban grid and movement densities along the grid can be described by the theory of ‘natural movement’ (Hillier et al., 1993). The fundamental association of spatial configuration is movement. According to Hillier (1996) movement is largely determined by spatial configuration and dictates the spatial pattern and form of the city. Based on empirical studies, Hillier (1996) argued that the structure or configuration of the urban grid is the most powerful single determinant of urban movement, both pedestrian and vehicular. The overall distribution of movement in an area is largely determined by the spatial configuration and natural movement (Hillier et al., 1993; Hillier & Stonor, 2010; Hillier & Vaughan, 2007). As configuration is the primary generator of pedestrian movement, without an understanding of it, it is hard to understand either urban pedestrian movement or the distribution of an attractor or the morphology of the urban grid. Natural movement shows that movement is fundamentally a morphological issue in urbanism where the aim is to understand the morphological logic of urban grid and their growth.

Extensive empirical studies in the last few decades have demonstrated that there is a strong correlation between spatial configuration and movement (Baran et al., 2008; Hadjri, 2006; Hillier, 2002; Jiang, 2009; Peponis et al., 1996). Hillier (1987) combined observation and space syntax to investigate the relationships between pedestrian movement and spatial configuration in a residential neighbourhood ‘Barnsbury’ in London. He found that there was a strong positive correlation between integration and the flow of pedestrian movement. Street lines along the integration core especially facilitate pedestrian movement. Hillier also identified that there was a positive and strong correlation between most integrated spaces and pedestrian movement in four London suburban areas. This study found a strong correlation between movement, integration and connectivity and this positive relation between integration and connectivity could be termed intelligibility. In contrast, three suburban areas that were substantially segregated indicated a poor relation between local and global integration. This means that the relation between local and global urban structure is not well defined.
According to Bill Hillier, in any urban system, configuration or urban street network is the primary generator of pedestrian movement patterns and attractors, which work as multipliers on the urban grid. In this context, attractor means shops, residential, commercial, educational and recreational facilities and even urban public space that generate activities in any urban system. In urban areas, attractors tend to be clustered in specific locations and they can function both positively or negatively (Hillier et al., 1993). These multiplier effects of attractors sometimes influence the natural movement along the grid. In an urban situation where configuration, movement and attractors all are present, it can be logically argued that the presence of attractors can influence the presence of people i.e. movement, but they cannot influence the configurational properties of the urban grid. On the other hand, configuration may affect movement and the presence of attractors but configurational parameters cannot be affected by the movement and attractors. Hence, according to the diagram (Figure 2.8) the configuration of the urban grid is the key generator that can influence attractors and movement of people along the grid. Without grasping this basic relation, it is difficult to understand either urban pedestrian movement or the distribution of attractors or the morphology of the urban grid (Hillier et al., 1993). Therefore, to understand the movement of people it is necessary to become acquainted with configuration of urban grid and the distribution of attractors. The distribution of urban grid, spatial configuration and the influence of multiplier effects on urban pedestrian movement will be discussed in Chapter 5.
2.6 Rationale for this Research and Proposed Model

The aim of this research is to identify the visual and physical characteristics of the built environment of designed urban open spaces to evaluate their levels of association with aesthetic response and social use. It also aims to investigate their morphological structure and spatial configuration to ascertain how the configurational properties and relative spatial position affects the uses of those spaces. The design of public space can have both positive and negative impacts on their use. Therefore, designers have a special responsibility to understand these impacts and to design in such a way as to serve the public good (Carr et al., 1992). Over the last few decades, environment behaviour studies have proven an effective way of discerning the interrelationship between the characteristics of the physical elements of urban open space and human responses. Most empirical studies on the evaluation of the built environment have focused on the differences between architects’ and non-architects’ responses, neither of which form the majority of any population. Most of the research has focused on neighbourhoods and public streets (Gehl, 2006; A. B. Jacobs, 1993; Mehta, 2006, 2009; Moudon, 1987; Rudofsky, 1969; Southworth & Ben-Joseph, 1997). Other studies have focused predominantly on residential streets, community spaces and street malls (Appleyard et al., 1981; Southworth, 2005; Sullivan et al., 2004). The majority of studies have concentrated on the physical attributes of the environment and the interrelationship between the use patterns and the physical elements (Loukaitou-Sideris & Banerjee, 1993; Marcus & Francis, 1998; Whyte, 1980) by combining behaviour mapping and GIS techniques (Goličnik, 2007; Marusic, 2011). Some authors are concerned about the visual preference, permeability and functional aspects of enclosed spaces and urban-scapes (Herzog & Flynn-Smith, 2001; Im, 1984; Nasar, 1983, 1984; Pugalis, 2009; Stamps, 2005a, 2005b). However, it is likely that positive aesthetic response in relation to public space depends to a certain extent on the visual attributes of physical characteristics and features. A logical assumption is that successful urban public spaces may also be those that generate positive aesthetic response and interactive social use.

Previous research into aesthetic response has been limited to different aspects of the landscape, building style, streetscape, city image, façade colour, house style, house form, urban environment, urban places and urban plazas (Bishop, 2007; Carlson, 2000; Castrillo, 2000; Heft & Nasar, 2000; Nasar, 1983, 1984, 1989a, 1989b, 1992, 1994; O'Connor, 2006, 2008; Tavakolian, 1990). In addition, Whyte (1980) explored the physical characteristics and use of urban plazas in New York City and Nasar (1994, 1998) examined aesthetic response to
streetscape and building exteriors. Some research has also been undertaken in relation to aesthetic experience of landscapes (Yi, 1992), architectural forms (Alp, 1979), and city images (Nasar, 1994, 1998; Olascoaga, 2003). For this reason, a gap in the literature exists in terms of studies that focus on the aesthetic response to designed urban open space and the effect of aesthetic response on the use of those spaces and therefore, the interrelationship between the perceptual aesthetic qualities and the social use. No studies of which the author is aware have been conducted on the aesthetic visual response as well as on the social use of urban open spaces in Dhaka, Bangladesh. There is a need for research according to user experience to design successful public urban space and focus should be upon the physical-morphological characteristics, aesthetic response and the social use of public urban open space. By focusing on the visual, morphological and physical characteristics of urban plazas and designed open spaces, this research will reveal the physical characteristics of public space that make the users’ aesthetic experience both interesting, soothing and their social use comfortable, lively and interactive. Thus, it seems imperative to explore the relationship between the environmental and aesthetic qualities of designed urban open space given that these spaces serve as a form of urban relief for urban dwellers. As mentioned, this research aims to fill the gap in the literature by concentrating on the visual, morphological attributes of the built environment of urban open space, aesthetic response and social use.

Several mediating and moderating factors have been identified in previous literature that may influence the effect of aesthetic response to the built environment of public space. Human preference plays an important role as a mediating factor while age, gender, profession and other socio-demographic variables as moderators are associated with the outcome of environmental evaluation. There have been some empirical studies in the field of environmental psychology regarding the differences between people of different backgrounds and experiences in relation to built environments. Purcell and Nasar suggested that group differences in environmental experience could arise from a variety of sources such as education, training and exposure to different ranges of experience and differences in geographical locations (Purcell & Nasar, 1992). Although aesthetic response depends on different moderating variables, research shows that order, familiarity and complexity are some important mediating factors for overall architectural preference to the environment (Herzog et al., 1976; Kaplan, 1987; Nasar, 1983, 1994). Aesthetic response is one of the visual characteristics of environmental evaluation that depends on the visual attributes of the built environment as well as on the emotional, socio-cultural experience of the observer. However,
due to the limited scope, this research is not addressing these mediating and moderating factors that may influence aesthetic response and hence social use.

To conclude, from existing literature, it is clear that the visual, physical and morphological properties contribute to architectural quality, aesthetic response and use patterns of public urban open space. While the literature identifies the visual and aesthetic dimensions of urban space as characteristics that enhance the qualities of public space, a gap exists in the literature concerning the precise nature of the aesthetic characteristics of the physical elements that enhance the interface between the environment and human response. Very little research is particularly concerned with the relationship between attributes of the physical-morphological environment, visual quality and social use of urban space that provided the rationale for this research. This research hypothesized that two factors, physical environment and configuration of urban space act as independent variables to determine the social use and aesthetic response to the built environment for environmental evaluation. The following visualization model represents the fundamental approach towards the research (Figure 2.9).

![Figure 2.9 Proposed fundamental model of research](image)

Currently very little is known about the relationship between this proposed model and outcomes that may prove useful for architects, urban designers and planners to understand the role of physical features and the configuration of urban spaces for aesthetic response and social use. This research examines the proposed model thereby aiming to highlight a broader perspective focusing on the architecture, urban design, environment behaviour study, environmental design and urban planning issues.
CHAPTER 3

RESEARCH METHODOLOGY: A TWO PHASE MIXED METHODS STUDY
3.1 Epistemological Framework and Theoretical Stance

The system of inquiry for any research generally starts with epistemology and this linear process ends with finding the methods (Figure 3.1). *Epistemology* is the theory of knowledge embedded in the theoretical perspective and thereby in the methodology while, the *theoretical perspective* is the philosophical stance informing the methodology. Thus, it provides a context for the process that lies behind the chosen methodology. On the other hand, *methodology* is the strategy, plan of action, process, or particular way of knowing reality. This is the research design that shapes choice and use of particular methods and links them to the desired outcomes. *Methods* are the techniques or procedures used to gather and analyse data related to some research question or hypothesis (Crotty, 1998).

![Figure 3.1 Basic elements of the research process (Crotty, 1998, p 4).](image)

It is obvious that new paradigms of inquiry grow day by day and from the theoretical perspective these paradigms include but are not limited to positivism, post-positivism, interpretivism, constructivism and critical inquiry/theory (Crotty, 1998; Denzin & Lincoln, 1994, 2000; Lincoln & Guba, 2000; Patton, 2002). According to Sale (2002), the ontological position of the post-positivism paradigm is one of objective reality, which exists as the only truth that is independent of human perception. Epistemologically, the investigator and investigated are considered to be independent entities. The investigators are capable of studying a phenomenon without influencing it or being influenced by it and knowledge accumulation is like adding building blocks to knowledge (Lincoln & Guba, 2000). Therefore, 'objectivism' is the epistemological view where things exist as *meaningful* entities independently of consciousness and experience, that have truth and meaning residing in them as objects (Crotty, 1998). It is acknowledged however, that objectivity can only ever be approached.

Different epistemologies tend to be associated with different approaches to research inquiry: for example, quantitative methods are more likely to be associated with post-positivist inquiry...
while qualitative methods allied with the interpretative/constructivist inquiry (Crotty, 1998; Groat & Wang, 2002; Lincoln & Guba, 1994; Patton, 2002). Under this paradigm, reality is considered to be relative and open to specific constructed realities. In this understanding of knowledge, it is clear that different people may construct meaning in different ways, even in relation to the same phenomenon (Crotty, 1998; Lincoln & Guba, 1994). Various epistemological and theoretical paradigms offer fundamentally different approaches to research methods (Sale, Lohfeld, & Brazil, 2002). As a discipline, Environment, Behaviour and Society (EBS) is explicitly empirical where the questions of study are pursued with the most rigorous of empirical research methods. Empirical research is mostly based on the results of observation, systematic collection and analysis of information and data from the tangible world (Moore, 2004, p. 7). In EBS research, the degree of objectivity is usually assessed in terms of its validity and reliability of the research method (Golledge & Stimson, 1997). (See section 3.7.9) Different theoreticians justified different research methods based on both qualitative and quantitative aspects in general. The relationships between the physical and psychosocial are the primary focus of this research, therefore it was necessary to collect (in a manner as close to objective as possible) data about people’s affective (subjective) responses and beliefs, and to analyse through methods such as qualitative and quantitative techniques. That is, although the data collected in this part of the research is of a subjective nature, the method of data collection and analysis was not - or rather set out to be as objective as possible given the people involved – researcher and participants and the context – both physical, geographic and psychosocial.

According to Sale et al. (2002) a clear distinction occurs between qualitative and quantitative research methods where, a qualitative approach is based on an ontological assumption of ‘multiple realities’ while a quantitative approach is based on positivism or a more universal understanding of reality. Qualitative research is focused on interpretation, meaning and understanding of any situation, settings or sense of a phenomenon (Coolican, 2004; Groat & Wang, 2002; Miles & Huberman, 1994). In contrast, quantitative research seeks to identify patterns of relationships between different situation, settings or variables without understanding how or why (Coolican, 2004; Groat & Wang, 2002). This research is embedded in both a subjectivist and an objectivist epistemology for the preliminary and main study respectively. The preliminary section of this research was based on a paradigm that admits subjective information as a particular form of legitimate data, such as personal feelings and opinions expressed by participants in response to semi-structured interviews that involved
sorting tasks for each participant. In contrast to the collection of subjective data, the main part of the research relied on the collection of data that revealed the pattern of relationships between different settings or variables without understanding the complexity of how or why, as the method used structured questionnaires with a quantitative measuring scale for each participant. For the preliminary study the theoretical stance is interpretive constructivism and for the main study a post-positivist paradigm is used (Table 3.1).

Table 3.1 Overview of the Research Process in Two Phases

<table>
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<tr>
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<th>Ontology</th>
<th>Epistemology</th>
<th>Theoretical perspective</th>
<th>Methodology</th>
<th>Method</th>
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<tbody>
<tr>
<td>Preliminary Study</td>
<td>Relativism</td>
<td>Subjectivism</td>
<td>Interpretative constructivism</td>
<td>Survey research design using photo-simulation</td>
<td>Semi-structured interview with sorting task</td>
</tr>
<tr>
<td>Main Study</td>
<td>Realism</td>
<td>Objectivism</td>
<td>Post-positivism</td>
<td>Survey research design with field survey</td>
<td>Questionnaire with scales</td>
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3.2 Research Questions and Hypothesis

This research started by identifying the factors and assumptions that may influence the aesthetic response and social use of designed urban open spaces. It is acknowledged that other than the morphology and aesthetics, types of social use can also depend upon several environmental, climatic, socio-cultural, economic and demographic factors. Investigating these aspects is beyond the scope of this research. This research aims to investigate the relationships between aesthetic response, social use and morphological configuration of designed urban open spaces of Dhaka city. Therefore, the primary hypothesis of this research is 'the social use of an urban space can be influenced by the aesthetic response and the surrounding morphology of that particular space and vice versa', and this can be symbolized by the following diagram (Figure 3.2). Investigating the relationships between aesthetic response and morphological configuration is beyond the scope of this research.

Figure 3.2 Hypothesis and tri-fold relationship of the research.
This research investigates four principal research questions in association with research sub-questions related to the physical and morphological characteristics, aesthetic response and social use of urban open space. The research questions have been developed from reviewing the existing literature and identifying the gaps in knowledge. This is in addition to the gap in related domains by considering the existing contexts and settings of the research. All four research questions are related to the constructs of aesthetic response, social use and morphological characteristics of designed urban open spaces.

**Research Question 1:**

How do the physical characteristics of the built environment of urban open spaces affect people's aesthetic response and social use?

This question is associated with two operational questions and they are:

1a. What are the most salient visual and physical characteristics in terms of their effect on aesthetic response?

1b. What are the most important visual and physical characteristics in terms of their effect on social use?

The aim of this question is to identify the most important visual and physical characteristics of different types of urban open spaces (i.e. plazas, squares, pedestrian malls) in terms of the affects of aesthetic response and social use. This question will qualitatively examine the physical, visual and morphological components of urban open spaces and sets out to identify the most important physical characteristics that may affect the aesthetic response and social use of the respondents.

**Research Question 2:**

Are variations in overall aesthetic response and social use associated with the most salient physical characteristics of designed urban open spaces in Dhaka?

This question links the following two operational questions:

2a. What are the levels of association between aesthetic response and the most salient physical characteristics of designed urban open spaces in Dhaka?
2b. What are the levels of association between social use and different types of designed urban open spaces in Dhaka?

From the findings of the first research question, the second question will investigate the levels of association and variation between aesthetic response and social use with respect to the different types of physical characteristics of urban open spaces of Dhaka, Bangladesh. The first sub-question intends to investigate whether the physical characteristics obtained from the first research question with different values are associated with differences in overall aesthetic response. The second sub-question sets out to investigate whether the variations in social use are associated with different kinds of urban open spaces of Dhaka, Bangladesh.

Research Question 3:

The primary hypothesis of this research is that aesthetic response and social use influence each other and a relationship exists between these two constructs. Therefore the third research question is:

What kind of relationship exists between aesthetic response and social use of designed urban open spaces in Dhaka?

This question will examine the pattern of relationship between aesthetic response and social use of urban open spaces and will investigate to what extent these two constructs influence each other.

Research Question 4:

According to Hillier (1996), movement and use pattern within an urban grid system is predominantly influenced by the surrounding morphological properties of the urban grid. To examine the relationships between the movement densities, social use and configuration of the studied urban open spaces, the fourth and final research question is:

Are variations in social use associated with the morphological configurations of designed urban open spaces in Dhaka?

This question will investigate the interrelationships between social use and morphology of the urban grid configuration of the eight study areas in Dhaka. Although the configuration of space might have an impact on aesthetic response, the scope of this research is limited to
identifying the interrelationships between social use and morphology of the urban grid. The following flow diagram clarifies the relationship between research questions and hypotheses (Figure 3.3). In the quest to answer these research questions, this research is divided into two phases and the following section highlights the research design and methodology in detail.

Here the 'independent constructs' refer to those attributes of the physical environment, which have already achieved identified and standard measurable features. Again it is acknowledged that these features (or settings) are not independent (of people) as this research used a specific range of variables of the specific independent constructs (Figure 3.3) based on those identified in previous research literature and through the results of the preliminary study. In contrast, the 'dependent constructs' refer to the aesthetic responses and differences in social use - the human responses and difference of use in the independent constructs. Based on the range of variables of independent constructs as well as moderator constructs (the socio-demographic characteristics of users), the dependent constructs vary and therefore, it is 'dependent' on the setting. It is acknowledged that the physical characteristics for aesthetic response, social use and configuration of urban space are interrelated and to some extent overlapping. However, to observe the relationships between different constructs and to perform the statistical analysis, it is imperative to divide these constructs into different sections (Figure 3.3).
The Evaluative Image of Designed Open Spaces: Bangladesh

PHYSICAL ENVIRONMENT
(Independent Constructs)

Attributes of the Physical Environment of Urban Open Spaces

Physical Characteristics for AR
Surrounding enclosure: Completely close to open
Height of enclosure: High to Low
Water features: Absent to present
Vegetation: Absent to present
Monuments and sculptures: Absent to present

Physical Characteristics for SU
Surrounding enclosure: Completely close to open
Height of enclosure: High to Low
Water features: Absent to present
Vegetation: Absent to present
Monuments and sculptures: Absent to present
Sitting spaces: Available to less available

Configuration of Urban Space
Global Integration (Rn)
Local Integration (R3)
Connectivity (CN)

OUTCOMES
(Dependent Constructs)

AESTHETIC RESPONSE
AR
Beautiful-Ugly
Like-Dislike
Pleasant-Unpleasant
Desirable-Undesirable

SOCIAL USE (SU)
Frequency of Use
Types of Use/Activities

Socio-demographic characteristics of urban space users
Age
Gender
Education background
Occupation
Types of work

Figure 3.3 Proposed model showing the relationship between the associated constructs and the research questions (Please note: AR represents the contraction of aesthetic response and SU is the short form of social use.)

3.3 Research Design and Methodology

3.3.1 Research Design

When investigators want to learn about classes or types of elements embedded in a diverse group, survey research design is often used (Zeisel, 2006). Surveys are often conducted because it is an easy, quick and accurate way to obtain the required information. There are three basic reasons to do surveys: (i) to influence or persuade some audience, (ii) to create or modify a product or service to provide for a particular public, (iii) to understand or predict...
human behaviour or conditions because they are the focus of academic or professional work (Alreck & Settle, 2004, p. 3). If the generalization of findings of a large population is desired due to the unavailability of information, then survey research design is the most appropriate method as it allows researchers to generalize about a large population by studying a small portion of the population (Zeisel, 2006).

To understand the relationship between aesthetic response, social use and configuration of urban open space, this study was conducted in two stages (Table 3.2):

a. A preliminary study to identify the visual and other physical characteristics of urban spaces for aesthetic response and social use and,

b. The main study concentrates on the urban open spaces of Dhaka to determine the levels of association and variation between aesthetic response, social use and physical-morphological properties of the study areas.

The first task in the research was to understand the relevance of visual and physical elements within the built environment of designed urban open spaces from users’ aesthetic and social perspective. Therefore, the first part was conducted by a survey using photo-simulation techniques that were exploratory in nature. In this study, the respondents identified architectural elements, important physical/visual characteristics, types of use and activities in terms of their effect on aesthetic response and social use respectively.

Table 3.2 Research Process in Two Phases

<table>
<thead>
<tr>
<th>PRELIMINARY STUDY</th>
<th>MAIN STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical characteristics of the built environment of urban plazas, squares, malls were identified to evaluate the aesthetic response and social use.</td>
<td>The main study set out to identify the levels of association and variation between aesthetic responses, social use and the spatial-morphological properties of the designed urban open spaces of Dhaka, Bangladesh.</td>
</tr>
</tbody>
</table>

Based on the findings, the subsequent main study aimed to confirm insights arising from the preliminary study. This study employed survey research design with field survey as a method. This chosen approach for research design focused on the embedded context of the urban open spaces of Dhaka city. Moreover, it sought to explain the relationships, both in terms of similarities and differences between the constructs. In addition to identifying the visual,
physical and morphological properties that are the key communicators of aesthetic response and social use of designed urban open spaces, the types of spatial analysis, social use and activity pattern were explored. In this phase, space syntax (Hillier, 1996) was used as an analytical tool to identify the configuration of the urban grid of the study areas and to explain the relationships between the spatial pattern of urban grid and social use.

3.3.2 Research Plan

Methodology as a process of research design operates as the background to the use of particular methods and links the choice and use of methods to reach the desired outcome (Crotty, 1998). In order to answer the research questions, the chosen survey research design focused on the urban open spaces of Dhaka, Bangladesh. To answer the research questions they were broken into several operational sub-questions. These operational questions also directed the choice of an appropriate research methodology and suitable methods for collecting data. The diagram (Figure 3.4) represents the inter-relationship between different phases of the research and details each to answer the research questions. The details, overall plan and analytical methods applied for data analysis from the research questions to findings is comprehensively provided in Table 3.3.

Table 3.3 The Constructs, Variables, Instruments and Data Analysis Process of the Research

<table>
<thead>
<tr>
<th>Main Research Question</th>
<th>Sub Questions</th>
<th>Constructs</th>
<th>Variables</th>
<th>Research Design</th>
<th>Measuring Instruments</th>
<th>Data Analysis</th>
</tr>
</thead>
</table>
| RQ1. How do the physical characteristics of the built environment of urban open spaces effect people's aesthetic response and social use? | 1a. What are the most salient visual and physical characteristics in terms of their effect on aesthetic response? | Physical/visual characteristics (independent) | • Surrounding enclosure  
• Height of the surrounding enclosure  
• Trees/vegetation  
• Water features / fountains  
• Monuments/ sculptures | Preliminary study: Exploratory survey research design using photo simulation | Semi-structured interview and probes | Qualitative content analysis |
| | | Aesthetic response (dependent) | • Beautiful-Ugly  
• Pleasant-Unpleasant  
• Desirable-Undesirable  
• Like-Dislike | | Sorting task with probes | |
1b. What are the most important visual and physical characteristics in terms of their effect on social use?

<table>
<thead>
<tr>
<th>Physical/visual characteristics (independent)</th>
<th>Physical/visual characteristics (independent)</th>
<th>Social use (dependent)</th>
<th>Social use (dependent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Surrounding enclosure</td>
<td>• Surrounding enclosure</td>
<td>• Frequency of use</td>
<td>• Frequency of use</td>
</tr>
<tr>
<td>• Height of the surrounding enclosure</td>
<td>• Height of the surrounding enclosure</td>
<td>• Types of use/activity</td>
<td>• Types of use/activity</td>
</tr>
<tr>
<td>• Trees/vegetation</td>
<td>• Trees/vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Water features/fountains</td>
<td>• Water features/fountains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Monuments/sculptures</td>
<td>• Monuments/sculptures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Availability of sitting spaces</td>
<td>• Availability of sitting spaces</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RQ2. Are variations in overall aesthetic response and social use associated with the most salient physical characteristics of designed urban open spaces in Dhaka?

<table>
<thead>
<tr>
<th>Physical characteristics (independent)</th>
<th>Physical characteristics (independent)</th>
<th>Social use (dependent)</th>
<th>Social use (dependent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Surrounding enclosure</td>
<td>• Surrounding enclosure</td>
<td>• Frequency of use</td>
<td>• Frequency of use</td>
</tr>
<tr>
<td>• Height of the surrounding enclosure</td>
<td>• Height of the surrounding enclosure</td>
<td>• Types of use/activity</td>
<td>• Types of use/activity</td>
</tr>
<tr>
<td>• Trees/vegetation</td>
<td>• Trees/vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Water features/fountains</td>
<td>• Water features/fountains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Monuments/sculptures</td>
<td>• Monuments/sculptures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2a. What are the levels of association between aesthetic response and the most salient physical characteristics of designed urban open spaces in Dhaka?

<table>
<thead>
<tr>
<th>Physical characteristics (independent)</th>
<th>Physical characteristics (independent)</th>
<th>Social use (dependent)</th>
<th>Social use (dependent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Surrounding enclosure</td>
<td>• Surrounding enclosure</td>
<td>• Frequency of use</td>
<td>• Frequency of use</td>
</tr>
<tr>
<td>• Height of the surrounding enclosure</td>
<td>• Height of the surrounding enclosure</td>
<td>• Types of use/activity</td>
<td>• Types of use/activity</td>
</tr>
<tr>
<td>• Trees/vegetation</td>
<td>• Trees/vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Water features/fountains</td>
<td>• Water features/fountains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Monuments/sculptures</td>
<td>• Monuments/sculptures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RQ3. What kind of relationship exists between aesthetic response and social use of designed urban open spaces in Dhaka?

<table>
<thead>
<tr>
<th>Aesthetic response (dependent)</th>
<th>Aesthetic response (dependent)</th>
<th>Social use (dependent)</th>
<th>Social use (dependent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Beautiful-Ugly</td>
<td>• Beautiful-Ugly</td>
<td>• Frequency of use</td>
<td>• Frequency of use</td>
</tr>
<tr>
<td>• Pleasant-Unpleasant</td>
<td>• Pleasant-Unpleasant</td>
<td>• Types of use/activity</td>
<td>• Types of use/activity</td>
</tr>
<tr>
<td>• Desirable-Undesirable</td>
<td>• Desirable-Undesirable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Like-Dislike</td>
<td>• Like-Dislike</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RQ4. Are variations in social use associated with the morphological configurations of designed urban open spaces in Dhaka?

<table>
<thead>
<tr>
<th>Morphological characteristics (independent)</th>
<th>Morphological characteristics (independent)</th>
<th>Social use (dependent)</th>
<th>Social use (dependent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Global Integration (Rn)</td>
<td>• Global Integration (Rn)</td>
<td>• Frequency of use</td>
<td>• Frequency of use</td>
</tr>
<tr>
<td>• Local Integration (R3)</td>
<td>• Local Integration (R3)</td>
<td>• Types of use/activity</td>
<td>• Types of use/activity</td>
</tr>
<tr>
<td>• Connectivity (CN)</td>
<td>• Connectivity (CN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Control (CV)</td>
<td>• Control (CV)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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3.4 Constructs and Variables

There are four types of constructs associated with this study, two of them linking with dependent variables and the remaining two with independent variables. All of these constructs are embedded into various research questions for example: aesthetic response and social use are dependent constructs; physical and morphological properties are independent constructs. Each construct is designed with different variables and these are discussed in detail next.

3.4.1 Aesthetic Response

The operational definition of the construct aesthetic response comprises a bundle of responses that includes emotional reactions and affective appraisals from the probabilistic model of
The Evaluative Image of Designed Open Spaces: Bangladesh

Nasar (1994) (Figure 2.3). The components and semantic differential rating scale variables linked to the construct of aesthetic response are itemized in Table 3.4.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Dependent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic Response</td>
<td>Pleasant-unpleasant</td>
</tr>
<tr>
<td></td>
<td>Beautiful-ugly</td>
</tr>
<tr>
<td></td>
<td>Like-dislike</td>
</tr>
<tr>
<td></td>
<td>Desirable-undesirable</td>
</tr>
</tbody>
</table>

3.4.2 Social Use

The operational definition of social use is the way people use any space and it occurs spontaneously as a direct consequence of people moving about and being in the same spaces as one another (Gehl, 2006). People can use any urban space individually or in a group depending on the types of activities. Referring to the construct of ‘social use’ in this research, the researcher asked active users and respondents about their use, activity and enjoyment of designed urban open spaces. This study did not set out to closely observe the ways in which, the respondents used the plazas or open spaces. Therefore, the findings and conclusions are based on the statements of users and respondents. By applying factor analysis, the construct of social use is further divided into active and passive social use. The components of social use and the related dependent variables are detailed in Table 3.5.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Dependent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive Social Use</td>
<td>Wandering: Exploring architecture</td>
</tr>
<tr>
<td></td>
<td>Watching: Watching people</td>
</tr>
<tr>
<td></td>
<td>Sitting: On the benches and seats</td>
</tr>
<tr>
<td></td>
<td>Relaxing: Enjoying nature/sitting on grass</td>
</tr>
<tr>
<td>Active Social Use</td>
<td>Eating: Having coffee/drinks/food</td>
</tr>
<tr>
<td></td>
<td>Talking: Chatting with friends</td>
</tr>
<tr>
<td></td>
<td>Walking: Walking around</td>
</tr>
</tbody>
</table>
3.4.3 Physical Characteristics

Physical characteristics of urban open spaces in this study include the architectural and design elements identified by the respondents. This research includes only the following physical characteristics that were most frequently mentioned by the respondents as influencing the dependent variables i.e., aesthetic response and social use.

a. A good sense of enclosure
b. The height of the surrounding enclosure
c. Good coverage of vegetation, greenery and naturalness
d. Inclusion of water features and fountains
e. The presence of any monuments or sculpture works
f. Availability of seating arrangements

3.4.4 Morphological Characteristics

The term morphology comes from the verb ‘morph’ that means to change in form, character or transformation of any object. Urban morphology therefore, is a branch of urban design that seeks to understand the form and structure of urban spaces. In this research, morphological characteristics mean the spatial configuration of the urban system and space syntax is used as an analytical tool to measure these configurational properties. To identify and describe the morphological characteristics, this research used the following configuration measures developed by Hillier (1996):

a. Global and local integration pattern
b. Connectivity and control
c. Intelligibility
d. Spatial nature of the integration core
e. Presence of any attractors

3.5 Ethical Considerations and Approval

To ensure the rights of the participants, certain ethical practices were taken according to the format of the ethics committee of the University of Sydney, Australia. All participants were provided with a participant’s information statement and a consent form to inform them about the procedure involved in the research to ensure participants that their participation was entirely voluntary (Appendix B, C, F, G). This study also maintains the ‘confidentiality’ of
the participants by considering each participant as anonymous. The researcher considered and followed all relevant ethical practices approved by the Human Research and Ethics Committee (HREC) of the University of Sydney. For the preliminary study, the approval number was 03-2009/11611 and for the main study the reference number was 09-2009/12072.

3.6 Preliminary Study

This research is based on a mixed-methods approach and survey research was the method applied to the preliminary study as this was an easy, quick, relatively inexpensive and accurate way to obtain the required information and to shape the research (Alreck & Settle, 2004, p. 3).

3.6.1 Aim of the Preliminary Study

As stated before, the aim of this study is to identify the aesthetically and socially preferred physical characteristics of the built environment of Dhaka’s designed urban plazas and paved open spaces and to evaluate the aesthetic response and social use of those spaces from the users’ standpoint. Inclusion of users’ opinions in the design of urban spaces can achieve high environmental quality as people are the core generators of successful urban places (Lo, Yiu, & Lo, 2003). They can play an active and important role in guiding the design, development decisions and prioritise that make places look appealing, feel comfortable, and meet their functional expectations (Dobbins, 2009). In the preliminary study, qualitative methods were employed to identify the physical characteristics of urban plazas, squares and pedestrian malls. According to Lincoln and Guba (1985, 1994, 2000), naturalistic inquiry always carried out in a logically enough natural settings and uses the methods that are appropriate to humanly implemented inquiry such as interviews, observation, document analysis and so on. A plethora of recent literature exists in different research domains using naturalistic qualitative approaches to obtain subjective depth in a study as this is the most acceptable way to obtain human responses (Plas & Lewis, 1996; Pugach, 2001; Pugalis, 2009). A list of the physical and visual attributes for aesthetic response and social use was prepared based on the responses from this study. After finalizing the physical, visual and morphological attributes of urban open spaces from the preliminary study and literature, the intention of the main study is to investigate the relationship between the physical characteristics, aesthetic response and social use.
3.6.2 Pilot Study

In order to ensure the appropriateness of the interview techniques and the number and wording of the questionnaire, this study was piloted in two phases. The aims of the pilot studies were to evaluate the questionnaire, to finalize the visual stimuli and duration of the evaluations.

In the first phase of pilot testing during December 2008, six doctoral students of the Faculty of Architecture, Design and Planning at the University of Sydney participated individually in an interview session and made several suggestions for improvement of the interview questions and techniques. The participants were asked for feedback about the visual stimuli and questionnaire in terms of the following aspects:

a. The size, number and photographic quality of the visual stimuli
b. Format, layout and readability of the questionnaire
c. Sequence and arrangements of the questions and use of different probes
d. Evaluation of the survey session time
e. Any other comments or feedback relevant to this survey

According to the majority of the participants, the size and quality of the photographs used as visual stimuli were appropriate. In total 24 images of different paved urban open spaces were used as visual stimuli where, the number of photographs and interview techniques had been specified through piloting. The researcher started with 24 photographs then gradually reduced the number and after piloting it was decided that eight was the optimum number to sort, as most people do not feel bored when asked to sort this many. Besides these, the duration of evaluation, number and wording of questions in the interview was also modified.
Based on the participants in the pilot study, some adjustments were made and the survey was pilot tested in a second phase with eight randomly selected people in the selected survey areas (Section 3.6.3) during January 2009. In this phase, the participants did not express any difficulties regarding the visual stimuli or the interview format. In conclusion, quite a few of changes were made to the interview technique and number of visual stimuli as an outcome of the pilot study to make it more simplified, understandable and legible to the people.

3.6.3 Population and Sample

This survey, using the photographs of 24 designed urban open spaces was conducted in four different urban spaces in Sydney, Australia in March 2009. These spaces were, Martin Place, Circular Quay, The Hearth: Faculty of Architecture Design and Planning at The University of Sydney and Johnson Park in Dulwich Hill, Sydney. Instead of conducting laboratory experiments, this study chose to observe directly the urban environment. The reason for using these four different urban spaces for photo-simulation was to obtain a diversified sample from accessible environmental settings. The participant group for this study were the people who were present and actively using those spaces at the time of the survey. A convenient sample size for this study was 50, and to recruit this sample size, 75 people had been approached. Diversification of the sample was based on age and gender.

3.6.4 Data Collection Method

In order to explore the first research question, this study employed survey research methods and used photo-simulation. Simulation through photographs is a common device in transmitting architectural values (Groat, 1982; Purcell, 1986, 1992; Stamps & Nasar, 1997; Wilson, 1996). Previous studies that have explored the validity of various simulation media have generally concluded that responses to colour photographs correlate highly with responses to the physical environment. As the epistemological and theoretical perspective of preliminary study is embedded in subjectivism with interpretive constructivism, a qualitative method was applied to collect necessary data. Therefore, a sorting task, semi-structured interviews with show card, including the use of probes (questions to clarify the points) was employed as a technique to collect the required data for this preliminary study (Figure 3.5).

3.6.4.1 Visual stimuli

As mentioned, one of the research instruments for this study was photo-simulation, where colour photographs of different urban plazas, squares and pedestrian malls from different parts of the world were used as visual stimuli. By using static images of existing urban plazas,
squares and pedestrian malls, the independent variables of the research i.e. physical characteristics of urban spaces were investigated. It is acknowledged that using two-dimensional images (photo-simulations) are not exact substitutes for the physical environment. Although these images can capture a vast amount of visual information, they are not comprehensive representatives of a physical three-dimensional environment. With regard to this, Hull and Stewart (1992) identified differences between on-site and photographic image-based evaluations. They also argued that differences might arise due to the influence of mood, participants’ fatigue or participants’ different ways to conceptualize the content of the photographs (Hull & Stewart, 1992).

Despite some disadvantages of using photographic images, different research domains use this medium successfully as a strong surrogate for the physical environment. To transmit architectural values, simulation through photographs is a common device in different research domains and particularly in the EBS (Environment, Behaviour and Society) domain, photographs or slides have been used extensively as a substitute for the physical environment (Berman, 2006; G. Brown & Gifford, 2001; Heft & Nasar, 2000; Hershberger, 1992; Imamoglu, 2000; Nasar, 1992b; Stamps, 2000; Stamps & Nasar, 1997). Previous studies that have explored the use of photographic images and slides as simulation media have generally concluded that the correlation between responses to colour photographs and responses to the physical environment is comparatively very high and an appropriately framed picture should be able to tell more than a thousand words (Gaber & Gaber, 2004; Groat, 1982). To minimize the loss of multimodal information, a few measures were taken in this research such as, selecting larger images, increasing the number of pixels per image, by digitally correcting the background, foreground and colour contrast etc.

### 3.6.4.2 Selection of visual stimuli

A group of eight scholars from the EBS (Environment, Behaviour and Society) research group, in the Faculty of Architecture, at the University of Sydney selected 24 photographs to use as visual stimuli from a series of 42 different photographs of urban open spaces. Therefore, this research employed 24 photographs (15cm x 20cm in size) and the images included paved open spaces from Sweden, Germany, Venice, London, Paris, Rome, Prague, Brussels, Madrid, different states of the USA, Australia, Mexico, Iran and different cities in the Middle East. All 24 photographs that were used for the photo-simulation are detailed in Appendix D. The selection of open spaces was based on two criteria. First, participants were
asked to sort the images into three piles–each pile to be composed of eight most representative images of three types of urban open spaces: urban plazas, urban squares and pedestrian malls. Second, the slides had to represent the diversity of types of scenes identified from the previous literature according to the following visual qualities. The important physical attributes for selecting the visual stimuli were: types of building enclosures, availability of water features, fountains, pedestrian facilities, sitting areas, contemporary, traditional and classical features of the designed urban open spaces and surrounding buildings, low and high building façades, presence or absence of monuments, sculptures and availability of vegetation, green areas etc.

As a multiple sorting task, in this study, each person sorted out eight photographs in each session; fifty people evaluated all 24 photographs into 50 different sessions. The total evaluation of all 24 photographs in 50 different sessions was 400 (50X24/3). Figure 3.6 shows some examples of the photographs that were used for the photo-simulation study.

Figure 3.6 Example of the photographs of urban plazas, squares and malls used for the photo-simulation.
3.6.4.3 Measuring instruments

**Focused interview:** The term 'interview', means any form of face-to-face systematic questioning to find out what people think, feel, do, know, believe and expect (Zeisel, 2006, p. 227). This technique is uniquely suited to discovering a respondent’s personal definition of complex E-B situations. Using focused interviews, interviewers find out in depth how an individual defines, feels about, perceives and reacts to a particular environment or situation (Zeisel, 2006, p. 227). Focused interviews in this study determined how individuals preferred how to use the space, what they considered important about it, and how they feel about it. In the focused interview, the main function of the interviewer is to focus attention on a given experience and its effects, where interviewers know in advance what topics or aspects of a question they wish to cover. The list is derived from the formulation of research questions that constitute a framework of topics to be covered as well as the manner in which the questions are asked (Judd, Kidder, & Smith, 1991). By using observation research methods, researcher analysed the structure of that situation in depth. As mentioned before, the focused interview group for this study were the people who were present and actively using the four areas at the time of the survey. In this technique, the respondents become the participants of the research. To achieve full coverage of the subjective experiences of the respondents and a depth of insight, the researcher used probes as a basic interview tool.

**Probe:** The instrument of this research was designed to obtain information on what are the ‘liked’ physical features and visual elements that influenced to prefer aesthetically or use socially those spaces than the others. Probes are predominantly questions that interviewers interpose to clarify point, to explain the situation, to continue talking or to shift the topic. The interviewer indicates to the respondent to provide more information about the depth of feelings, personal context or detail of a situation. Different probes can be used to promote flow, achieve non-direction, extend the range, encourage specificity, increase depth and to tie-in context (Zeisel, 2006, pp. 230-231). The interviewer should use probes to keep an interview flowing without directing it and this research used addition and reflecting probes to achieve this.

**Sorting task:** A ‘multiple sorting task’ is an analytical tool to explore and understand the users’ experiences that can be further classified into Q-sort and F-sort (Canter, Brown, & Groat, 1985). The Q-sort technique, developed by Stephenson (1953) is a categorization or sorting technique, which directs participants to group visual stimuli into categories as defined
by the researcher (Amin, 2000; Stephenson, 1953). Alternatively, the F-sort technique is a modification of the Q-sort technique that allows participants to define or group visual stimuli according to their own categories without any direction from the researcher. Both F-sort and Q-sort techniques are considered as effective qualitative approaches to capture subjective responses into an objective set of data to allow quantitative data analysis (Adhya, 2008; Amin, 2000; S. R. Brown, 1986; Groat, 1982; Mrtek, Tafesse, & Wiger, 1996).

In this research, the multiple sorting task, particularly Q-sorting technique, was applied to investigate and understand users’ subjective experiences regarding aesthetic response and social use pattern of the selected urban spaces. With the Q-sorting task, the researcher allowed participants to group the photographs according to their 'likeability' and 'usability' criteria, which is discussed in detail below.

3.6.5 Data Collection Process

This study included a Q-sorting task as one of the data collection processes, also known as a directed sort. Participants were first directed to sort the visual stimuli into piles or groups according to their 'like' and 'dislike' criteria. From the pilot study, it was decided that eight was the optimum number to sort. Therefore, participants first sorted eight photographs then the next participant sorted the next eight photographs and so on. In the second phase, the same participant categorized the same photographs according to the 'usability' of those spaces. As with the previous sorting, the numbers of photographs was also fixed at eight.

After sorting the photographs into desired groups, a face-to-face semi-structured focused interview was conducted with the use of a show card. For each question this study used show cards so that the interviewee could concentrate fully on the sorted photographs and only on the question of the show card. The researcher kept the set of questionnaire to record the responses (Appendix A). The aim of this interview was to glean in-depth information and to understand users’ feelings, perceptions and responses towards the photographs that they had already sorted. In this phase, the researcher used addition and reflecting probes to keep the flow of the interview without directing it. The time for the survey and the interview ranged from 15 minutes to 25 minutes. With the permission from the respondents, the interview session was also audio-recorded. This audiotape later helped the researcher to verify the given responses in those sessions. The outcome of the interviews and audio recordings permitted analysis and interpretation of the results as follows.
3.6.6 Data Analysis and Results

Physical characteristics of the built environment are one of the most interesting criteria for urban designers and architects (Mehta, 2006). Respondents from the preliminary study indicated some of the most important ‘liked’ physical features of urban plazas, squares and pedestrian malls that can influence their aesthetic response and social use. With the increasing volume of literature in urban design, physical characteristics are considered to be the most important in determining the visual qualities of the built environment, and by extension, its use. These characteristics include architectural, morphological, socio-demographic, security, management, climate and other ambient features of the environment.

Among the numerous physical characteristics, surrounding enclosure, height of the surrounding enclosure, presence of vegetation and nature, availability of water features or fountains, monuments or sculptures were the aesthetically preferred physical attributes of the designed urban plazas and public open spaces from the respondents’ viewpoints. In addition to these physical and visual attributes, respondents identified ‘availability of seating spaces’ as one of the most important physical features for the social use of those spaces. Aesthetic response and social use are the highest rated physical features and different research literature corroborates these findings (Collins & Collins, 1986; Herzog, 1992; Herzog & Barnes, 1999; Lynch & Hack, 1984; Mehta, 2006, 2007; Moughtin, 2003; Nasar, 1994; Sitte, 1889a, 1898; Ulrich et al., 1991). In addition to sorting out the most important physical elements, the respondents identified their anticipated use pattern, likely activities and desired companionship they would seek to enjoy those space.

As discussed previously, focused interviews were conducted with fifty respondents, and Figure 3.7 and 3.8 capture all responses of the interviewees. After compiling the data into different groups, similar responses were classified under the ‘same’ category and the responses were qualitatively analysed with a combination of content and frequency analysis. Therefore, only the frequently mentioned visual characteristics (at least 35 of the 50 respondents) were included for further study. Figure 3.9 and 3.10 represent the most ‘liked’ physical features for the aesthetic response and social use respectively. These two graphs highlighted only the most important ‘liked’ physical features as identified by the respondents. Of the several physical characteristics, Figure 3.9 highlights only the most important and frequently mentioned constructs that could influence aesthetic response to urban open spaces for example: enclosure and surroundings, enclosure height, nature, monuments and fountains.
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Figure 3.8 Urban design characteristics for social use according to the participants.
Most Important 'Liked' Physical Features for Aesthetic Response

![Bar chart showing the most important physical features for aesthetic response in Bangladesh.]

- Enclosure & Surroundings
- Enclosure Height
- Nature
- Monuments
- Fountains

Architectural characteristics nominated by the respondents.

Figure 3.9 Most important and frequently mentioned urban design characteristics for aesthetic response.

Most Important 'Liked' Physical Features for Social Use

![Bar chart showing the most important physical features for social use in Bangladesh.]

- Fountains
- Water
- Water Features
- Sculpture
- Monuments
- Trees
- Landscaping
- Green Trees
- Vegetation
- Garden
- Lively Trees
- Completely open
- Partially enclosed
- Enclosed structure
- Enclosure Height
- Benches & Seats

Architectural characteristics nominated by the respondents.

Figure 3.10 Most important urban design characteristics for social use.
Figure 3.10 highlights the most ‘liked’ physical features for social use pattern of urban open spaces mentioned by the respondents. For example, the respondents repeatedly mentioned trees, green trees, lively trees, vegetation and from the qualitative content and frequency analysis all of these characteristics fall under the category ‘Nature’. Therefore, the most frequently-mentioned categories are enclosure and surroundings, fountains, monuments, nature, enclosure height, benches and seats. The findings suggest that some of the most important urban design characteristics i.e. architectural, morphological and visual elements need to be considered for future urban planning and design of public spaces that are included for further research in the main study.

3.6.7 Findings and Discussions

3.6.7.1 A good sense of enclosure:

The preliminary study revealed that sense of enclosure is one of the most important physical attributes and most people preferred ‘partially enclosed’ public spaces rather than ‘completely open’. The urban open spaces that are surrounded by buildings, trees or other physical elements can create a comfortable situation for users. Open spaces surrounded by any physical elements to form a partially enclosed environment are the most desirable settings for users. The enclosure is one of the prerequisites of any urban open space (Collins & Collins, 1986; Crowhurst-Lennard & Lennard, 1995; Moughtin, 2003; Unwin, 1909; Webster, 2007). For Sitte, according to the form and type of enclosure only two categories of square exists, deep and wide (Collins & Collins, 1986; Sitte, 1889b, 1898) Other famous researchers investigated several medieval squares and identified ‘enclosure’ and ‘proportion’ as the most important elements for the traditional urban spaces where ‘closed’ and ‘dominated’ squares are the most enclosed (Unwin, 1909; Zucker, 1970). Zucker argued that the space is self-contained in a closed square and in a dominated square, the space is directed towards the main building. He also suggested that platonic forms and geometric volumes like squares, and rectangular or circular shapes are always desirable to create a comparatively self-contained enclosed square.

The important characteristics that may influence the quality of enclosure in any square or plaza are the corner treatment, the nature of enclosing buildings, height, roofline, ground floor and facade treatment of the enclosing buildings, overall size and the shape of the space itself in relation to the surroundings (Gehl, 2006; Moughtin, 2003). Moughtin argued that the more open the corner of any urban space, the less it is that people are likely to experience a sense of
enclosure. The building around any open space should be constructed in such a manner that it creates a continuous surface to achieve an architectural unity. Moughtin further suggested that enclosure feelings are comparatively relative and can be increased by creating a more built up corner, reducing the size of the space, by close setting of the side walls and decreasing the three dimensional modelling of the surrounding buildings. In ancient squares, the designers or architects extensively used single or double colonnades to achieve enclosure feelings. Landscape architect Jere Stuart French thought that people are the most important ingredients for a square by giving colour, scale and harmony to the urban space and also acting as the primary enclosing agent ‘wall’ of mentioned space (French, 1984, pp. 30-31). Other than the building facade, urban open spaces surrounded by trees, vegetation and street furniture (e.g. lighting, benches, seats, flowerpots, fences, low height walls etc.) are also notable features that can create a reasonable sense of enclosure in any urban open space (Mehta, 2006).

Different facade treatment, ornamental features and detailing of the enclosing building also influence the sense of enclosure. Crowhurst-Lennard and Lennard (1987, 1995) stated the necessity of public open spaces for the liveability of any city and identified the sense of enclosure, presence of surrounding enclosure and the position of focal points as the most important elements for creating successful urban plazas, squares and other types of open spaces. From the preliminary study, people usually preferred old and historic building façades rather than those of modern buildings. The old historic façades with arches, pillars, decorated columns and windows are the most liked physical attributes. For windows, most people prefer different sizes and shapes rather than the conventional rectangular type. Contrasting and vibrantly coloured ornamented sills and lintel levels are also desirable. However, it is the size and shape of any urban open space that is the most important feature to consider when attempting apposite enclosure of any space. According to Sitte (1889) the most delightful intimate squares may be as small as 15-21 m (50-70 ft) and can create small cosy social spaces for any social use. In contrast, ‘modern gigantic plazas’ can create the most pernicious influence and people may feel lost in them (Sitte, 1889a).

According to the results of the preliminary study, for both aesthetic response and social use, partially enclosed spaces are the most preferable. For aesthetic response the respondents of the preliminary study preferred partially-enclosed spaces (87%) rather than comparatively open (57%) or completely-enclosed spaces (70%). Similarly, for social use, most of the respondents mentioned partially enclosed spaces (83%) and comparatively open spaces (67%).
as their highest and second highest preferences. In comparison to partially enclosed and comparatively open spaces, the respondents did not mention frequently the use of completely enclosed spaces (43%) for social interaction. One possible reason to choose partially-enclosed spaces for the given aesthetic response is that visibility of the surrounding enclosure is more desirable. Conversely for social use, privacy and social interaction is more important therefore the users chose partially enclosed and comparatively open spaces.

3.6.7.2 Height of the surrounding enclosure:

Height is another important criterion that can influence aesthetic response and social interaction within any urban open space. Enclosure feelings of any open space also depend on the height of the surrounding enclosure. A sense of enclosure is defined by certain desirable proportions of the vertical elements and horizontal surfaces where the height of the surrounding enclosure is one of the vertical elements (Alexander, Ishikawa, & Silverstein, 1977; Cullen, 1971, 2007; Lynch & Hack, 1984; Mehta, 2009). Vegetation, hedges, buildings and any other types of vertical boundary can surround an urban open space to create an enclosed appearance (Salingaros, 1999). According to Mehta, the proportion of the height (of buildings, walls, trees and other vertical edge elements), to the space is important and can create a good sense of enclosure (Mehta, 2009). Other literature suggests that in enclosed space, pedestrians' eye level, visual angle and visual focus is limited to the floor surface, ground floor level and different activities on horizontal surfaces (Gehl, 2006; Rapoport, 1977; Whyte, 2007).

According to the results of the preliminary study, people selected those images where the height of the surrounding enclosure varies from three to five storeys high (11m to 18m). The roofline of the surrounding enclosure should not be extremely high or low to obtain a reasonable sense of enclosure. The surrounding height of any open space is also relative and depends on the overall size and width of that particular area. A feeling of oppression and vulnerability may result if the height to width ratio of any urban place is too high or too low. In order to achieve a harmonious proportion, the height of buildings and the width of public spaces should be within a ration of 1:3 to 1:6 at least (Alberti, 1755, p. 173). In a relatively small space, people feel much more enclosed and protected rather than in a large space. In a small plaza, the surrounding buildings that are moderately high may create psychological discomfort and would cause segregation (Dillon, 2005; Moirongo, 2002). The users of such
As previously mentioned, the social use of any space is positively influenced by the height of the surrounding enclosure as it gives very secluded feelings to the users of that space. It has been observed that aesthetic response to any urban plaza and designed urban open spaces may vary depending on both the type and height of the surrounding enclosure. Urban plazas with a moderately high enclosure not only provide privacy to users of that space but also give shelter and protect people from sun or rain. As regards aesthetic response, the respondents of the preliminary study preferred medium height enclosures (80%) in preference to spaces with an extremely high enclosure (40%). On the other hand, for social use the user group preferred low enclosure (83%) in preference to one of medium height (70%) or one that is high (60%). Their choice of height differences may have been influenced by the fact that some people opt for privacy when socialising. In terms of aesthetic response, visibility of the surrounding enclosure is more desirable.

3.6.7.3 A good coverage of vegetation, greenery and nature:

The natural built dimension is the most prominent dimension of human response to improve people’s quality of life and well-being (Beck, 2009; Chen, Bao, & Zhu, 2006; Herzog, Kaplan, & Kaplan, 1976, 1982; Nasar, 1989, 1994, 1998). The relevant corpus of literature consistently demonstrates nature as a content variable with a restorative and aesthetic value and extensive empirical research work has documented preferences for nature or natural elements over man made elements (Dekay & O'Brien, 2001; Kaplan, Kaplan, & Wendt, 1972; Nakamura, Takano, & Watanabe, 2002; Nasar, 1983, 1984). According to Nasar (1989), natural scenes have less intense and less predictable irregularities that can enhance unity and visual preference than man made scenes. The natural dimension has repeatedly emerged in different research literature and found human preference for nature over built features as the most prominent dimension of human response to the environment (Herzog et al., 1976, 1982; Kaplan & Kaplan, 1989; Nasar, 1989, 1992a, 1994; Schalk & Sustersic, 2009; Ulrich, 1983; Whyte, 2007; Yang & Volkman, 2010).

A body of research literature also suggests that nature provides a higher level of restoration from stress as well as calming, soothing and healing effects of natural scenes over urban scenes (Cilliers, Diemont, Stobbeelaar, & Timmermans, 2010; Kaplan, 1995; Kaplan & Kaplan, 1989; Ulrich et al., 1991). Even in the sorting task a distinction between the natural
and built environment often stimulated people to sort the photographs into different groups. People preferred natural settings and elements more than the scenes depicting human intervention (Kaplan et al., 1972; Woolley, 2003). According to Kuo (1998), who undertook a photo simulation study, participants feel safer and more comfortable with a higher density of tree planting over urban elements (Kuo, Bacaicoa, & Sullivan, 1998).

The outcomes of the preliminary study also suggested preference for an extensive coverage of vegetation, greenery and for nature over the urban environment. Both for aesthetic response and social use of designed urban open spaces the term ‘nature’ has been identified by using the following terminology: trees, landscaping, vegetation, green trees, garden, lively trees. The outcomes of this study corroborate the research literature and participants prefer those spaces that have a comparatively higher density of tree planting. A high percentage of participants (87%) also stated that it is very important for both aesthetic response and social use that the space looks more natural with a comparatively higher level of trees, vegetation and greenery. To this end, the use of vegetation and greenery to complement any urban open space is highly desirable.

3.6.7.4 The inclusion of water features and fountains:

According to Moughtin, four types of water features structured the city form and these are a water point or fountain, pool, linear watercourse like a river or canal and lastly the coast that is associated with the edge of any city (Moughtin, 2003). The existence of water features as a part of life is inevitable and in any urban open space it is provided for the enjoyment, recreational, business and retail life of the users. It provides the opportunities for significant aesthetic, economic, social and environmental benefits between public and private interests (Dovey, 2005). Water features or fountains in an urban situation can provide three sensual experiences: sight, sound and touch. Urban designers, when designing any space, should consider enhancing these sensual qualities (Banerji & Ghosh, 1994; Woolley, 2003; Yang & Volkman, 2010). As water has also been found to enhance scenic qualities, in many cities, public access to water-front areas has been increased by developing different types of water features and fountains (Francis, 1991; Ulrich, 1983; Whyte, 2007). Lynch suggested that any natural features like a water body or vegetation reinforces the image and strengthens the imageability of any object or path to make it more memorable to the viewers (Lynch, 1960, 2007).
The outcome of the preliminary study supports Lynch’s notion. According to the respondents, the inclusion of fountains or water features is one of the most important factors underpinning the aesthetic approval and social use of any public space. People usually prefer those spaces that include water features, e.g. fountains, tranquil lake, pool, cascade, waterfall, water wall, water tunnel or any kind of flowing water body as a part of the landscape. The inclusion of water in designed urban open spaces is one of the most important ‘liked’ physical features both for aesthetic response and social use. In fact, it is one of the highest ranked design elements and almost every successful plaza incorporates a water body or fountain as an obvious part of design. ‘Water features’ and ‘fountains’ attracted high percentages of approval (87% and 77%) that is termed as ‘liked’ physical features for both aesthetic response and social use respectively. Therefore, the inclusion of water as a physical design element in any urban plaza is almost mandatory.

3.6.7.5 Presence of monuments or sculptures:

Monuments or sculptures are other important landscaping elements of urban design. The size, type and position of monuments can vary according to their surroundings and locality. In each city, and in each public place, the arrangement of monuments is entirely different, needs to be harmonized with their surroundings (Sitte, 1889a, 1898). On occasion, water features, vegetation and other landscaping elements are incorporated within the structure of sculpture to become the central attraction of that public space. Usually sculptures or monuments are located at the focal point or in the most attractive part of an open space. Monuments or sculptures often become the centre of a range of social activities and gatherings. Couples, children and elderly people enjoy sitting, chatting, reading, playing, gossiping playing, in general relaxing around such focal points.

According to Sitte, the monuments of any public plaza or square should also be harmonized with the size and shape of that space however; a monumental structure fails as a focal point in excessively small or large squares (Sitte, 1889a, 1889b, 1898). Lynch found the landmark to be one of the elements by which a city is recognized and understood and that give a city a strong image. To achieve a strong imageability, a landmark or any monumental structure is equally important as a path, node, edge and district (Lynch, 1960, 2007). The findings of this study also support the literature and the participants prefer those spaces that have a monumental structure or sculpture as a central social gathering point. Both for aesthetic
response and social use respondents identified the presence of monuments or sculptures (74% and 64% respectively) as one of the most important 'liked' physical features.

3.6.7.6 Availability of seating arrangements:

Sitting space has been recognized as one of the most important characteristics that retain people in public spaces and support social behaviour and positive social interaction (Makagon, 2003; Whyte, 1980, 2007; Zhang & Lawson, 2009). The findings of this study confirm that the availability of adequate sitting spaces was identified as one of the most desirable physical characteristics for people in urban plazas, squares and pedestrian malls. Studies of plazas in Vancouver, New York and some Australian Cities found that the choice of sitting spaces in the form of benches, chairs, ledges, low height walls and even stairs and extended steps were the most important factors in keeping people in public space (Joardar, 1977; Joardar & Neill, 1978; Whyte, 1980, 2007). People used these horizontal surfaces for sitting while chatting, gossiping, reading books/news papers, watching other people, listening to music, taking photographs, sun-bathing, having lunch/coffee and other diversified social activities. The combination of food with the above-mentioned social activities usually encourages people to stay longer in any urban open space and prolongs their socializing (Mehta, 2006; Whyte, 1980, 2007).

Findings of the preliminary study also corroborate the literature by revealing the availability of seating spaces as the most desirable settings for social interaction and diversified social use. The positioning of fixed or movable chairs in front of any food outlet provides a further means for a social get together, given that eating and drinking are distinct forms of socializing. Using steps and stairs are yet another divergent way of sitting with friends and colleagues. These incidental integral surfaces such as ledges, planters, steps, stairs, bollards and so on contributed to retaining people in public space and is considered as an key design features for urban areas (Burton & Mitchell, 2006; Lo et al., 2003; Mehta, 2009). Fixed wooden benches with backs seem to provide comfortable seating arrangements for elderly people, couples and family members.

By analysing the results, it can be summarized that benches and seats are an important design element for social get-togethers in urban plazas, squares or pedestrian malls. With diversified verbal expressions, respondents identified seating spaces, seating arrangements, cosy feeling, private seating spaces and benches as different forms of seating arrangements within the construct of 'benches and seats'. Sitting spaces and benches are the most highly mentioned
physical characteristics as recognized by the respondents (90% and 80% respectively) for social use.

3.6.8 Implications for the Main Study

This research is an empirical enquiry to unveil the levels of association between environmental aesthetic response, social use and morphological characteristics of designed urban open spaces. Most urban design literature of public spaces struggles to identify either the components of the physical characteristics of public space or the social use pattern of those spaces. By integrating these approaches, this study sets out to understand and address the pattern of relationships between the above aspects. From the key findings of the preliminary study, it can be concluded that a physically well-designed open space is usually comprised of a medium to low height enclosure that provides a partially enclosed space for the users with a generous amount of vegetation, water features, presence of monuments or sculptures and adequate seating arrangements. These are the most fundamental visual and functional dimensions and act as vital physical, visual and morphological elements in the design of urban plazas, squares, pedestrian malls and other types of urban open spaces.

The evaluative image of the built environment of urban plazas and designed open spaces are one of the essential visual characteristics of the urban environment. The role of architects, urban designers and other city design related authorities are to create aesthetically appealing design solutions for the users (Lang, 1994, 2007). From the findings of the preliminary study, this research investigates in depth the aesthetic qualities of physical, visual features and the social use patterns of designed urban open spaces. These findings aid the development of an interaction model of aesthetic response and social use that can draw links between those factors and the physical, visual and morphological characteristics of urban open spaces. This interactive model can be used as a design protocol to evaluate and design future urban public space.

3.6.9 Strengths and Limitations of the Process

This research used a mixed method approach however; qualitative methods were used in the preliminary study. Multiple sorting tasks particularly the Q-sorting technique was applied and these were considered as effective, reliable qualitative approaches to capturing subjective responses into an objective set of data to allow quantitative data analysis (Amin, 2000; S. R. Brown, 1986; Groat, 1982; Mrtek et al., 1996). Other than that, focused interviews and probes were used as basic data collection tools, which are also reliable methods for qualitative
research (Judd et al., 1991; Zeisel, 2006). The strength and limitations of the research process for the preliminary qualitative part of the research is discussed below.

### 3.6.9.1 Use of visual stimuli and photographic images

Using the photographic images of 24 urban plazas, squares and pedestrian malls from photo-simulation techniques, the independent variables ‘physical characteristics’ of this research were identified. It is acknowledged that using two-dimensional images for photo-simulations are not exact substitutes for the physical environment. Although these images can capture a vast amount of visual information to represent the existing environment, however they are not comprehensive representatives of physical environments. Despite some disadvantages of using photographic images, different research domains use this medium successfully as strong surrogates for the physical environment (G. Brown & Gifford, 2001; Heft & Nasar, 2000; Hershberger, 1992; Imamoglu, 2000; Nasar, 1988, 1992b; Stamps, 2000; Stamps & Nasar, 1997). However, the key advantages of using visual stimuli from different parts of the world were to identify the diversified types of features from various plazas, squares and malls. To minimize the loss of multimodal information a few measures were taken in this research such as selecting larger images, increasing the numbers of pixels per image, by digitally correcting the background, foreground and colour contrast.

### 3.6.9.2 Small number of respondents

In the focused interviews, the main function of the interviewer to focus attention on a given experience and its effects, where interviewers know in advance what topics or aspects of a question they wish to cover. Individual focused interviews were conducted in the preliminary study to obtain qualitative, in-depth responses. Therefore, after approaching 75 people only 50 intense and comprehensive interviews were undertaken. Although the number of respondents was small, due to the nature of the focused interview, this research was able to achieve relatively comprehensive coverage of the subjective experiences and depths of insight of the respondents.

### 3.6.9.3 The relativity of the terms: aesthetic response and social use

The main objective of the preliminary study was to identify the physical characteristics of urban open spaces in terms of aesthetic response and social use. This research fully acknowledges that referring to the term ‘social use’ on the questionnaire referred to asking the respondents about their anticipated use pattern of the selected visual images. Although due to
the use of different types of urban space as surrogates for physical environments, this research obtained diversified responses to the physical features. However, as the preliminary study used photographic images, all the findings were based on the anticipated social use of those selected plazas, squares and malls.

3.6.9.4 Determining physical characteristics without considering other factors

The scope of this research was limited to the constructs of aesthetic response, social use and morphological configuration of urban open space and sought to investigate and understand users’ subjective experiences regarding aesthetic response and social use pattern of the selected urban spaces. Therefore, other factors like environmental, climatic, socio-cultural and economic factors that may have influenced the subjective experience and responses of the participants were not considered here.

3.7 Main Study

3.7.1 Aim of the Main Study

From the preliminary study, the respondents identified some important physical characteristics of the built environment of urban open spaces in relation to their aesthetic response and social use. The aim of the main study was to corroborate the findings of the preliminary study to determine the levels of association between aesthetic response, social use and the most salient physical, visual characteristics of designed urban open spaces. In addition, it also identifies spatial structure, function, social use and activity patterns of the eight study areas of Dhaka, Bangladesh. In the main study, a quantitative method was employed to identify the urban grid configuration and its relationship to human response and use (Figure 3.11). Therefore, statistical analysis (using SPSS, PASW) and space syntax techniques were utilized to define the subjective relationship in quantitative objective terms.

Figure 3.11 Detail of the main study.
3.7.2 Pilot Study

The aims of the pilot studies were to evaluate the main questionnaire and measuring scale, to finalize the layout, format and wording of the questionnaire and duration of the evaluations. The pilot studies were conducted from mid July to mid August 2009. In order to ensure the appropriateness of the interview techniques, number, wording and sequence of the questions, this study had been piloted in three phases:

■ In the first phase, six doctoral students from the Faculty of Architecture, Design and Planning at the University of Sydney participated in individual interviews and made several suggestions for improvement of the interview questions and techniques. Based on their suggestions, some adjustments were made.

■ In the second phase, there were eight participants (both students and visitors) from different open spaces in the Camperdown / Darlington Campus at the University of Sydney. The main objective of this pilot testing was to ensure the appropriateness of the interview techniques and questions before translating it to Bengali version.

■ In the third phase, ten local Bangladeshi people in the Dulwich Hill suburb of Sydney, Australia participated with the Bengali translated version of the questionnaire. As the main fieldwork was to be conducted in Dhaka, Bangladesh with the Bengali translated version, this test was conducted to improve interview techniques.

Adjustment after pilot testing:

1. Some technical terms used in the measurement instrument and questionnaire format were changed to simplify it and to make it more understandable to the general public.

2. Different colour codes and graphics were introduced to make it more legible, comprehensible and interesting to the public.

3. Most people experienced psychologically stress because of the appearance of the questionnaire and this was minimized by reducing the number of pages and by adjusting the line spacing and format.

4. General instructions, style, wording and the sequence of questions of the overall questionnaire format were changed to make it more readable and intelligible to the participants.
5. The questionnaire included both Bengali and English versions side by side because:

- The use of popular English words in Bengali is very common, for example building, height, engineer etc.
- This format is more readable and bilingual participants could cross check the questions.
- This format was also easily understandable for people who know only Bengali.

3.7.3 Selection of the Study Areas: Sampling Process and Frame

There were some considerations to determine the sampling frame and the selection of the study areas. In order to identify the urban open spaces, the author commenced a short informal interview with 15 architects and 15 randomly selected people in Dhaka, Bangladesh. The objective of this interview was to identify the most important and frequently used designed urban open spaces, where people prefer to visit and relax. As only a few open spaces exist in Dhaka, this research at first attempted to use all open spaces of the city but based on the interviews, twelve urban open spaces were selected. Out of these twelve spaces, finally eight urban spaces were included in the main study based on the following criteria:

a. Different urban open spaces were selected based on the six physical characteristics, which were identified from the preliminary study.

b. Selected urban open spaces had to be unique in characteristics and which were accessible to the public, in usable condition and had to exhibit a varied level and pattern of occupancy.

c. Centrally located, actively used for congregation, vibrant in character and more globally positioned open spaces for the city of Dhaka.

d. Open spaces that displayed morphological diversity in terms of global and local positioning enabled the exploration of relationships between morphological properties, accessibility and use of the urban open space.

The remaining four spaces were excluded due to privatization of ownership, restricted accessibility, overlapping physical characteristics, or were not vibrant and in use by the people.
3.7.4 Brief Description of the Study Areas

3.7.4.1 Urban open space 1 - Dhanmondi 8

In 1956, Dhanmondi was developed as a residential area and Dhanmondi Lake is located within that residential area. In the development plan, about 16% of the total area of Dhanmondi was designated for the lake and finally in 1998 the lake-side area had been developed as a successful urban open space (Hossain, Ishtiaque, & Poddar, 2009). There are few nodal points designed as an activity hub, where the area near Dhanmondi 8 and 32 are the important study locations of this research.

![Image of Urban open space 1, Dhanmondi 8](image)

The lake has become a well-visited local attraction, with cultural hubs such as the *Rabindra-Sarobar* (or water body), which is the main attraction of the lake-side development near Dhanmondi 8 (Figure 3.12). The lake was made accessible and visible to the public.
realm, by increasing physical accessibility from the surrounding neighbourhood and introducing visual connectivity by low green hedges. Physical connectivity was achieved by insulating walkways through the periphery of the lakeside and also introducing side roads from surrounding accessible locations. Different functions such as a food and drink corner, boat club, open-air theatre, jogging track, community-playing facilities etc. are distributed in different strategic locations to make the space lively, vibrant and active. According to the results of space inventory observation (Table 4.1 in Chapter 4), this open space is surrounded by medium height, moderate enclosure with plentiful vegetation and a water body. Although there is no monumental structure and very little primary seating (i.e. benches and chairs within this area), great amount of supplementary or secondary seating in the form of steps, low walls, pedestals and so on are the main attraction for users.

3.7.4.2 Urban open space 2 - Dhanmondi 32

Dhanmondi 32 is another important focal point within this lakeside development. This area is accessible to the general public through a bridge connection. The important focus of this zone is shatayu prangon (century yard), which acts as a practice ground for roller skating, light exercises and different kinds of seasonal games (Figure 3.13).

To make this area self-sustainable, some passive activities and food facilities are necessary pre-requisites around this urban space. The concept was to introduce these amenities as attractors, to bring in more people to the lakeside areas. A few large green spaces were designed in strategic locations with easy visibility towards the lake and accessible from the neighbourhood. The idea of this lakeside development was to restore the overall environmental quality of the tranquil lake-side area (Hossain et al., 2009). This area is surrounded by a low height, 'partially open' enclosure with great amount of vegetation and water features. Very few monuments or sculptures are located here but the use of both primary and supplementary seating spaces is prominent.
3.7.4.3 Urban open space 3 - Sangshad Bhaban

The third urban open space is the south plaza of the parliament building (in Bengali Sangshad Bhaban), designed by architect Louis I. Kahn. This Plaza faces Manik Mia Avenue and gradually rises to more than 6 meter (20 ft) height and serves as a beautiful exterior as well as a main entrance (used by the members during sessions) to the Parliament Building. Although this designed urban open space is hard-surfaced all over, the surrounding green areas, vegetation and water bodies make this space cool and serene during summer. The main attractions of this plaza are the extended steps and ramps leading directly to the façade of the parliament building (Figure 3.14).

This urban space can be described as a low height, partially open enclosure with plentiful vegetation. Other important characteristics are a moderate number of water features and seating areas with monumental elements.
3.7.4.4 Urban open space 4 - Zia Uddan

Zia Uddan (sometimes called Chandrima Uddan) is one of the important open spaces situated next to the Parliament building (Urban Open Space 3), in Dhaka, Bangladesh. The name Chandrima Uddan literally means ‘Moonlight Park’ in Bengali. This urban space is notable for being the place where the former Bangladeshi President, Ziaur Rahman was buried. It is connected to the road by a bridge, which runs over the Crescent Lake. This is a common place to spend leisure time in the vicinity. Although this space is immense, this research included only the shaded part for the study (Figure 3.15). This area is surrounded by an extremely low ‘partially open’ enclosure with vast tracts of vegetation and a moderate number of water
features. The use of secondary seating spaces with a monumental tomb or mausoleum is highlighted by the space inventory observation as ‘quite a lot’.

Figure 3.15 Urban open space 4, Zia Uddan.

3.7.4.5 Urban open space 5 - Rayer Bazaar

This urban space is primarily a memorial, designed in the late 1990s to mourn the memory of the war in 1971. This is the place where the Pakistani Army killed thousands of civilians during the 1971 Liberation War. *Boddho Bhumi Smriti Soudha* (or Slaughter-Place Memorial) was built to commemorate the death of the nations’ finest intellectuals and others, who were killed at the very end of the war of liberation (14 December, 1971) by the Pakistani army with the help of their collaborators at Rayer Bazaar brick field in Dhaka. The memorial was constructed at the place where the mass killing took place. Among the people who were killed indiscriminately were educationists, physicians, journalists, writers, film directors, critics and
other professionals. This urban open space is a place where people have a strong desire to visit to pay their respect for the intellectuals (Figure 3.16).

Although this place is located at the western edge of Dhaka city, it becomes an important urban space for local people on weekend. This space becomes highly significant and acts as an important global attractor on a specific day, 14th December of each year. This open space is surrounded by a moderate height, ‘partially enclosed’ structure with a moderate amount of vegetation. There is a small water body located within the complex to highlight the immense brick sculptural structure, which is also facilitated by moderate amount of seating spaces.

![Image of urban open space 5, Rayer Bazaar](Huq, 2007)

3.7.4.6 Urban open space 6 - Ramna

*Suhrawardy Udyan* formerly known as *Ramna Race Course* ground is a national memorial located in central Dhaka. Originally it served as the military club of British soldiers stationed in Dhaka. It was then called the *Ramna Race Course*. After the end of colonial rule, this place...
(sometimes referred to as *Dhaka Race Course*) was used for legal horse racing on Sundays. Ramna Race Course was renamed after the Bangladeshi leader *Huseyn Shaheed Suhrawardy*.

The space is also etched in history as the original Flag of Bangladesh was also hoisted here for the second time since, it was first unfurled at the University of Dhaka and the first time it was flown at such a large public gathering in Bangladesh. It was also the site of a centuries old Hindu temple and landmark, the *Ramna Kali Mandir*. Incidentally it became the setting for the surrender of Pakistani Army on December 16, 1971. The instrument of surrender was signed at this place and the date is celebrated by Bangladeshis as ‘Victory Day’. The place was redesigned in the late 1990s and is currently maintained as an historic, designed urban open space with an eternal flame set up in 1996 to symbolize freedom. This space is surrounded by a low, ‘partially open’ structure with a moderate amount of water features. This space can be
characterized by plentiful vegetation with a moderate amount of seating and monumental sculptures (Figure 3.17).

3.7.4.7 Urban open space 7 - Shahid Minar

The Shahid Minar is a national monument in Dhaka Bangladesh, established to commemorate the martyr, who was killed during the Language Movement demonstrations in 1952. In that year on February 21, dozens of Bengali students and political activists were killed when the Pakistani police force opened fire on Bengali protesters. The reason was that Bengali people were demanding equal status for their native tongue, Bangla. The Language Movement gained momentum and after a long struggle, Bangla was given equal status to Urdu. To commemorate the dead, the Shahid Minar was designed and built by Hamidur Rahman a Bangladeshi sculptor in several phases. Today, the Shahid Minar is the centre of cultural activities in Dhaka. Every year, the ‘Language Movement’ is remembered at that monument.

The design of the current Shahid Minar mainly follows the original plan of 1957. The minars are constructed of pure marble stone upon a 4.3 m (14 ft) high stage. The stairs and railings are painted in white to create a heavenly appearance. The fences on both sides are highlighted with lines from the poems of famous poets in iron letters. This monument and the surrounding open spaces were constructed in several stages. In the final phase, the main stage and the columns remained unchanged but the stairs were extended forward to give the area and the stairs a monumental appearance (Figure 3.18). This open space is surrounded by an extremely low, ‘completely open’ structure with very little vegetation. This immense monument has no water body located within the complex but its amenity is supplemented by some sitting spaces.
3.7.4.8 Urban open space 8 - Teacher Student Centre (TSC)

The teacher-Student Centre (TSC) is designed as the social and cultural heart of the campus within the institutional zone of Dhaka city. The food and drink kiosk, in addition to the open air stage, makes this area vibrant and colourful for staging meetings, functions, lectures, arts exhibitions, concerts and other diversified activities (Figure 3.19). This is a vibrant space by the teachers, students, activists of socio-cultural organizations with various programmes such as, educational, co-curricular and entertainments, national and international seminars, symposia, freshers' receptions, orientation programmes and farewells of different Departments and Institutes of the University.

This open space is surrounded by a low, 'moderately enclosed' structure with a moderate amount of vegetation. This space is characterised by having very few monumental sculptures and a great amount of sitting spaces, but without a water body located within the complex.
3.7.5 Population and Sample

The concept of population usually means the entire population from which, the desired information can be collected. A sample specifies the specific number of population to be surveyed. For this research, population means the people who use plazas, squares or any kind of urban open space in any city of the world.

Aesthetic response to the physical characteristics and social use of designed urban open spaces refers to responses of people irrespective of age, gender, socio-economic status and so on. This study is interested in the evaluation of aesthetic response and social use of urban open spaces determined by the public or user group. One practical issue that had an impact on
the sampling process was that the evaluation needed to be conducted in each urban open space in a natural environment. Therefore, this survey was conducted in eight different urban open spaces in Dhaka, Bangladesh from September to November 2009. A brief description of these eight study areas has already been discussed in Section 3.7.4.

3.7.5.1 Sample unit specification

Usually the sample unit in any survey represents the smallest entity that consists of individual people responding. Each person or respondent can be viewed as a sample unit from which data can be obtained. As it is the smallest and most important single entity, a sample unit should be specified before conducting the survey research. Therefore for this study, the sample unit will be each individual respondent who participated in the study.

3.7.5.2 Sampling selection process

The practical specification of a sampling design begins with identification of the population and the number to be surveyed. It is important for the research to identify respondents that represent a broader cross-section of the entire population. To ensure a diversified sample of a population, it is useful to divide the population into two or more desired segments and to choose the samples equally from each portion. The selection of sample is often based on demographic details (i.e., age, gender, ethnicity etc.) or other criteria depending upon the aim of the research. For this study, the sample needed to be diverse in terms of demographic and educational background as well as through convenience and who are ready to participate in this study. Diversity was based on:

- Male vs. female
- Different age ranges (from 18-55 years)

3.7.5.3 Sample size

Convenience sampling was used for the main study, and this is considered as a non-probability based sampling method (Coolican, 2004). The participant group for this study were the people who were present and actively using those spaces at the time of survey. Large sample sizes are less likely to exhibit sampling bias and are considered ‘efficient estimators’ of a population (Argyrous, 2005; Coolican, 2004). For each study area, a convenient sample size was 35 and for the eight urban open spaces, the total sample size was 280. For each urban
space, an equal proportion of men and women from different age groups were approached to take part in the survey.

3.7.5.4 Sampling bias

A number of strategies were implemented to minimize the possibility of sampling bias, which may occur if the sample size contains an under or over representation of one particular category of participant (Coolican, 2004). Hence, the target sample for this study was fixed at 280, which is an acceptable number to minimize biasness. In addition, to broaden the sample base, an equal proportion of men and women from a broader age range were selected to represent the larger group of population.

3.7.6 Data Collection Methods

3.7.6.1 Measuring instruments

The set of categories or range of scores on a variable is called a ‘scale’ and the process of assigning scores to objects to yield a measure of a construct is called ‘scaling’ (Judd et al., 1991). Scaling is the branch of measurement that involves the construction of an instrument that associates qualitative constructs with quantitative metric units. When scales are used, reports describe the distribution of respondents along the scale or in categories. The positions of various individuals or groups can then be compared with one another. The proposed measurement instrument is a linear, numeric scale. This simple, linear, numeric scale is the most advisable method of scaling when evaluative responses are to be judged on a single dimension and arrayed on a scale with equal intervals (Alreck & Settle, 2004). The use of a scale is also the most economical where several items are all to be rated on the same dimension on an interval scale. Scales with numeric values are usually equidistant from one another in an interval scale.

The measurement instrument was used to investigate patterns of aesthetic response in respect of the four dependent variables comprised of semantic differential rating scale items. Semantic differential rating scales have been used widely as an effective tool for measuring and describing meaning in relation to environments, various age groups and cultures (Osgood, 1957; Russell, 1988). According to Stamps (2000), semantic differential rating scales, Q sorts and other methods of measurement highly correlated (r = 0.99) imply a strong reliability. Moreover, Ward and Russell (1981) assessed different methods for measuring responses to the environment including semantic differential and multi-dimensional scaling and found that
in spite of some level of variance, all methods were found to be relevant and relatively reliable (Ward & Russell, 1981). On the other hand, to measure the social use of urban open space, a linear numeric ‘Likert’ scale was used. When variables need to be judged on a single dimension scale of equal intervals; a simple, linear, numeric scale is the most straightforward method of scaling (Zeisel, 2006). This scale is the most economical and is termed an interval scale as all the numeric values are equidistant from one another (Hoyle, Harris, & Judd, 2002).

**Semantic differential rating scales:** A semantic differential rating-scale is a set of rating scale items, comprised of bi-polar opposite adjectives identified by the researcher that are considered relevant, meaningful or familiar to the construct or stimulus about which the judgments are to be made. This study incorporated four bi-polar semantic differential rating-scale items related to the construct of ‘aesthetic response’ as a measurement instrument adapted from the factor analysis, literature and earlier studies. The four sets of dependent variables are:

1. Pleasant - Unpleasant
2. Like - Dislike
3. Beautiful - Ugly
4. Desirable - Undesirable

According to Heise (1970), the rating scale item per dimension should be within a range of one to four and a maximum number of judgements or evaluations in a measurement instrument should be around fifty (Heise, 1970). Therefore, this study assessed the response to each physical characteristic for the above four variables. The following is an example of the bi-polar format used in the measurement instrument to rate the physical environment (Figure 3.20).

```
Pleasant □ □ □ □ □ □ □ Unpleasant
```

**Figure 3.20 Example of bi-polar format of semantic differential rating scales.**

**Likert scales:** In the Likert scale, a group of statements are presented to respondents to indicate the intensity of their agreement or disagreement (Zeisel, 2006). Usually Likert-scaled questions are grouped together in a set of questions to understand the respondents’ opinion by
tabulating the scores of the statements. This research used a group of five-point Likert type scale to understand the social use pattern of the respondents. Respondents were asked to identify the use and activity pattern for each urban space through a series of selected questions (Appendix E). The following is an example of the Likert type scale used in the measurement instrument to rate the social use pattern of urban open spaces (Figure 3.21).

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Neutral</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Figure 3.21 Example of Likert type scale used in the measurement instrument.

**Observing pedestrian movement:** Observing the surrounding pedestrian density is an important factor to determine the social use pattern (Gehl, 2006; Gehl & Gemzoe, 1996). According to Hillier (1996) the more human movement around any space, the higher the potential for participants to use it, therefore this study observed the average number of pedestrians present in each study space. For the movement density, the data set was obtained through systematic site observations and observations of pedestrian movement were made using the 'gate method' (Kasemsook, 2003; Michele, 2008). To index the use density and to measure the number of observed people in a space, this study used a gate method instead of using an encounter rate (Klarqvist, 1993; Michele, 2008). Due to the nature of the study spaces, observation through the gate method was more appropriate than an encounter rate for this study. At first for each site, the numbers of 'gate' locations were fixed and observation of pedestrian movement was conducted for each gate. The location of gates is highlighted with red arrow on the detail plan of each study area (see Chapter 5, Figure 5.19-5.40). For every gate, movement was observed for five minutes per hour, every hour from 10 am to 6 pm, on weekdays and weekends. The average number of pedestrian movements was calculated to obtain the density per hour for each gate. If a line had more than one gate, all movement densities per hour for all the observation gates were averaged to obtain the movement density per hour of that line. In this way, for each urban open space, the average number of pedestrians or the movement density was obtained. The total number of pedestrian movements for each study area is below (Table 3.6).
### Table 3.6 Pedestrian Movement Rate/hr of Eight Study Areas

<table>
<thead>
<tr>
<th>Designed urban open space</th>
<th>Movement/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Dhanmondi 8</td>
<td>305</td>
</tr>
<tr>
<td>2: Dhanmondi 32</td>
<td>282</td>
</tr>
<tr>
<td>3: Sangshad Bhaban</td>
<td>269</td>
</tr>
<tr>
<td>4: Zia Uddan</td>
<td>314</td>
</tr>
<tr>
<td>5: Rayer Bazaar</td>
<td>94</td>
</tr>
<tr>
<td>6: Ramna</td>
<td>102</td>
</tr>
<tr>
<td>7: Shahid Minar</td>
<td>102</td>
</tr>
<tr>
<td>8: Teacher Student Centre (TSC)</td>
<td>199</td>
</tr>
</tbody>
</table>

**Space inventory observation:** The space inventory observation is another instrument given to the Bangladeshi architects in Sydney, Australia to evaluate the physical characteristics of the study areas after executing the field survey in Dhaka. Given their educational background, experience and cultural familiarity of those spaces, a cohort of 25 Bangladeshi architects participated. The schedule was composed of a set of visual stimuli and a Likert-scale questionnaire for each space. The details of the space inventory rating scale and consent form are provided in Appendix H, I. The results of the space inventory observation are included in Chapter 4.

#### 3.7.7 Data Collection Procedures

The final survey took place from September to November 2009 in Dhaka, Bangladesh. To conduct the survey, four local university students were trained as research assistants (RA), how to introduce themselves to respondents and how to administer the survey in a group of two. Each RA administered a trial survey and was observed by the principal researcher and necessary recommendations were given to each of them to attain the same standard. The research assistants collected the final data from each urban open space in a group of two and the principal researcher supervised alternate data collection sessions in each group. Each data collection session was conducted during the day (10 am to 6 pm) and the session time varied between 15 to 20 minutes. After the target sample size was achieved for one space, the researcher started to gather data for the next open space. The procedure that followed for each data collection session is detailed below:
1. The researcher asked each participant politely to participate and upon agreement, a set of ‘participant information statements’ to read and a ‘consent form’ to sign was provided.

2. A set of questions was given to the participants and the researcher verbally delivered the written instructions and clarified any word in the local language, which was unfamiliar to the participants.

3. The participants completed the questionnaire by themselves.

4. After the end of each session, participants were thanked for taking part. The researcher and the RA then took the information sheet, consent form and questionnaires from the participants.

3.7.8 Methods of Data Analysis

3.7.8.1 Screening and cleaning the data

After collecting and coding all the data, an SPSS 17 file was created for data input and analysis. The total data input process was scrutinized thoroughly to check the accuracy of the data with the help of research assistants. Errors were corrected at this stage.

3.7.8.2 Missing data

Missing data can have a negative impact on overall data analysis and care should be taken to handle the missing data for most of the research design (Tabachnick & Fidell, 2007). This study faced a minimal occurrence of missing data due to the method of data collection. Each questionnaire was checked for missing data after the data collection session, and was set aside if the researcher found any missing data. The researcher then approached another person of similar gender and age to fulfil the target sample size and to minimize the missing data on the questionnaires. During data analysis, missing data were handled by selecting ‘exclude cases pair wise’ and SPSS excluded the case or person for the specific analysis.

3.7.8.3 Statistical analysis methods

Some major data analysis methods are common to determine the levels of association between the variables and these includes correlation analysis, analysis of variance (ANOVA) and covariance (ANCOVA), multiple and linear regression, canonical correlation, structural equation modelling, and so on.
In assessing suitable data analysis methods the researcher considered Wilkinson, Coolican, Pallant and Tabachnick and Fidell’s advice in selecting and analysing the preferred methods (Coolican, 2004; Pallant, 2007; Tabachnick & Fidell, 2007; Wilkinson & Task Force on Statistical Inference, 1999). These selected methods are very familiar, reliable and valid in terms of statistical evidence that is specific to research aims and questions (Tabachnick & Fidell, 2007). Other than that, descriptive statistics and factor analysis were used to determine the components of the construct, aesthetic response and social use. These methods, their applications and associated assumptions in relation to the research questions are discussed in detail in Chapter 4.

3.7.8.4 Space syntax techniques

Space syntax is spatial analysis to explore the configurational properties of urban space. This is a set of descriptive techniques for representing, quantifying and modelling the spatial configuration of buildings and settlements. The objective properties of the urban grid configuration can be subjectively defined in terms of some syntactic measures that include integration, connectivity, control, intelligibility etc. *UCL Depthmap* was used to syntactically analyse the axial map of Dhaka city. The morphological, configurational and spatial analyses of urban street layout (with particular emphasis of the spatial structure of urban open spaces in terms of different syntactic properties), are discussed in greater detail in Chapter 5.

3.7.9 Quality Assurance: Trustworthiness of the Research

The main aim of trustworthiness of the research is to ensure that the study can be replicated in different settings and at different times by using the same measurement instruments and data collection procedures (Groat & Wang, 2002; Lincoln & Guba, 1985, 1994; Pallant, 2007). Among the several indicators of quality assurance, reliability and validity of the measurement instrument is the most important, and is examined in the following section.

3.7.9.1 Determining the reliability of the measurement instruments

Reliability usually refers to the capacity to repeat or replicate similar and consistent research findings over a number of occasions (Coolican, 2004; Groat & Wang, 2002; Kinnear & Gray, 2009). According to Coolican (2004), internal reliability measures the internal consistency of the test or measurement instrument, and external reliability refers to the stability of the procedure across time. Both are important measures of reliability. The internal consistency of a measurement instrument is characterised by a high consistency rate of responses and the
way the participants tend to respond to similar questions in similar ways (Coolican, 2004; Hinton, 2004; Pallant, 2007). To test the internal and external reliability of the measurement instrument the following steps were considered in this study:

**Reducing measurement error:** Firstly, the members of the EBS research group, Faculty of Architecture, Design and Planning, the University of Sydney reviewed and assessed the measurement instrument in the pilot study. During the data collection and data entry phase, all collected data were double checked and verified thoroughly. Furthermore, to avoid statistical error a sample size of at least 100 is desirable (Malhotra & Grover, 1998). The present study included 280 samples, which was sufficient to generate valid statistical conclusions.

**Cronbach’s alpha:** Internal consistent reliability was measured using Cronbach’s alpha to make sure that the scale measured the same characteristics i.e. the variance of participants’ scores on each rating scale item (Kinnear & Gray, 2009; Pallant, 2007). It is suggested that an alpha (α) score of 0.7 or above indicates a consistent reliability of the instrument (Coolican, 2004; Hinton, 2004; Tabachnick & Fidell, 2007). However, for a short scale with fewer than 10 items, the alpha score usually indicates low values (Pallant, 2007). In this study, the alpha level for aesthetic response (4 items) is 0.916 and social use (7 items) is 0.858 respectively indicating a very high level of internal reliability of the measuring instruments. Table 3.7 to 3.10 reports Cronbach’s alpha coefficient for the components of aesthetic response and social use.

**Scale: Aesthetic Response**

Table 3.7 Reliability Statistics for Aesthetic Response

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>No. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.916</td>
<td>.918</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 3.8 Item-Total Statistics for Aesthetic Response

<table>
<thead>
<tr>
<th></th>
<th>Scale Mean if Item Deleted</th>
<th>Scale Variance if Item Deleted</th>
<th>Corrected Item-Total Correlation</th>
<th>Squared Multiple Correlation</th>
<th>Cronbach's Alpha if Item Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant-unpleasant</td>
<td>18.50</td>
<td>3.240</td>
<td>.856</td>
<td>.743</td>
<td>.875</td>
</tr>
<tr>
<td>Like-dislike</td>
<td>18.47</td>
<td>3.368</td>
<td>.799</td>
<td>.660</td>
<td>.895</td>
</tr>
<tr>
<td>Beautiful-ugly</td>
<td>18.49</td>
<td>3.333</td>
<td>.841</td>
<td>.717</td>
<td>.881</td>
</tr>
<tr>
<td>Desirable-undesirable</td>
<td>18.35</td>
<td>3.296</td>
<td>.745</td>
<td>.560</td>
<td>.915</td>
</tr>
</tbody>
</table>
Scale: Social Use

Table 3.9 Reliability Statistics for Social Use

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.858</td>
<td>.865</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 3.10 Item-Total Statistics for Social Use

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Scale Mean if Item Deleted</th>
<th>Scale Variance if Item Deleted</th>
<th>Corrected Item-Total Correlation</th>
<th>Squared Multiple Correlation</th>
<th>Cronbach's Alpha if Item Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting: On the benches and seats</td>
<td>22.77</td>
<td>27.532</td>
<td>.881</td>
<td>.941</td>
<td>.800</td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/sitting on grass</td>
<td>22.76</td>
<td>28.818</td>
<td>.817</td>
<td>.826</td>
<td>.811</td>
</tr>
<tr>
<td>Walking: Walking around</td>
<td>22.82</td>
<td>33.547</td>
<td>.381</td>
<td>.169</td>
<td>.869</td>
</tr>
<tr>
<td>Wandering: Exploring architecture</td>
<td>22.79</td>
<td>27.832</td>
<td>.862</td>
<td>.986</td>
<td>.803</td>
</tr>
<tr>
<td>Talking: Chatting with friends</td>
<td>22.56</td>
<td>34.391</td>
<td>.340</td>
<td>.131</td>
<td>.873</td>
</tr>
<tr>
<td>Eating: Having coffee/drinks/food</td>
<td>23.85</td>
<td>31.751</td>
<td>.359</td>
<td>.159</td>
<td>.884</td>
</tr>
<tr>
<td>Watching: Watching people</td>
<td>22.79</td>
<td>27.739</td>
<td>.871</td>
<td>.987</td>
<td>.802</td>
</tr>
</tbody>
</table>

Test-retest reliability: This test was performed to measure the external reliability of the survey instrument. Test-retest reliability is a consistent score of a given instrument, which become reasonably consistent across different measurement environments among the same participants (Coolican, 2004). Amongst the respondents 10% were retested with the same questionnaire after one week of the survey and a high degree (85%) of consistency was found between the test answers, which indicate a quite reliable instrument.

3.7.9.2 Determining the validity of the measurement instrument

The following measures were taken to determine the validity of the measurement instrument.

Internal validity: Internal validity is the notion of the extent to which the effects found in a study can be taken to be accurate (Coolican, 2004). For the accuracy and credibility of the research, triangulation was carried out using different interviewed respondents.

External validity: External validity is the notion of generalization of the research findings irrespective of location, population and times (Coolican, 2004; Groat & Wang, 2002). To ensure the external validity, the survey was conducted in the natural situation of eight urban
open spaces in Dhaka, Bangladesh. The respondents were selected through stratified random sampling. There is a common debate regarding the generalization of the findings from the sample given that the sample may not be truly representative of the population. To address the issue, this research increased the sample size to 280 in total for the eight study areas.

**Face validity:** The measurement instrument can be considered as having face validity when what is being measured is clear without revealing the underlying reason of the research (Coolican, 2004). One of the aims of the pilot study was to test the face validity of the instrument. Moreover, the instrument was pre-tested with several PhD students and experts to determine its validity.

**Content validity:** Content validity refers to whether the instrument measures what is intended to be measured and Coolican (2004) suggests using peers, research colleagues and expertise to evaluate the validity of an instrument in this regard. Colleagues from the Faculty of Architecture, Design and Planning at the University of Sydney participated in the pilot study to ensure that the questionnaire reflected the contents of the aesthetic response and social use in appropriate proportion.

**Construct validity:** The notion of construct validity determines the theoretical validity of the underlying construct represented by the variables (Coolican, 2004). Factor analysis was used to determine the validity of linking four variables to aesthetic response and seven variables to social use. According to Malhotra and Grover (1998) when the variables load together without cross loading onto others, then it ensures construct validity. In this study, no overlap on the Pattern Matrix (Table 4.5 in Chapter 4) ensured the construct validity of the instrument.

### 3.7.10 Strength and Limitations of the Process

#### 3.7.10.1 Determining the number of variables for the dependent constructs

The numbers of variables for the dependent construct, aesthetic response and social use used in the main study were obtained from the preliminary study and literature review. Factor analysis suggested that four variables linked to aesthetic response and seven variables to social use. This research is not concerned with how people perceive and evaluate different visual characteristics and uses of the spaces in a broader sense; rather the pattern of response and social use are limited to a specific range of variables. Although different literature
suggested different numbers of variables, this research focused more on the data obtained from the qualitative focused interviews of the preliminary study.

3.7.10.2 Measurement instrument

The measurement instrument for the construct of 'social use' used in the main study had not been previously used or tested; therefore is not considered as standardized. Furthermore, the number of variables to measure the construct of social use was limited to seven. Hence, it was not possible to determine whether the data obtained from the main study was truly representative or not.

3.7.10.3 Use of space syntax technique

Space syntax theory and technique is applied to identify the configurational and morphological properties of urban system. The data and results obtained from the questionnaire relating to the spatial analysis of urban structure, had not been used, crosschecked or tested before. Therefore, it was not possible to determine the generalizability of the findings.

3.7.10.4 Sample size for each study area

The total sample size for this study was 280, which is statistically a sound sample size to derive general conclusion. However, the sample size for each space is only 35, which is not sufficiently representative for the stated population of the study. This study has drawn conclusions based on the combined population for the eight study areas. This is statistically a sound sample size from which to derive general conclusions.

3.7.10.5 Consideration of other physical factors

The scope of this study is limited to the variables aesthetic response and social use only. However, it is fully acknowledged that both aesthetic response and social use are subjective features and depend on different environmental, socio-cultural, social status, economic and other personal factors, which have not been considered here. This can open up possibilities for future research by considering different moderating factors of the environment and respondents.
CHAPTER 4

RESULTS AND INTERPRETATION OF THE
STUDY AREAS FROM SPSS ANALYSIS
4.1 Introduction

This chapter presents the main findings and interpretations of the study about the relationship between aesthetic responses, social uses and the physical characteristics of urban open spaces of Dhaka, Bangladesh. It opens with a discussion about the specific research questions of this study as well as examining the statistical construal of the patterns of responses and social uses of urban open spaces. This chapter is divided into three sections. In the first section, the components and variables associated with the dependent constructs, aesthetic response, social use and their level of interrelationship are identified by using factor analysis and correlation respectively. In the second section, by using ANOVA the aspects of aesthetic response and their association with the physical characteristics and the study areas are explored. In the third section the ANOVA is used to explore the relationship between social use patterns with eight urban open spaces of Dhaka.

4.2 Results from Space Inventory Observation

The physical characteristics of each designed urban open spaces were identified using a space inventory survey, which was based on the five ‘most liked’ physical features of paved urban spaces as per the preliminary study. These are surrounding enclosure, height of the surrounding enclosure, water feature, vegetation, monuments or sculptures. These five most liked physical features are further divided into five different levels. Nominal group consensus was used to identify different levels within each of the five categories and a total of 25 Sydney-based Bangladeshi architects participated. The ‘nominal group consensus’ is a data collection technique used to gain consent among participants for a selected research method. This technique is very similar to the Delphi technique (which uses a panel of experts) as both employ participants with relevant knowledge or experience according to the aims of the study. Selection of the participant group was based on the relevance of their educational background, experience and cultural familiarity; and each participant was provided with a set of visual stimuli and a Likert-scale questionnaire for each designed urban open spaces (Appendix H).

Regarding the measurement of specific physical characteristics, this research relied upon those elements identified by the Bangladeshi architects interviewed. It is acknowledged however, that dimensions given in terms of low, moderate and high are relative and this is often how authors refer to these qualities. The relevant literature related to the proportion of these physical characteristics is discussed in detail in Chapter 3. The results of the space inventory observations are detailed in Table 4.1.
Table 4.1 Types of Physical Characteristics of Eight Study Areas According to Space Inventory Observation

<table>
<thead>
<tr>
<th>Designed urban open space</th>
<th>Surrounding Enclosure</th>
<th>Height of Enclosure</th>
<th>Water Feature</th>
<th>Vegetation</th>
<th>Monuments/Scultpures</th>
<th>Sitting Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Dhanmondi 8</td>
<td>Moderate enclosure</td>
<td>Moderate height</td>
<td>Quite a lot</td>
<td>Quite a lot</td>
<td>None at all</td>
<td>Great amount</td>
</tr>
<tr>
<td>2: Dhanmondi 32</td>
<td>Partially open</td>
<td>Low</td>
<td>Great amount</td>
<td>Great amount</td>
<td>Moderate amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>3: Sangshad Bhaban</td>
<td>Partially open</td>
<td>Low</td>
<td>Moderate amount</td>
<td>Quite a lot</td>
<td>Moderate amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>4: Zia Uddan</td>
<td>Partially open</td>
<td>Extremely low</td>
<td>Moderate amount</td>
<td>Great amount</td>
<td>Quite a lot</td>
<td>Very few</td>
</tr>
<tr>
<td>5: Rayer Bazaar</td>
<td>Partially enclosed</td>
<td>Moderate height</td>
<td>Very few</td>
<td>Moderate amount</td>
<td>Great amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>6: Ramna</td>
<td>Partially open</td>
<td>Low</td>
<td>Moderate amount</td>
<td>Quite a lot</td>
<td>Moderate amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>7: Shahid Minar</td>
<td>Completely open</td>
<td>Extremely low</td>
<td>None at all</td>
<td>Very few</td>
<td>Great amount/size</td>
<td>Very few</td>
</tr>
<tr>
<td>8: TSC</td>
<td>Moderate enclosure</td>
<td>Low</td>
<td>None at all</td>
<td>Moderate amount</td>
<td>Very few</td>
<td>Great amount</td>
</tr>
</tbody>
</table>

4.3 Components and Variables Linked to Aesthetic Response and Social Use

The aim of the first research question has been discussed in Chapter 3. The second research question was designed to examine empirically the relationship between aesthetic response, social use and the physical characteristics of urban open spaces. To answer this question it is important to determine the components and the dependent variables that linked to the construct aesthetic response and social use. All continuous variables that were used to determine the construct aesthetic response and social use were examined through factor analysis. Different stages and associated detailing to identify the components of each of the dependent constructs are described below.

4.3.1 Checking and Confirming the Assumptions of Factor Analysis

Factor analysis is an exploratory data reduction technique to summarize and extract data that allows the determination of the smallest number of factors (Pallant, 2007). Factor analysis explains variations within the data where the resulting Eigen values and factor loading provide a statistical basis for linking variables to a given construct (Coolican, 2004; Tabachnick & Fidell, 2007). The following assumptions were tested prior to conducting factor analysis.
4.3.1.1 Sampling adequacy

The data were first assessed to check the assumptions and suitability for factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value is 0.833 and Bartlett’s Test of Sphericity value is significant (p = 0.000), therefore factor analysis is appropriate (Table 4.2). A data set is considered as appropriate for factor analysis when the KMO value is at least 0.6 or above and the Sig. value of Bartlett's Test is 0.05 or smaller (Pallant, 2007; Tabachnick & Fidell, 2007). The number of factors or components extracted from factor analysis may vary depending on the loading of the components and the results may be considered as ‘clean’ when the variables are strongly related (Pallant, 2007). To determine the number of factors some important aspects need to be considered first.

### Table 4.2 KMO and Bartlett’s Test Results Showing Sampling Adequacy

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>0.833</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>3312.685</td>
</tr>
<tr>
<td>df</td>
<td>55</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000</td>
</tr>
</tbody>
</table>

4.3.1.2 Eigen value: Determination of components

It is common practice to use Eigen values greater than 1 to determine how many components meet this criterion (Hinton, 2004; Pallant, 2007). In this case only the first three components recorded Eigen values above 1 (4.479, 2.999, 1.018) explaining 40.71%, 27.26% and 9.25% of the variance respectively. These three components explain a total of 77.23% of the cumulative variance as detailed in Table 4.3.

4.3.1.3 Scree plot

A change of shape of the scree plot after running factor analysis also provides an indication of the principle factors (Hinton, 2004; Pallant, 2007). In Figure 4.1 there is a clear break after the third component and these three components capture much more of the variance than the remaining components. There is also another small break after the fifth and sixth components but these breaks are not worthy of note. Therefore, from the scree plot it is recommended to retain the first three components.
### Table 4.3 Percentage of Variance Explained by the Components Extracted from Factor Analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigen values</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>4.479</td>
<td>40.717</td>
<td>40.717</td>
</tr>
<tr>
<td>2</td>
<td>2.999</td>
<td>27.260</td>
<td>67.977</td>
</tr>
<tr>
<td>3</td>
<td>1.018</td>
<td>9.251</td>
<td>77.228</td>
</tr>
<tr>
<td>4</td>
<td>0.825</td>
<td>7.497</td>
<td>84.725</td>
</tr>
<tr>
<td>5</td>
<td>0.712</td>
<td>6.475</td>
<td>91.200</td>
</tr>
<tr>
<td>6</td>
<td>0.331</td>
<td>3.012</td>
<td>94.211</td>
</tr>
<tr>
<td>7</td>
<td>0.239</td>
<td>2.173</td>
<td>96.385</td>
</tr>
<tr>
<td>8</td>
<td>0.190</td>
<td>1.729</td>
<td>98.114</td>
</tr>
<tr>
<td>9</td>
<td>0.157</td>
<td>1.427</td>
<td>99.541</td>
</tr>
<tr>
<td>10</td>
<td>0.044</td>
<td>0.396</td>
<td>99.937</td>
</tr>
<tr>
<td>11</td>
<td>0.007</td>
<td>0.063</td>
<td>100.000</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

<sup>a</sup> When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

**Figure 4.1** Scree plot of factor analysis (n=280).
4.3.1.4 Component matrix

Another table that requires examination at to finalize the number of factors, is the component correlation matrix. SPSS retains only those components with Eigen values above 1 and uses the Kaiser criterion as the default (Pallant, 2007). Table 4.4 detailed the component correlation matrix and identified only three components.

Table 4.4 Component Correlation Matrix

<table>
<thead>
<tr>
<th>Component/Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.000</td>
<td>0.110</td>
<td>0.420</td>
</tr>
<tr>
<td>2</td>
<td>0.110</td>
<td>1.000</td>
<td>0.092</td>
</tr>
<tr>
<td>3</td>
<td>0.420</td>
<td>0.092</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

4.3.1.5 Pattern and structure matrix

The pattern matrix and structure matrix played an important role in making the final decision concerning the number of factors. In Table 4.5 for the structure matrix, six items loaded above 0.3 on Component 1, four items loaded above 0.8 on Component 2 and seven items above 0.3 loaded on Component 3. Ideally to act as an active component, at least three or more items should be loaded on each component. Therefore, three factor solutions are likely to be more appropriate. In total eleven variables were used in this study to represent the construct aesthetic response and social use.

Table 4.5 Pattern and Structure Matrix

<table>
<thead>
<tr>
<th></th>
<th>Pattern Matrix</th>
<th>Structure Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Component</td>
<td>Component</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Wandering: Exploring architecture</td>
<td>0.986</td>
<td></td>
</tr>
<tr>
<td>Watching: Watching people</td>
<td>0.984</td>
<td></td>
</tr>
<tr>
<td>Sitting: On the benches and seats</td>
<td>0.979</td>
<td></td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/sitting on grass</td>
<td>0.936</td>
<td></td>
</tr>
</tbody>
</table>
4.3.2 Results and Interpretations of the Components of Factor Analyses

The results of the factor analysis highlighted that three factors emerged as linked to the constructs, with one of these representing aesthetic responses and two of them representing social uses (Table 4.6). Among the eleven variables, four variables linked to the construct ‘aesthetic response’ and these are pleasant-unpleasant, beautiful-ugly, like-dislike, and desirable-undesirable. From factor analysis, the construct social use can be further divided into two sub-components; active social use and passive social use. From the pattern matrix, it has been identified that four variables linked to passive social use and these are wandering, watching, sitting and relaxing. On the other hand, three components linked to active social use such as: eating, talking and walking. It is also statistically appropriate to link four variables to the construct aesthetic response, four variables to passive social use, and three variables to active social use, as these variables are very strongly inter-correlated (Table 4.7 and 4.8).

<table>
<thead>
<tr>
<th>Component variables</th>
<th>Component 1: Aesthetic Response</th>
<th>Component 2a: Passive Social Use</th>
<th>Component 2b: Active Social Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant-unpleasant</td>
<td>0.930</td>
<td>0.805</td>
<td>0.318</td>
</tr>
<tr>
<td>Beautiful-ugly</td>
<td>0.919</td>
<td>0.729</td>
<td>0.732</td>
</tr>
<tr>
<td>Like-dislike</td>
<td>0.891</td>
<td>0.355</td>
<td>0.434</td>
</tr>
<tr>
<td>Desirable-undesirable</td>
<td>0.825</td>
<td></td>
<td>0.471</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Component 2a: Passive Social Use</th>
<th>Component 2b: Active Social Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wandering</td>
<td>Watch</td>
<td>Eating</td>
</tr>
<tr>
<td>Watching</td>
<td>Sitting</td>
<td>Talking</td>
</tr>
<tr>
<td>Sitting</td>
<td>Relaxing</td>
<td>Walking</td>
</tr>
<tr>
<td>Relaxing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3.3 Correlations Coefficient between Aesthetic Response and Social Use

The third research question investigated the relationship between aesthetic response and social use. Pearson product-moment correlation analysis was applied to identify the level of association between these two dependent variables and the strength of correlation between the components of aesthetic response and social use are quite strong. According to Pallant (2007), correlation coefficients from 0.10 to 0.30 indicate a weak correlation, coefficients from 0.30 to 0.50 indicate a medium correlation and coefficients from 0.50 to 1.0 indicate a strong correlation. Strong correlation occurs among the four variables linked to aesthetic response (pleasant-unpleasant, like-dislike, beautiful-ugly, and desirable-undesirable) with the coefficients ranging from 0.65 up to 0.81 (Table 4.7).

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pleasant-Unpleasant</td>
<td>1</td>
<td>0.783 **</td>
<td>0.812 **</td>
<td>0.710 **</td>
</tr>
<tr>
<td>2. Like-Dislike</td>
<td>0.783 **</td>
<td>1</td>
<td>0.755 **</td>
<td>0.650 **</td>
</tr>
<tr>
<td>3. Beautiful-Ugly</td>
<td>0.812 **</td>
<td>0.755 **</td>
<td>1</td>
<td>0.706 **</td>
</tr>
<tr>
<td>4. Desirable-Undesirable</td>
<td>0.710 **</td>
<td>0.650 **</td>
<td>0.706 **</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

There is also a medium to strong relationship between the variables of social use. The correlation coefficients between the seven variables are medium to strong (0.30 to 1.0) and there is no weak correlation among these variables (except one 0.151 between talking and walking).

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Watching: Watching people</td>
<td>1</td>
<td>0.329 **</td>
<td>0.294 **</td>
<td>0.993 **</td>
<td>0.342 **</td>
<td>0.870 **</td>
<td>0.958 **</td>
</tr>
<tr>
<td>2. Eating: Having coffee/drinks/food</td>
<td>0.329 **</td>
<td>1</td>
<td>0.261 **</td>
<td>0.315 **</td>
<td>0.211 **</td>
<td>0.277 **</td>
<td>0.318 **</td>
</tr>
<tr>
<td>3. Talking: Chatting with friends</td>
<td>0.294 **</td>
<td>0.261 **</td>
<td>1</td>
<td>0.291 **</td>
<td>0.151 *</td>
<td>0.291 **</td>
<td>0.315 **</td>
</tr>
<tr>
<td>4. Wandering: Exploring architecture</td>
<td>0.993 **</td>
<td>0.315 **</td>
<td>0.291 **</td>
<td>1</td>
<td>0.339 **</td>
<td>0.862 **</td>
<td>0.955 **</td>
</tr>
<tr>
<td>5. Walking: Walking around</td>
<td>0.342 **</td>
<td>0.211 **</td>
<td>0.151 *</td>
<td>0.339 **</td>
<td>1</td>
<td>0.389 **</td>
<td>0.373 **</td>
</tr>
<tr>
<td>6. Relaxing: Enjoying nature/sitting on grass</td>
<td>0.870 **</td>
<td>0.277 **</td>
<td>0.291 **</td>
<td>0.862 **</td>
<td>0.389 **</td>
<td>1</td>
<td>0.906 **</td>
</tr>
<tr>
<td>7. Sitting: On the benches and seats</td>
<td>0.958 **</td>
<td>0.318 **</td>
<td>0.315 **</td>
<td>0.955 **</td>
<td>0.373 **</td>
<td>0.906 **</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).
walking) (Table 4.8). By observing the values in Tables 4.7 and 4.8, it is possible to summarize the pattern of relationship among the seven variables of social use are medium to strong, that is exhibiting a moderate to high inter-relationship.

Table 4.9 Correlation Coefficient between Aesthetic Response and Social Use

<table>
<thead>
<tr>
<th>Variables</th>
<th>N=280</th>
<th>Pleasant-Unpleasant</th>
<th>Like-Dislike</th>
<th>Beautiful-Ugly</th>
<th>Desirable-Undesirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting: On the benches and seats</td>
<td></td>
<td>0.064</td>
<td>0.107</td>
<td>0.053</td>
<td>0.169 **</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.288</td>
<td>0.075</td>
<td>0.381</td>
<td>0.005</td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/sitting on grass</td>
<td>0.093</td>
<td>0.143 *</td>
<td>0.093</td>
<td>0.206 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.122</td>
<td>0.017</td>
<td>0.119</td>
<td>0.001</td>
</tr>
<tr>
<td>Walking: Walking around</td>
<td></td>
<td>-0.011</td>
<td>0.035</td>
<td>-0.021</td>
<td>0.147 *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.859</td>
<td>0.558</td>
<td>0.727</td>
<td>0.014</td>
</tr>
<tr>
<td>Wandering: Exploring architecture</td>
<td></td>
<td>0.072</td>
<td>0.114</td>
<td>0.041</td>
<td>0.179 **</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.229</td>
<td>0.057</td>
<td>0.494</td>
<td>0.003</td>
</tr>
<tr>
<td>Talking: Chatting with friends</td>
<td></td>
<td>0.150 *</td>
<td>0.147 *</td>
<td>0.150 *</td>
<td>0.215 **</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.012</td>
<td>0.014</td>
<td>0.012</td>
<td>0.000</td>
</tr>
<tr>
<td>Eating: Having coffee/drinks/food</td>
<td></td>
<td>-0.040</td>
<td>-0.024</td>
<td>-0.055</td>
<td>0.079</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.500</td>
<td>0.693</td>
<td>0.357</td>
<td>0.187</td>
</tr>
<tr>
<td>Watching: Watching people</td>
<td></td>
<td>0.068</td>
<td>0.117 *</td>
<td>0.050</td>
<td>0.175 **</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.255</td>
<td>0.050</td>
<td>0.407</td>
<td>0.003</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

From Table 4.9 it is evident that there is a medium to strong relationship between aesthetic response (pleasant-unpleasant, like-dislike, beautiful-ugly) with only two types of use pattern ‘walking’ and ‘eating’. However, a very weak correlation between the rest of the variables indicated a comparatively feeble relationship. Therefore, the relationship between aesthetic response and social use is very limited hence, less significant.
4.4 Relationship between Physical Characteristics of Urban Open Space and Aspects of Aesthetic Response

The research questions that were discussed above were introduced to explain the relationship between physical characteristics of urban open space and aspects of aesthetic response. From preliminary study, five physical characteristics or independent variables were identified that may influence the dependent variables (aesthetic response). In this section, the details of the variation between different groups' mean score will be indicated.

4.4.1 Checking the Assumptions of ANOVA

Analysis of variance (ANOVA) compares the mean scores between different groups with the variability within each of the groups (Pallant, 2007). An F ratio represents the variance between and within the groups, which are calculated by dividing the variance between the groups by the variance within the groups. A large F ratio indicates more variability between the groups than within each group and an F ratio close to 1 indicates no difference between the groups (Hinton, 2004; Pallant, 2007). Instead of t tests, one-way ANOVA was conducted for five physical characteristics on eight urban open spaces to reduce type I error. Type I errors occur when there are significant differences however, the difference may be due to random occurrences (Hinton, 2004; Kinnear & Gray, 2009). As a parametric technique, ANOVA rests on some general and specific assumptions like, normal distribution of dependent variables, homogeneity of variance, Bonferroni adjustment to the alpha level, effect size and absence of outliers. Therefore, prior to conducting ANOVA the following tests were applied to data.

4.4.1.1 Homogeneity of variance

One of the assumptions of parametric techniques is that samples are obtained from a population of equal variances and the variability of scores for each group is similar (Pallant, 2007). Levene's test for equality of variance was applied to test for homogeneity. The assumption of homogeneity of variance is not considered to be violated if the Sig. value is greater than 0.05 (Coolican, 2004; Kinnear & Gray, 2009; Pallant, 2007). The results of applying Levene's test indicate that the assumption of homogeneity of variance was not violated (Table 4.10).
4.4.1.2 Normal distribution

Another assumption of parametric statistics is the distribution of scores of the dependent variable. It is assumed that the population from which the samples are taken is normally distributed (Pallant, 2007). The normal distribution usually describes a symmetrical bell-shaped curve with the highest frequency of scores in the middle. In this study, it is assumed that the distributions of scores on an independent variable are ‘normal’. At the time of initial data screening, the distribution of normality was checked. Moreover, the Kolmogorov-Smirnov statistics was used to check for normality. The resulting value was more than 0.05 (‘a non-significant result’) indicating normality (Pallant, 2007). The distribution of normality was also checked by observing the shape of histograms and the slope of normal probability plots (Q-Q plots). In each case the scores were reasonably distributed (Tabachnick & Fidell, 2007).

4.4.1.3 Outliers

Outliers usually refer to extreme scores or values that are substantially lower or higher than the other values in the data set (Kinnear & Gray, 2009; Pallant, 2007; Tabachnick & Fidell, 2007). Most statistics techniques are sensitive to outliers. In this case, box-plots of each variable indicated no extreme point outliers. Moreover, the 5% trimmed mean and mean values are very similar, indicating the values are not too different from the remaining distribution.

4.4.1.4 Type I error

Type I errors were minimized by selecting an appropriate alpha level of 0.05.

4.4.2 Results of the ANOVA Analyses for Five Physical Characteristics

4.4.2.1 Aesthetic response and surrounding enclosure

The one-way between groups analysis of variance was conducted to explore the impact of surrounding enclosures on aesthetic response. Subjects were divided into five groups according to the level of enclosure to openness (Group 1: completely enclosed, Group 2:
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partially enclosed, Group 3: moderately enclosed, Group 4: partially open and Group 5: completely open) respectively. Table 4.11 provides the results of one-way ANOVA for the independent variable ‘surrounding enclosure’ of eight urban open spaces on four dependent variables of aesthetic response. The $F (3, 276)$ ratios detailed in Table 4.11 are greater than 1, indicating significant differences at the $p < .05$ level in aesthetic response to the surrounding enclosures of eight urban open spaces. The results suggest that the variations of surrounding enclosures are associated with variations in respect to the four variables linked to aesthetic response.

Table 4.11 Significant Values for Surrounding Enclosure on Overall Aesthetic Response

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>Sig.</th>
<th>$n^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrounding enclosure (pleasant-unpleasant)</td>
<td>Between Groups</td>
<td>14.554</td>
<td>3</td>
<td>4.851</td>
<td>7.052</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>189.871</td>
<td>276</td>
<td>0.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surrounding enclosure (like-dislike)</td>
<td>Between Groups</td>
<td>10.239</td>
<td>3</td>
<td>3.413</td>
<td>5.200</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>181.157</td>
<td>276</td>
<td>0.656</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surrounding enclosure (beautiful-ugly)</td>
<td>Between Groups</td>
<td>15.407</td>
<td>3</td>
<td>5.136</td>
<td>7.286</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>194.536</td>
<td>276</td>
<td>0.705</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surrounding enclosure (desirable-undesirable)</td>
<td>Between Groups</td>
<td>8.596</td>
<td>3</td>
<td>2.865</td>
<td>3.970</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>199.229</td>
<td>276</td>
<td>0.722</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $p < .05$, $SS =$ sum of squares, $df =$ degrees of freedom, $MS =$ mean squares, $n^2 =$ effect size.

Table 4.12 Multiple Comparisons (Tukey HSD)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>(I) Surrounding enclosure</th>
<th>(J) Surrounding enclosure</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrounding buildings (pleasant-unpleasant)</td>
<td>4.Partially open</td>
<td>2.Partially enclosed</td>
<td>0.457 *</td>
<td>0.121</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>4.Partially open</td>
<td>3.Moderate enclosure</td>
<td>0.529 *</td>
<td>0.157</td>
<td>0.005</td>
</tr>
<tr>
<td>Surrounding buildings (like-dislike)</td>
<td>4.Partially open</td>
<td>2.Partially enclosed</td>
<td>0.357 *</td>
<td>0.119</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>4.Partially open</td>
<td>3.Moderate enclosure</td>
<td>0.457 *</td>
<td>0.153</td>
<td>0.016</td>
</tr>
<tr>
<td>Surrounding buildings (beautiful-ugly)</td>
<td>4.Partially open</td>
<td>2.Partially enclosed</td>
<td>0.464 *</td>
<td>0.123</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>4.Partially open</td>
<td>3.Moderate enclosure</td>
<td>0.550 *</td>
<td>0.159</td>
<td>0.003</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

Despite reaching statistical significance, the numerical difference in mean scores between the groups was not very large. The effect size was calculated by dividing the sum of squares between groups by the total sum of squares ($\eta$-squared) and Cohen suggests that 0.01 is a small effect, 0.06 is a medium effect and 0.14 is a large effect (Cohen, 1988). Hence, the effect size calculated by using $\eta$-squared for the variables pleasant-unpleasant and beautiful-ugly was medium ($> 0.07$) and the effect size for the other two variables was small. Post-hoc
comparisons using the Tukey HSD test indicated that the mean score for Group 4: partially open was significantly different from Group 2: partially enclosed and Group 3: moderately enclosed (Table 4.12). Figure 4.2 depicts the relationship between aesthetic responses on different types of surrounding enclosures. The mean score for partially open is significantly different from other enclosure types. Table 4.12 includes only those values that are significant at $p < 0.05$ and ignores values that do not differ significantly. Group 1: completely enclosed and Group 5: completely open did not differ significantly from Groups 2, 3 or 4.

Changes in different levels of surrounding enclosures appear to be associated with variation of aesthetic response i.e. pleasant-unpleasant, beautiful-ugly and like-dislike. Variations are stronger for two types of surrounding enclosure: partially enclosed, moderately enclosed and strongest for partially open enclosures. Partially open enclosures are significantly different from other enclosure types and are strongly associated with the construct aesthetic response.
4.4.2.2 Aesthetic response and height of the surrounding enclosure

ANOVA was conducted to explore the impact of height of the surrounding enclosures on aesthetic response. Subjects were divided into five groups according to the height of the surrounding enclosure from extremely low to extremely high (Group 1: extremely low, Group 2: low, Group 3: moderate height, Group 4: high and Group 5: extremely high) respectively. Table 4.13 provides the results of the one-way ANOVA for the independent variable ‘height of the surrounding enclosure’ of eight urban open spaces on four dependent variables. The $F$ (2, 277) ratios detailed in Table 4.13 is greater than 1, indicating a significant difference at the $p < 0.05$ level in aesthetic response to the five different heights of the surrounding enclosures. The results suggest that the variations of enclosure heights are associated with the four variables that linked to aesthetic response.

Table 4.13 Significant Values for Height of the Surrounding Enclosure on Overall Aesthetic Response

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>SS Between Groups</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure height (pleasant-unpleasant)</td>
<td>19.295</td>
<td>2</td>
<td>9.648</td>
<td>11.941</td>
<td>.000</td>
<td>0.079</td>
</tr>
<tr>
<td>Within Groups</td>
<td>223.790</td>
<td>277</td>
<td>0.808</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosure height (like-dislike)</td>
<td>10.535</td>
<td>2</td>
<td>5.267</td>
<td>6.768</td>
<td>.001</td>
<td>0.046</td>
</tr>
<tr>
<td>Within Groups</td>
<td>215.576</td>
<td>277</td>
<td>0.778</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosure height (beautiful-ugly)</td>
<td>7.873</td>
<td>2</td>
<td>3.936</td>
<td>4.514</td>
<td>.012</td>
<td>0.031</td>
</tr>
<tr>
<td>Within Groups</td>
<td>241.524</td>
<td>277</td>
<td>0.872</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosure height (desirable-undesirable)</td>
<td>14.119</td>
<td>2</td>
<td>7.060</td>
<td>8.379</td>
<td>.000</td>
<td>0.057</td>
</tr>
<tr>
<td>Within Groups</td>
<td>233.367</td>
<td>277</td>
<td>0.842</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $p < .05$, SS = sum of squares, df = degrees of freedom, MS = mean squares, $n²$ = effect size.

Table 4.14 Multiple Comparisons (Tukey HSD)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>(I) Height of the surrounding enclosure</th>
<th>(J) Height of the surrounding enclosure</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building height (pleasant-unpleasant)</td>
<td>2. Low</td>
<td>1. Extremely low</td>
<td>0.419 *</td>
<td>0.124</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Low</td>
<td>3. Moderate height</td>
<td>0.648 *</td>
<td>0.139</td>
</tr>
<tr>
<td>Building height (like-dislike)</td>
<td>2. Low</td>
<td>1. Extremely low</td>
<td>0.324 *</td>
<td>0.122</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Low</td>
<td>3. Moderate height</td>
<td>0.471 *</td>
<td>0.136</td>
</tr>
<tr>
<td>Building height (beautiful-ugly)</td>
<td>2. Low</td>
<td>3. Moderate height</td>
<td>0.410 *</td>
<td>0.144</td>
<td>0.013</td>
</tr>
<tr>
<td>Building height (desirable-undesirable)</td>
<td>2. Low</td>
<td>1. Extremely low</td>
<td>0.371 *</td>
<td>0.127</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Low</td>
<td>3. Moderate height</td>
<td>0.548 *</td>
<td>0.142</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.
The effect size calculated by using $\eta^2$ squared for the variables pleasant-unpleasant was medium ($> 0.07$) and the effect size for other three variables were considered as small effect ($< 0.06$). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 2: low was significantly different from Group 1: extremely low and Group 3: moderate height. Figure 4.3 depicted the relationship between aesthetic responses on height of the surrounding enclosure. The mean score for low height is significantly different from different height of the surrounding enclosure. Table 4.14 includes only those values that are significant at $p < 0.05$ and ignore the values that do not differ significantly ($p > 0.05$). Group 4: high and Group 5: extremely high did not differ significantly from Group 1, 2 or 3 therefore, these values were not included in this table.

To summarize, changes in height of surrounding enclosures appear to be more highly associated with variation of pleasant-unpleasant, like-dislike and desirable-undesirable at

Figure 4.3 Respondents’ preferences for height of the surrounding enclosure.
significant level (p < 0.001) as the effect size is comparatively higher for these variables. Variations for aesthetic responses are stronger for two types of height: extremely low and moderate height, and strongest for the low enclosures.

4.4.2.3 Aesthetic response and water features

The ANOVA was conducted to explore the impact of water features on aesthetic response. Subjects were divided into five groups according to the availability of water features from none at all to a great amount (Group 1: none at all, Group 2: very few, Group 3: moderate amount, Group 4: quite a lot and Group 5: great amount) respectively. Table 4.15 provides the results of the one-way ANOVA for the independent variable ‘water features’ of eight urban open spaces on four dependent variables of aesthetic response. The $F(3, 206)$ ratios detailed in Table 4.15 are greater than 1, indicating significant differences at the p < 0.05 level to the availability of water features. The results suggest that the availability of water features at 5 different levels is associated with variations of the four variables linked to aesthetic response.

### Table 4.15 Significant Values for Water Features on Overall Aesthetic Response

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
<th>$n^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water features (pleasant-unpleasant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.305</td>
<td>3</td>
<td>0.768</td>
<td>2.465</td>
<td>0.063</td>
<td>0.034</td>
</tr>
<tr>
<td>Within Groups</td>
<td>64.190</td>
<td>206</td>
<td>0.312</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water features (like-dislike)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3.048</td>
<td>3</td>
<td>1.016</td>
<td>2.793</td>
<td>0.041</td>
<td>0.040</td>
</tr>
<tr>
<td>Within Groups</td>
<td>74.933</td>
<td>206</td>
<td>0.364</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water features (beautiful-ugly)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>5.676</td>
<td>3</td>
<td>1.892</td>
<td>5.100</td>
<td>0.002</td>
<td>0.070</td>
</tr>
<tr>
<td>Within Groups</td>
<td>76.419</td>
<td>206</td>
<td>0.371</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water features (desirable-undesirable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3.619</td>
<td>3</td>
<td>1.206</td>
<td>3.144</td>
<td>0.026</td>
<td>0.043</td>
</tr>
<tr>
<td>Within Groups</td>
<td>79.048</td>
<td>206</td>
<td>0.384</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p < .05, SS = sum of squares, df = degrees of freedom, MS = mean squares, $n^2$ = effect size.

The effect size calculated by using *eta* squared for the variable ‘beautiful-ugly’ was medium (> 0.06) and the effect size for other three variables were considered as small effect (< 0.06). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 2: very few was significantly different from Group 3: moderate amount and, Group 3 differed significantly from Group 5: great amount. Figure 4.4 depicts the relationship between aesthetic responses on different types of water features. The mean score for moderate amount is significantly different from other types of water features. Table 4.16 includes only those values that are significant at p < 0.05 and ignore the values that do not differ significantly...
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(p > 0.05). Group 1: none at all and Group 4: quite a lot did not differ significantly from Group 2, 3 and 5. Therefore, these values were not included in this table.

Table 4.16 Multiple Comparisons (Tukey HSD)

<table>
<thead>
<tr>
<th>Dependent Variables (beautiful-ugly)</th>
<th>(I) Amount of water feature</th>
<th>(J) Amount of water feature</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water features</td>
<td>2. Very few</td>
<td>3. Moderate amount</td>
<td>0.352*</td>
<td>0.119</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>5. Great amount</td>
<td>3. Moderate amount</td>
<td>0.352*</td>
<td>0.119</td>
<td>0.018</td>
</tr>
<tr>
<td>Water features</td>
<td>3. Moderate amount</td>
<td>5. Great amount</td>
<td>-0.333*</td>
<td>0.121</td>
<td>0.032</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

Figure 4.4 Respondents' preferences for amount of water features.

To summarize, variation in the number of water features appear to be more highly associated with variation for ‘beautiful-ugly’ as the effect size is medium (.07) for this variable.
Variations for aesthetic responses differ at three levels of water feature; very few, moderate amount and great amount and among them, moderate amount is significantly in higher preference from the other types of water feature.

4.4.2.4 Aesthetic response and vegetation

The ANOVA was conducted to explore the impact of availability of vegetation on aesthetic response. Subjects were divided into five groups according to the availability of vegetation from none at all to great amount (Group 1: none at all, Group 2: very few, Group 3: moderate amount, Group 4: quite a lot and Group 5: great amount) respectively. Table 4.17 provides the results of one-way ANOVA for the independent variable ‘availability of vegetation’ of eight urban open spaces on four dependent variables of aesthetic response. The $F(3, 276)$ ratios detailed in Table 4.17 is very close to 1, indicating non-significant differences for aesthetic response at different level of vegetation.

![Graphs showing respondents' preferences for amount of vegetation.](image)

Figure 4.5 Respondents’ preferences for amount of vegetation.
Table 4.17 Significant Values for Vegetation on Overall Aesthetic Response

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation (pleasant-unpleasant)</td>
<td>Between Groups</td>
<td>1.552</td>
<td>3</td>
<td>0.517</td>
<td>1.869</td>
<td>0.135</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>76.433</td>
<td>276</td>
<td>0.277</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation (like-dislike)</td>
<td>Between Groups</td>
<td>1.692</td>
<td>3</td>
<td>0.564</td>
<td>1.988</td>
<td>0.116</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>78.305</td>
<td>276</td>
<td>0.284</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation (beautiful-ugly)</td>
<td>Between Groups</td>
<td>1.606</td>
<td>3</td>
<td>0.535</td>
<td>1.988</td>
<td>0.116</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>74.305</td>
<td>276</td>
<td>0.269</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation (desirable-undesirable)</td>
<td>Between Groups</td>
<td>.868</td>
<td>3</td>
<td>0.289</td>
<td>1.043</td>
<td>0.374</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>76.529</td>
<td>276</td>
<td>0.277</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p < .05, SS = sum of squares, df = degrees of freedom, MS = mean squares, n² = effect size

The results suggest that the variations of different levels of vegetation are not significantly associated with variations of the four variables that are linked to aesthetic response. The effect size calculated by using eta squared for all the variables were considered a small effect (< 0.03). Post-hoc comparisons using the Tukey HSD test indicated no significant difference between different levels of vegetation. However, from Figure 4.5 it is noticeable that ‘quite a lot’ of vegetation is desirable for different level of aesthetic response and the mean score for ‘quite a lot’ is significantly different for different types of responses. To summarize, for vegetation rated higher than a moderate amount is associated with variation in aesthetic response.

4.4.2.5 Aesthetic response and monuments/sculptures

ANOVA was conducted to explore the impact of monuments and sculptures on aesthetic response. Subjects were divided into five groups according to the size and amount of monuments and sculptures from none at all to great amount/size (Group 1: none at all, Group 2: very few amount/size, Group 3: moderate amount/size, Group 4: quite a lot amount/size and Group 5: great amount/size). Table 4.18 provides the results of the one-way ANOVA for the independent variable ‘monuments and sculptures’ of eight urban open spaces on four dependent variables for aesthetic response. The $F$ (3, 171) ratios detailed in Table 4.18 are greater than 1, indicating significant differences at the p < 0.05 level for aesthetic response to the monuments and sculptures. The results suggest that the availability of monuments and sculptures at 5 different levels is associated with variations of the four variables linked to aesthetic response.
Table 4.18 Significant Values for Monuments/Sculptures on Overall Aesthetic Response

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monuments, sculptures (pleasant-unpleasant)</td>
<td>Between Groups</td>
<td>7.680</td>
<td>3</td>
<td>2.560</td>
<td>8.735</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>50.114</td>
<td>171</td>
<td>0.293</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monuments, sculptures (like-dislike)</td>
<td>Between Groups</td>
<td>7.200</td>
<td>3</td>
<td>2.400</td>
<td>8.079</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>50.800</td>
<td>171</td>
<td>0.297</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monuments, sculptures (beautiful-ugly)</td>
<td>Between Groups</td>
<td>8.043</td>
<td>3</td>
<td>2.681</td>
<td>9.022</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>50.814</td>
<td>171</td>
<td>0.297</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monuments, sculptures (desirable-undesirable)</td>
<td>Between Groups</td>
<td>5.494</td>
<td>3</td>
<td>1.831</td>
<td>5.841</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>53.614</td>
<td>171</td>
<td>0.314</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p < .05, SS = sum of squares, df = degrees of freedom, MS = mean squares, n² = effect size.

The effect size calculated by using eta squared for the first three variables pleasant-unpleasant, like-dislike and beautiful-ugly was almost large (> 0.12) and the effect size for ‘desirable-undesirable’ were considered as medium effect (> 0.06). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 3: moderate amount/size and Group 4: quite a lot amount/size were significantly different from Group 2: very few amount/size and Group 5: great amount/size. Figure 4.6 depicts the relationship between aesthetic responses to monuments or sculptures of the study spaces. The mean score for great amount/size of monuments or sculptures is significantly different from other levels. Table 4.19 includes only those values that are significant at p < 0.05 and ignores the values that do not differ significantly (p > 0.05). Group 1: ‘none at all’ do not differ significantly from Group 2, 3, 4 and 5 therefore; these values are not included in the following table.

Table 4.19 Multiple Comparisons (Tukey HSD)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>(I) Monuments or sculptures</th>
<th>(J) Monuments or sculptures</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monuments, sculptures (pleasant-unpleasant)</td>
<td>3. Moderate amount/size</td>
<td>2. Very few amount/size</td>
<td>-0.343 *</td>
<td>0.129</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Quite a lot amount/size</td>
<td>-0.629 *</td>
<td>0.129</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Great amount/size</td>
<td>-0.457 *</td>
<td>0.129</td>
<td>0.000</td>
</tr>
<tr>
<td>Monuments, sculptures (like-dislike)</td>
<td>3. Moderate amount/size</td>
<td>4. Quite a lot amount/size</td>
<td>-0.600 *</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Great amount/size</td>
<td>-0.429 *</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>4. Quite a lot amount/size</td>
<td>2. Very few amount/size</td>
<td>0.343 *</td>
<td>0.130</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Moderate amount/size</td>
<td>0.600</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td>Monuments, sculptures (beautiful-ugly)</td>
<td>3. Moderate amount/size</td>
<td>4. Quite a lot amount/size</td>
<td>-0.600 *</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Great amount/size</td>
<td>-0.414 *</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>4. Quite a lot amount/size</td>
<td>2. Very few amount/size</td>
<td>0.457 *</td>
<td>0.130</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Moderate amount/size</td>
<td>0.600</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td>Monuments, sculptures (desirable-undesirable)</td>
<td>3. Moderate amount/size</td>
<td>4. Quite a lot amount/size</td>
<td>-0.514 *</td>
<td>0.134</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Great amount/size</td>
<td>-0.357 *</td>
<td>0.116</td>
<td>0.013</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.
To summarize, the presence or absence of monuments and sculptures appears to be more strongly associated with variation in pleasant-unpleasant, like-dislike and beautiful-ugly as the effect size is very close to large (> 0.12) for this variable. Variations in aesthetic responses differ particularly for moderate to great amount/ size of monuments and sculptures.

4.4.2.6 Aesthetic response and eight urban open spaces

The one-way between groups analysis of variance was conducted to explore the impact of eight urban open spaces on aesthetic response. As there are eight urban open spaces, subjects were divided into eight groups and the physical characteristics of these urban open spaces have already been mentioned in Chapter 3 (Group 1: Dhanmondi 8, Group 2: Dhanmondi 32, Group 3: Sangshad Bhaban, Group 4: Zia Uddan, Group 5: Rayer Bazaar, Group 6: Ramna, Group 7: Shahid Minar and Group 8: TSC). Table 4.20 provides the results of the one-way ANOVA for the urban spaces on aesthetic response. The $F (7, 272)$ ratios detailed in Table
4.20 are greater than 1, indicating significant differences at the p < 0.05 level in aesthetic response. The results suggest that the variations of different physical characteristics of eight urban open spaces are associated with variations with respect to the four variables linked to aesthetic response.

<table>
<thead>
<tr>
<th>Overall Aesthetic Response</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant-Unpleasant</td>
<td>Between Groups</td>
<td>13.471</td>
<td>7</td>
<td>1.924</td>
<td>4.789</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>109.314</td>
<td>272</td>
<td>0.402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Like-Dislike</td>
<td>Between Groups</td>
<td>11.368</td>
<td>7</td>
<td>1.624</td>
<td>4.062</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>108.743</td>
<td>272</td>
<td>0.400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beautiful-Ugly</td>
<td>Between Groups</td>
<td>13.339</td>
<td>7</td>
<td>1.906</td>
<td>5.070</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>102.229</td>
<td>272</td>
<td>0.376</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desirable-Undesirable</td>
<td>Between Groups</td>
<td>14.711</td>
<td>7</td>
<td>2.102</td>
<td>4.526</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>126.286</td>
<td>272</td>
<td>0.464</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p < .05, SS = sum of squares, df = degrees of freedom, MS = mean squares, n² = effect size.

Despite reaching statistical significance, the numerical difference in mean scores between the groups was comparatively medium in size. Hence, the effect size calculated by using eta squared for the four variables was medium (greater than 0.06 but less than 0.14). Figure 4.7 depicted the ‘mean plot’ across eight designed urban open spaces to identify the relationship between the four variables of aesthetic response. This plot provides an effective way to compare the mean scores for the different groups (Pallant, 2007). Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 2: Dhanmondi 32 and Group 8: TSC are significantly different from Group 1: Dhanmondi 8, Group 3: Sangshad Bhaban and Group 6: Ramna and Group 7: Shahid Minar. Table 4.21 includes only those values that are significant at p < 0.05 and ignores the values that do not differ significantly. Group 4 and 5 do not differ significantly from any of Group 1, 2, 3, 6, 7 and 8.

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>(I) Urban Space</th>
<th>(J) Urban Space</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant-Unpleasant</td>
<td>2. Dhanmondi 32</td>
<td>1. Dhanmondi 8</td>
<td>0.514 *</td>
<td>0.152</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sangshad Bhaban</td>
<td>0.486 *</td>
<td>0.152</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. TSC</td>
<td>0.629 *</td>
<td>0.152</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>8. TSC</td>
<td>2. Dhanmondi 32</td>
<td>-0.629 *</td>
<td>0.152</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Ramna</td>
<td>-0.571 *</td>
<td>0.152</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Shahid Minar</td>
<td>-0.543 *</td>
<td>0.152</td>
<td>0.009</td>
</tr>
</tbody>
</table>
The Evaluative Image of Designed Open Spaces: Bangladesh

| Like-Dislike          | 2. Dhanmondi 32 | 3. Sangshad Bhaban | 8. TSC | 0.486 * | 0.151    | 0.031    | 0.543 * | 0.151    | 0.009    |
|----------------------|-----------------|--------------------|--------|---------|------|-------|---------|------|-------|-------|
|                      | 8. TSC          | 2. Dhanmondi 32    | 0.543  | 0.151   | 0.009|
|                      | 6. Ramna        | 0.0486             | 0.151  | 0.031   |
|                      | 7. Shahid Minar | -0.514             | 0.151  | 0.017   |
| Beautiful-Ugly       | 2. Dhanmondi 32 | 1. Dhanmondi 8     | 0.457  | 0.147   | 0.041|
|                      | 3. Sangshad Bhaban | 0.514              | 0.147  | 0.012   |
|                      | 8. TSC          | 0.714              | 0.147  | 0.000   |
|                      | 2. Dhanmondi 32 | 0.714              | 0.147  | 0.000   |
|                      | 6. Ramna        | -0.600             | 0.147  | 0.001   |
|                      | 7. Shahid Minar | -0.543             | 0.147  | 0.006   |
| Desirable-Undesirable| 3. Sangshad Bhaban | 2. Dhanmondi 32    | -0.571 | 0.163   | 0.012|
|                      | 6. Ramna        | -0.629             | 0.163  | 0.004   |
|                      | 7. Shahid Minar | -0.657             | 0.163  | 0.002   |

* The mean difference is significant at the 0.05 level.

Figure 4.7 Mean of respondents’ preferences across eight designed urban open spaces.

To summarize, changes in different physical characteristics of urban open spaces appear to be associated with variation in aesthetic response. The variations such as; pleasant-unpleasant, like-dislike, beautiful-ugly are the strongest for the six urban open spaces. The urban open space of Dhanmondi 32 and TSC is significantly different from Dhanmondi 8, Sangshad
Bhaban, Ramna and Shahid Minar. For desirable-undesirable, Sangshad Bhaban is different significantly from Dhanmondi 32, Ramna and Shahid Minar. The mean score of aesthetic response for Dhanmondi 32, Sangshad Bhaban, Zia Uddan and Ramna is significantly different from other urban open spaces.

4.5 Relationship between Urban Open Space and Social Use

From factor analysis it has been identified that the construct social use can be further divided into two categories; active social use and passive social use. Four variables are linked to one category, passive social use and the three variables linked to the other, active social use. One-way analysis of variance (ANOVA) was used to identify the level of association between the two types of social use and the eight urban open spaces of Dhaka, Bangladesh.

4.5.1 Checking the Assumptions of ANOVA

Analysis of variance (ANOVA) compares the variability of mean scores between the different groups with the variability within each of the groups (Pallant, 2007). An F ratio represents the variance between and within the groups. A large F ratio indicates more variability between the groups than within each group, and an F ratio close to 1 indicates no difference between the groups (Hinton, 2004; Pallant, 2007). Instead of t tests, one-way ANOVA was conducted for five physical characteristics on eight urban open spaces to reduce type I error. Type I error occurs when a significant differences exists however, the difference may be due to a random occurrence (Hinton, 2004; Kinnear & Gray, 2009). As a parametric technique, ANOVA rests on some general and specific assumptions such as, a normal distribution of dependent variables, homogeneity of variance, Bonferroni adjustment to the alpha level, effect size and absence of outliers. Therefore, prior to conducting ANOVA the following tests were applied to data.

4.5.1.1 Homogeneity of variance

One of the assumptions of parametric techniques is that samples are obtained from a population of equal variances and the variability of scores for each of the groups is similar (Pallant, 2007). Levene’s test for equality of variance was applied to test the homogeneity. The assumption of homogeneity of variance is not considered to be violated if the Sig. value is greater than 0.05 (Coolican, 2004; Kinnear & Gray, 2009; Pallant, 2007). The results of applying Levene’s test indicate that the assumption of homogeneity of variance was not violated (Table 4.22).
Table 4.22 Levene’s Test of Equality

<table>
<thead>
<tr>
<th>Levene’s Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.347</td>
<td>7</td>
<td>272</td>
<td>0.228</td>
</tr>
</tbody>
</table>

4.5.1.2 Normal distribution

Another assumption for parametric statistics is the distribution of scores of the dependent variable and it is assumed that the population from which the samples are taken are normally distributed (Pallant, 2007). At the time of initial data screening, the distribution of normality was checked. In addition, Kolmogorov-Smirnov statistics were used to check for normality and the resulting value was more than 0.05 indicating normality (Pallant, 2007). The distribution of normality can also be checked by observing the shape of the histogram and the slope of normal Q-Q plots. In this case, the scores are reasonably distributed (Tabachnick & Fidell, 2007).

4.5.1.3 Outliers

Outliers usually refer to the extreme scores or values that are substantially lower or higher than the other values in the data set (Kinnear & Gray, 2009; Pallant, 2007; Tabachnick & Fidell, 2007). Most statistics techniques are sensitive to outliers. In this case, box-plots of each variable indicate no extreme point outliers. Moreover, the 5% trimmed mean and mean values are very similar, indicating that the values are not too different from the remaining distribution.

4.5.1.4 Type I error

Type I errors were minimized by selecting an appropriate alpha level of 0.05.

4.5.2 Results of ANOVA Analysis for Eight Study Areas on Active Social Use

One-way between groups analysis of variance was conducted to explore the impact of urban open spaces on active social use. As there are eight urban open spaces, subjects were divided into eight groups and the physical characteristics of these eight urban open spaces have been mentioned in Chapter 3 (Group 1: Dhanmondi 8, Group 2: Dhanmondi 32, Group 3: Sangshad Bhaban, Group 4: Zia Uddan, Group 5: Rayer Bazaar, Group 6: Ramna, Group 7: Shahid Minar and Group 8: TSC). Table 4.23 provides the results of the one-way ANOVA for eight urban open spaces on active social use. The \( F(7, 272) \) ratios detailed in Table 4.23 is greater than 1, which indicated a significant difference at the \( p < 0.05 \) level in active social use. The
results suggest that the variations of different physical characteristics of urban open spaces are associated with variations in respect to the three variables linked to active social use.

Table 4.23 Significant Values of Eight Urban Open Spaces on Active Social Use

<table>
<thead>
<tr>
<th>Variables</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating: Having coffee/drinks/food</td>
<td>Between</td>
<td>71.825</td>
<td>7</td>
<td>10.261</td>
<td>4.907</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within</td>
<td>568.800</td>
<td>272</td>
<td>2.091</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking: Chatting with friends</td>
<td>Between</td>
<td>18.043</td>
<td>7</td>
<td>2.578</td>
<td>2.072</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td>Within</td>
<td>338.400</td>
<td>272</td>
<td>1.244</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking: Walking around</td>
<td>Between</td>
<td>67.539</td>
<td>7</td>
<td>9.648</td>
<td>8.129</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Within</td>
<td>322.857</td>
<td>272</td>
<td>1.187</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p < .05, SS = sum of squares, df = degrees of freedom, MS = mean squares, n² = effect size.

Despite reaching statistical significance, the numerical difference in mean scores between the groups was comparatively medium in size. Hence, the effect size calculated by using eta squared for the first two variables (eating and talking) is medium (greater than 0.06 but less than 0.14) and for the last variable ‘walking’ is large in size. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 5: Rayer Bazaar is significantly different from the rest of the seven groups for the variable ‘walking around’ (Table 4.24). For ‘having food/drinks’ Group 3, 7 and 8 differ significantly from the other groups. On the other hand the variable ‘chatting with friends’ does not differ significantly from the other groups. From Figure 4.8, 4.9 and 4.10 it is clear that ‘eating’ and ‘walking’ is very important for some urban open spaces however, ‘talking or chatting with friends’ is significantly different and very important for almost all urban spaces.

Table 4.24 Multiple Comparisons (Tukey HSD)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>(I) Urban Space</th>
<th>(J) Urban Space</th>
<th>Mean difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating: Having coffee/drinks/food</td>
<td>3. Sangshad Bhaban</td>
<td>4. Zia Uddan</td>
<td>-1.057 *</td>
<td>0.346</td>
<td>0.050</td>
</tr>
<tr>
<td></td>
<td>7. Shahid Minar</td>
<td>2. Dhanmondi 32</td>
<td>1.086 *</td>
<td>0.346</td>
<td>0.039</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sangshad Bhaban</td>
<td>1.143 *</td>
<td>0.346</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Rayer Bazaar</td>
<td>1.114 *</td>
<td>0.346</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td>8. TSC</td>
<td>2. Dhanmondi 32</td>
<td>1.257 *</td>
<td>0.346</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sangshad Bhaban</td>
<td>1.314 *</td>
<td>0.346</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Rayer Bazaar</td>
<td>1.286 *</td>
<td>0.346</td>
<td>0.006</td>
</tr>
</tbody>
</table>
### Walking: Walking around

<table>
<thead>
<tr>
<th>Designed Urban Open Space</th>
<th>Mean Difference (significant level)</th>
<th>P-value</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dhanmondi 8</td>
<td>-1.600*</td>
<td>0.260</td>
<td>0.000</td>
</tr>
<tr>
<td>2. Dhanmondi 32</td>
<td>-1.000*</td>
<td>0.260</td>
<td>0.004</td>
</tr>
<tr>
<td>3. Sangshad Bhaban</td>
<td>-1.600*</td>
<td>0.260</td>
<td>0.000</td>
</tr>
<tr>
<td>4. Zia Uddan</td>
<td>-1.057*</td>
<td>0.260</td>
<td>0.002</td>
</tr>
<tr>
<td>6. Ramna</td>
<td>-1.286*</td>
<td>0.260</td>
<td>0.000</td>
</tr>
<tr>
<td>7. Shahid Minar</td>
<td>-1.514*</td>
<td>0.260</td>
<td>0.000</td>
</tr>
<tr>
<td>8. TSC</td>
<td>-1.000*</td>
<td>0.260</td>
<td>0.004</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

---

![Figure 4.8 Respondents' use pattern for 'walking: walking around' across eight designed urban open spaces.](image-url)

Figure 4.8 Respondents' use pattern for 'walking: walking around' across eight designed urban open spaces.
To summarize, changes in different physical characteristics of urban open spaces appear to be associated with variation in active social use i.e. eating, talking and walking. Variations are
strongest for the variables ‘eating’ and ‘walking’ and differ significantly for various urban open spaces. The variable ‘talking: chatting with friends’ does not differ significantly from the other variables. Therefore, talking is equally important for every space. The mean plot depicts a functional relationship between the eight urban open spaces and their mean scores on active social use. The plot depicts that ‘talking and chatting’ with friends are the most important use pattern for all the study areas. The plot recorded the highest score for active social use: ‘eating’ and ‘talking’ in Dhanmondi 8, Zia Uddan and TSC, and the lowest mean score for ‘walking around’ is in Rayer Bazaar and TSC.

4.5.3 Results of ANOVA Analysis for Eight Study Areas on Passive Social Use

The one-way between groups analysis of variance was conducted to explore the impact of eight urban open spaces on passive social use. As mentioned before, there are eight urban open spaces, and subjects are divided into eight groups (Group 1: Dhanmondi 8, Group 2: Dhanmondi 32, Group 3: Sangshad Bhaban, Group 4: Zia Uddan, Group 5: Rayer Bazaar, Group 6: Ramna, Group 7: Shahid Minar and Group 8: TSC). Table 4.25 provides the results of one-way ANOVA for eight urban open spaces on passive social use. The \( F \) (7, 272) ratios detailed in Table 4.25 are greater than 1, indicating significant differences at the \( p < 0.01 \) level in passive social use. The results suggest that the variations of different physical characteristics for eight urban open spaces are associated with variations with respect to the three variables linked to passive social use.

Despite reaching statistical significance, the numerical difference in mean scores between the groups was comparatively medium in size. Hence, the effect size calculated by using \( \eta^2 \) squared for the four variables (sitting, relaxing, wandering, and watching) is medium (greater than 0.06 but less than 0.14). Post-hoc comparisons using the Tukey HSD test (Table 4.26) indicate that the mean score for Group 2: Dhanmondi 32, Group 3: Sangshad Bhaban and Group 7: Shahid Minar differs significantly from Group 1, 5 and 6. Group 4: Zia Uddan and Group 8: TSC do not differ significantly from the other groups. Figure 4.11 depicts the use pattern for passive social use across eight designed urban open spaces.
Table 4.25 Significant Values for Eight Urban Open Spaces on Passive Social Use

<table>
<thead>
<tr>
<th>Variables</th>
<th>Between Groups</th>
<th>Within Groups</th>
<th>df</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
<th>n²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting: On the benches and seats</td>
<td>42.043</td>
<td>7</td>
<td>6.006</td>
<td>4.547</td>
<td>0.000</td>
<td>0.104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/sitting on grass</td>
<td>31.371</td>
<td>7</td>
<td>4.482</td>
<td>3.502</td>
<td>0.001</td>
<td>0.082</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wandering: Exploring architecture</td>
<td>36.157</td>
<td>7</td>
<td>5.165</td>
<td>3.853</td>
<td>0.001</td>
<td>0.090</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching: Watching people</td>
<td>36.157</td>
<td>7</td>
<td>5.165</td>
<td>3.853</td>
<td>0.001</td>
<td>0.090</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p < .05, SS = sum of squares, df = degrees of freedom, MS = mean squares, n² = effect size

Table 4.26 Multiple Comparisons (Tukey HSD)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>(I) Urban Space</th>
<th>(J) Urban Space</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting: On the benches and seats</td>
<td>2. Dhanmondi 32</td>
<td>1. Dhanmondi 8</td>
<td>-0.943 *</td>
<td>0.275</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Shahid Minar</td>
<td>-0.857 *</td>
<td>0.275</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sangshad Bhaban</td>
<td>1.171 *</td>
<td>0.275</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Rayer Bazaar</td>
<td>0.971 *</td>
<td>0.275</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Ramna</td>
<td>0.943 *</td>
<td>0.275</td>
<td>0.010</td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/sitting on grass</td>
<td>3. Sangshad Bhaban</td>
<td>2. Dhanmondi 32</td>
<td>0.943 *</td>
<td>0.270</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Rayer Bazaar</td>
<td>0.971 *</td>
<td>0.270</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Ramna</td>
<td>0.943 *</td>
<td>0.270</td>
<td>0.013</td>
</tr>
<tr>
<td>Wandering: Exploring architecture</td>
<td>7. Shahid Minar</td>
<td>2. Dhanmondi 32</td>
<td>0.857 *</td>
<td>0.277</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sangshad Bhaban</td>
<td>1.171 *</td>
<td>0.277</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Rayer Bazaar</td>
<td>0.971 *</td>
<td>0.277</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Ramna</td>
<td>0.943 *</td>
<td>0.277</td>
<td>0.017</td>
</tr>
<tr>
<td>Watching: Watching people</td>
<td>7. Shahid Minar</td>
<td>2. Dhanmondi 32</td>
<td>0.857 *</td>
<td>0.277</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sangshad Bhaban</td>
<td>1.171 *</td>
<td>0.277</td>
<td>0.001</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

To summarize, changes in different physical characteristics of urban open spaces appear to be associated with variation in passive social use i.e. sitting, relaxing, wandering, and watching. Variations are strongest and differ significantly for six urban open spaces and do not significantly differ for Dhanmondi 8, Sangshad Bhaban and TSC, which means these spaces are most favoured. The mean plot depicts a functional relationship between the eight urban spaces.
open spaces and their mean scores on passive social use. The plot recorded almost same score for all types of passive social use. According to the plot, the highest score for passive social uses are in Dhanmondi 8, Sangshad Bhaban and TSC.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Dhanmondi 8</th>
<th>Dhanmondi 32</th>
<th>Sangshad Bhaban</th>
<th>Zia Uddan</th>
<th>Rayer Bazar</th>
<th>Ramna</th>
<th>Shahid Minar</th>
<th>TSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting: On the benches and seats</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>70%</td>
<td>60%</td>
<td>50%</td>
<td>40%</td>
<td>30%</td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/sitting on grass</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>70%</td>
<td>60%</td>
<td>50%</td>
<td>40%</td>
<td>30%</td>
</tr>
<tr>
<td>Wandering: Exploring architecture and surroundings</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>70%</td>
<td>60%</td>
<td>50%</td>
<td>40%</td>
<td>30%</td>
</tr>
<tr>
<td>Watching: Watching people</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
<td>70%</td>
<td>60%</td>
<td>50%</td>
<td>40%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Figure 4.11 Respondents’ use pattern for ‘passive social use’ across eight designed urban open spaces.
4.6 Key Findings

4.6.1 Factor Analysis and Correlation

- Factor analysis was used to extract the constructs of this research and the results highlighted three factors that linked to the dependent variable, one representing aesthetic response and the other two social use. The construct social use further divided into active and passive social use.

- In total, eleven variables linked to three constructs that were extracted from factor analysis. Four variables, 'pleasant-unpleasant', 'beautiful-ugly', 'like-dislike', and 'desirable-undesirable' are associated with the construct 'aesthetic response'. Strong correlations (with the coefficients ranging from 0.65 to 0.81) statistically justify linking these four variables to the construct aesthetic response.

- From factor analysis, the construct social use can be further divided into two sub-components, active social use and passive social use. Four variables have been identified as linked to passive social use and these are wandering, watching, sitting and relaxing. Three components have been linked to active social use such as: eating, talking and walking. It is also statistically appropriate to link four variables to passive social use and three variables to active social use as these variables are very strongly inter-correlated. The correlation coefficients between the seven variables are medium to strong (0.30 to 1.0), and this exhibit a moderate to high inter-relationship.

- Pearson product-moment correlation analysis was applied to identify the level of association between two dependent variables, aesthetic response and social use. A medium to strong relationship has been identified between aesthetic response with only two types of social use pattern 'walking' and 'eating'. However, a very weak correlation between the rest of the dependent variables indicates a feeble relationship. Therefore, it can be stated that the relationship between aesthetic response and social use is very limited hence, less significant than the previous relationships.

4.6.2 ANOVA for Aesthetic Response

- Changes in the level of surrounding enclosures appear to be associated with variation in aesthetic response i.e. pleasant-unpleasant and beautiful-ugly. Variations are strong for two types of surrounding enclosure: partially enclosed, moderately enclosed and strongest for partially open enclosures. Therefore, the mean score for partially open enclosures is
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significantly different from the other enclosure type and very strongly associated with the construct aesthetic response.

• The mean score for a low height is also significantly different from various heights of the surrounding enclosures i.e. extremely low and moderate height. Changes in height of the surrounding enclosures appear to be more strongly associated with variation in pleasant-unpleasant, like-dislike and desirable-undesirable at the significance level of p < 0.001, as the effect size is comparatively higher for this variable. Variations in aesthetic response are sensible for two types of height: extremely low, moderate height and strongest for a low height enclosure.

• The mean score of water features for ‘moderate amount’ is significantly different from other types of water features. Variation in the number of water features appears to be more strongly associated with variation in ‘beautiful-ugly’ as the effect size is medium (.070) for this variable. Variations in aesthetic response differ for three level of water feature: very few, moderate amount and great amount, and among them, a moderate amount has a significantly higher preference than for other types of water feature.

• A non-significant difference in aesthetic response appears for different levels of vegetation and these variations are not associated with variations of aesthetic response. A post-hoc comparisons test indicated no significant difference between different levels of vegetation. However, ‘quite a lot’ amount of vegetation is desirable for a higher aesthetic response and the mean score for ‘quite a lot’ is significantly noticeable. To summarize, vegetation higher than a moderate amount is associated with variation in aesthetic response.

• The mean score for great amount/size of monuments or sculptures is significantly different from other levels. The presence or absence of monuments and sculptures appear to be more strongly associated with variations in pleasant-unpleasant, like-dislike and beautiful-ugly as the effect size is very close to large (> 0.12) for this variable. Variations in aesthetic responses differ particularly for moderate to great amount/ size of monuments and sculptures.

• Changes in different physical characteristics of urban open spaces appear to be associated with variations in aesthetic response. For the responses such as: pleasant-unpleasant, like-dislike, beautiful-ugly, the designed urban open space of Dhanmondi 32 and TSC are
significantly different to Dhanmondi 8, Sangshad Bhaban, Ramna and Shahid Minar. For desirable-undesirable, Sangshad Bhaban differs significantly from Dhanmondi 32, Ramna and Shahid Minar. The mean scores for Dhanmondi 32, Sangshad Bhaban, Zia Uddan and Ramna are significantly different for aesthetic response from other urban open spaces. From Table 4.1, it can be observed that these designed Urban Open Spaces possess similar kinds of physical characteristics according to the respondents. Although the contextual settings of the eight study areas are different; for the observed five physical features, these four spaces share similar kinds of architectural settings and visual characteristics. This could be the reason why some spaces scored higher than others. From the ANOVA, the aesthetic response for each of the five variables also highlighted the most preferred types of physical characteristics (Figure 4.2 to 4.6) for the aesthetically preferred designed urban open space such as, Dhanmondi 32, Sangshad Bhaban, Zia Uddan and Ramna.

4.6.3 ANOVA for Social Use

- With variation in active social use i.e. eating, talking and walking, changes in different physical characteristics of urban open spaces seem very strongly associated. Variations are strongest for the variables ‘eating’ and ‘walking’ and differ significantly for different urban open spaces. They do not significantly differ for the variable ‘talking: chatting with friends’. Therefore, talking is equally important for every space. The mean plot depicts a functional relationship where ‘talking and chatting’ with friends are the most important use patterns for all study areas. The plot recorded the highest score for active social use: ‘eating’ and ‘talking’ in Dhanmondi 8, Zia Uddan and TSC and the lowest mean score for ‘walking around’ is in Rayer Bazaar and TSC. Hence, TSC is important for eating and talking but not for walking around.

- Variations in passive social use are strongest and differ significantly for six urban open spaces and do not significantly differ for Dhanmondi 8, Sangshad Bhaban and TSC, which means these spaces are most favoured for social use. The mean plot records a functional relationship and almost the same score for all types of passive social use. According to the plot, the highest score for passive social uses are in Dhanmondi 8, Sangshad Bhaban and TSC.
CHAPTER 5

MORPHOLOGICAL AND SPATIAL ANALYSIS OF DHAKA CITY AND THE STUDY AREAS
5.1 Configurational Analysis of the Urban Layout of Dhaka City

According to Conzen (2004), the diversity of morphology in South Asian cities arises from the diversity of historical development, functional types and different combinations of morphological characteristics. Dhaka has grown and evolved in size, scale and extent in its history and morphology according to political and commercial considerations. In this section, a historical and morphological overview has been highlighted to reveal its evolutionary development over time. In addition to descriptions of the development phases, space syntax theory is applied to reveal whether these changes are arbitrary, or whether there is any hidden logic to the pattern of growth over time. In this phase, UCL Depthmap software was applied for the syntactic analysis.

Other than the historical development, configurational analysis of space syntax is explored to identify the global-local integration, the spatial nature of the integration core and the spatial relationship between the first and second order syntactic measures in relation to the changing pattern of urban function (Chapter 2). As the present research concentrates on designed urban open space, this morphological analysis of the development patterns of urban spaces, as well as the importance of street networks both locally and globally can be identified. Moreover, the highest and lowest syntactic values of different periods are highlighted on an integration map. This assists in the identification of globally important roads of Dhaka city. The historical and morphological development in eight different stages is highlighted by using syntactic maps of 1608 to 2001 (Figure 5.2 to 5.5) and 2007. The bold lines signify the highest integration (R=n) values that mainly pass through the commercial interfaces and different bands of colour denote different ranges of syntactic measures. The numerical and explanatory interpretations of these syntactic values are discussed in the following section.

5.1.1 Historical Evolution of Urban Layout of Dhaka City

The morphology of third world developing cities often reflects dualism of urban form, the traditional or pre-colonial and the modern (Herbert & Thomas, 1997). The first type predominantly built up with narrow streets and congested patterns with few open spaces and functional areas. The modern city, in contrast, allocated a more spacious layout and geometry. The morphological and historical evolution of the urban form of Dhaka city also follows the similar typology. Before carrying out the configurational analysis of the study areas, the evolutionary process and transformation of the spatial configuration of Dhaka city needs to be investigated. The historical evolution provides an in-depth understanding of how the existing
urban morphology transformed into the present context and how the functional aspects implied by the layout have changed accordingly.

The syntactic analysis of Figure 5.2 shows that in Pre-Mughal Dhaka (map of 1608 AD), the global integration core sits along the oldest market centre and different bazaar streets show equal importance in the integration analysis. Moreover, the analysis shows the elongated integration core within the market centre leading in a northerly direction towards Mughal Dhaka. In the syntactic analysis of Mughal Dhaka (map of 1764 AD), the global integration core again resides on the market centre of the Pre-Mughal city and extends towards the north-western periphery of the city. The morphological pattern seems to correspond to the commercial and administrative cores to a greater extent (Figure 5.2). The local integration values suggest that most of the bazaar streets are locally focused (Table 5.2).

In 1859 the global integration core sat along the two bazaar streets (Figure 5.3). It took the form of a T connecting the two commercial hubs of the city. During this phase, the city’s Pre-Mughal Hindu Core comprised densely inhabited areas that extended towards the Muslim Mughal Core, i.e., the Chawk and projected outwards to the Colonial city. This may be referred to as the period of unification (Nilufar, 1997). Other than the Mughal core, most of the areas, particularly the extended western part of Chawk Bazaar and the northern part of the British addition, were loosely integrated. In the axial map of 1859 Dhaka, it clearly shows that the integration core largely coincided with the commercial interface of the city, suggesting that the bazaar streets of Dhaka constituted the city dwellers’ most important commercial hub.

![Diagram](image.png)

Figure 5.1 Demarcation between Pre-Mughal and Mughal city.
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Oldest market centre (global integration core of Pre-Mughal city)

Measure=2

Figure 5.2 Global integration (R = n) map of Dhaka city in 1608 and 1764. Basic axial map adapted from (Nilufar, 1997), syntactic analysis (Ferdous, 2010).

British addition: colonial city

Hindu core

Chawk Bazaar: Muslim Mughal core & commercial hub

Global integration core follows Bazaar Street: parallel to the river

Figure 5.3 Global integration (R = n) map of Dhaka city in 1859 and 1916. (Axial map drawn from the base map of 1764 that was reconstructed on the basic information of 1859 and 1916).

In the map of 1916, the most integrated line connected with the Chawk Bazaar and extended towards the north, forming a linear integration core parallel to the river. From the syntactic analysis of 1916, it can be clearly seen that since the Mughal period, the bazaar streets along the Buriganga River has retained its importance, both locally and globally.
Figure 5.4 Global integration ($R = n$) map of Dhaka city in different phases from 1960 to 1995. Basic axial map adapted from (Khan, 2008; Nilufar, 1997), syntactic analysis (Ferdous, 2011).
It needs to be mentioned that among the eight study areas, some of the urban spaces evolved historically (details in Chapter 3), but most of these spaces became famous as urban open spaces only after 1987 and did not exist on maps of 1608 to 1960. All of the study spaces can be located on the map of 2001 (Figure 5.5). As the city extended towards the north, the integration core also extended in the northern direction and concentrated on the geographical
centre of the city. It is noticeable that in every stage of syntactic analysis, the integration cores (thick red lines) follow the bazaar streets or commercial interfaces of the city. Here, the term bazaar street signifies the commercial interface or market centre of the city. Typically, in the indigenous form of a city, the grid structure is muted to a complex path system. This was the core concept generating Islamic bazaar streets as these heterogeneous types of spaces generated human activity at the pedestrian level (Figure 5.6). These types of bazaar streets follow the neighbourhood or residential area and generated a mixed-use complex within the city road network. They are morphologically indigenous and often mixed-use in character.

![Figure 5.6 Transformation of Roman street into Islamic bazaar. Adapted from (Rapoport, 1977, p. 219)](image)

Therefore, by revealing the historical review of urban development it has been observed that the evolution and changes of urban morphology clearly cluster in the central area rather than the periphery. From the syntactic analysis of different phases of the 19th century (Figure 5.4 and 5.5), it can be clearly identified that since the Mughal period the integration core included the bazaar streets that follow the geographic centre of the city. As Dhaka city extended in a northerly direction, the integration core followed the most connected and integrated commercial interface of the city. Besides, the correlation between the local and global syntactic properties (i.e. intelligibility) was also reasonably good\(^1\) (Table 5.1), especially the integration values suggested that both local and global function of the city expressed steady growth to the inhabitant (Nilufar, 1997).

---

\(^1\) According to Pallant (2007), correlation coefficients from .10 to .30 indicate a weak correlation, coefficients from .30 to .50 indicate a medium correlation and coefficients from .50 to 1.0 indicate a strong correlation.
Table 5.1 Correlation (R^a) Value of Local and Global Measure in Different Periods in Dhaka

<table>
<thead>
<tr>
<th>Period</th>
<th>( R^a ) of ( R_n - R_3 )</th>
<th>( y = ax \pm b )</th>
<th>( R^a ) of ( R_n - CN )</th>
<th>( y = ax \pm b )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before1608</td>
<td>0.4114</td>
<td>( y = 1.8947x + 0.543 ) ( R^2 = 0.1692 )</td>
<td>0.3447</td>
<td>( y = 3.6075x + 0.5922 ) ( R^2 = 0.1188 )</td>
</tr>
<tr>
<td>1764</td>
<td>0.5243</td>
<td>( y = 2.742x - 0.1079 ) ( R^2 = 0.2749 )</td>
<td>0.4023</td>
<td>( y = 4.8713 - 0.3705 ) ( R^2 = 0.1619 )</td>
</tr>
<tr>
<td>1859</td>
<td>0.3137</td>
<td>( y = 1.823x + 0.8402 ) ( R^2 = 0.0984 )</td>
<td>0.2364</td>
<td>( y = 3.1798x + 1.3402 ) ( R^2 = 0.0559 )</td>
</tr>
<tr>
<td>1916</td>
<td>0.4147</td>
<td>( y = 2.155x + 0.6672 ) ( R^2 = 0.172 )</td>
<td>0.3031</td>
<td>( y = 3.9358x + 0.9749 ) ( R^2 = 0.0918 )</td>
</tr>
<tr>
<td>1960</td>
<td>0.5251</td>
<td>( y = 2.48x + 0.1759 ) ( R^2 = 0.2756 )</td>
<td>0.3931</td>
<td>( y = 5.4837x - 0.7382 ) ( R^2 = 0.1546 )</td>
</tr>
<tr>
<td>1987</td>
<td>0.4288</td>
<td>( y = 2.0918x + 0.5365 ) ( R^2 = 0.1838 )</td>
<td>0.3216</td>
<td>( y = 4.6054x + 0.0185 ) ( R^2 = 0.1034 )</td>
</tr>
<tr>
<td>1995</td>
<td>0.4926</td>
<td>( y = 2.4996x - 0.0742 ) ( R^2 = 0.2426 )</td>
<td>0.3738</td>
<td>( y = 5.5517x - 1.3678 ) ( R^2 = 0.1397 )</td>
</tr>
<tr>
<td>2001</td>
<td>0.3889</td>
<td>( y = 2.1424x + 0.3884 ) ( R^2 = 0.1512 )</td>
<td>0.2831</td>
<td>( y = 3.7084x + 0.6122 ) ( R^2 = 0.0798 )</td>
</tr>
</tbody>
</table>

Note: \( R^a = Correlation, R_n = Global Integration, R_3 = Local Integration, R^2 = Tangent of Slope. \)

5.1.2 Spatial Configuration of the Urban System of Dhaka City

5.1.2.1 Pattern of axial segments

The axial structure of Dhaka to some extent looks like a ‘deformed grid’ in which all the major lines extend by conserving lower degree line relations, allowing ninety degree line relation to the longer lines. Like some Western and Arab cities, the local sub-areas in Dhaka are mostly fitted into the larger scale grid, using a ninety-degree relation to join the internal streets of the city’s local areas. Sometimes, this ninety-degree relation transformed into an obtuse or open angle as the internal streets move towards the heart of the local areas and continue out in another direction (Hillier, 1996).

Hillier provided a theoretical overview of local spatial structure and suggested that when the local area with a relatively small number of axial segments are considered, the lines which are wholly internal, are likely to be shorter than the lines which connect the interior to the exterior (Hillier, 1996). This proposition seems apparent in the morphology of Dhaka. Old Dhaka represents a morphology in which the lines that intersect at open angles tend to be shorter and less differentiated in length from those of the more localized streets. Conversely, new Dhaka
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morphology illustrates a pervasive disposition for longer lines to be incident to others at open angles while the more localized shorter lines tend to be adjacent or close to right angles (Figure 5.5). Furthermore, it appears that in old Dhaka, lines that are internal to an area rarely cross a perceived boundary and become part of another local area as opposed to new Dhaka wherein at least some lines, which are part of the local areas, continue into neighbouring areas. In Hillier's terms, whereas old Dhaka resembles a 'linearly discrete' character like some Arab cities, new Dhaka resembles the organic morphological pattern of some west European cities, e.g. London. Hillier further suggests that the morphological differentiation that distinguishes old from new Dhaka represents 'an example of parametric differences expressing cultural variation in a fundamental settlement process' within the perimeter of a single city (Hillier, 1996, pp. 354-355). A propos of the two groups, although both followed a similar, natural process of formation; the underlying spatial differences are evident at the local as well as the global level. The next part of analysis explores more on this aspect in the indigenous or historic part along with the contemporary organic settlements of new Dhaka. This will use a number of basic numerical data as observed in the morphology of the areas under study.

5.1.2.2 Global integration (Rn)

Figure 5.7 illustrates the distribution of global integration (Rn) across Dhaka city in the year of 2007. According to the map, the most integrated lines are located at the geographic centre of the city rather than at the periphery. More specifically, the longest axial line that mainly passes through the commercial hub of the city is the most integrated. The higher Rn values are concentrated within the more contemporary part of Dhaka. Physically, the most integrated lines, i.e. red in colour, connect the eastern and western parts of Dhaka city, indicating an extension of the core towards the north. The most segregated lines are concentrated mainly on the periphery of the city (Figure 5.7). The south-eastern and north-western edges are totally isolated from the centre or integration hub of the city. In general, the global integration values (Table 5.2) appear to be confined by the major roads that tend to spread over a wide range but do not necessarily transverse from the central to the peripheral areas. The mean global integration value of the total urban system (in 2007) was 0.539, with a minimum and maximum range of 0.210 and 0.838 respectively, suggesting a comparatively medium level of accessibility to the urban system. Here 'accessibility' refers to the extent to which any space is enable people to reach, use and visit without any impairment (Burton & Mitchell, 2006).
5.1.2.3 Local integration (R3)

In contrast to global integration (Rn), local integration (R3) indicates the ‘relative accessibility’ of specific lines up to three turns away with reference to their immediate neighbours. By observing the local integration map (Figure 5.8), a different distribution pattern is found, wherein the local integrators tend to be dispersed over the whole plan layout or all over the city rather than concentrated upon a specific location. A comparative analysis of the local and global integration maps shows that most of the roads that are globally
important may not necessarily have been integrated locally, and vice versa. Among all axial lines, very few roads are integrated both locally and globally and these are Mirpur Road, Old and New Airport Road, DIT Road and New Eskaton Road (Figure 5.14). The highest and lowest R3 values of the total urban system (Figure 5.8) are 4.399 and 0.333 respectively. The mean R3 value is 1.6055, implying that the configuration of Dhaka is characterised by a comparatively lower level of accessibility with reference to local neighbours.

Figure 5.8 Local integration (R3) map of Dhaka, 2007. (Ferdous, 2011)
Table 5.2 Global and Local Measures of Dhaka in Different Periods (1608-2001)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration Global R=n Max</td>
<td>0.9596</td>
<td>0.9973</td>
<td>0.7531</td>
<td>0.9903</td>
<td>1.1695</td>
<td>1.2395</td>
<td>1.3381</td>
<td>1.0337</td>
<td></td>
</tr>
<tr>
<td>Integration Global R=n Min</td>
<td>0.3181</td>
<td>0.3411</td>
<td>0.2240</td>
<td>0.3577</td>
<td>0.4631</td>
<td>0.4522</td>
<td>0.5152</td>
<td>0.3120</td>
<td></td>
</tr>
<tr>
<td>Integration Global R=n Mean</td>
<td>0.6361</td>
<td>0.6834</td>
<td>0.5175</td>
<td>0.6367</td>
<td>0.7766</td>
<td>0.8519</td>
<td>0.8897</td>
<td>0.6829</td>
<td></td>
</tr>
<tr>
<td>Std. deviation</td>
<td>0.1436</td>
<td>0.1283</td>
<td>0.1050</td>
<td>0.1360</td>
<td>0.1497</td>
<td>0.1607</td>
<td>0.1486</td>
<td>0.1243</td>
<td></td>
</tr>
<tr>
<td>Integration Local R=3 Min</td>
<td>0.2109</td>
<td>0.2109</td>
<td>0.2109</td>
<td>0.2109</td>
<td>0.2109</td>
<td>0.2109</td>
<td>0.2109</td>
<td>0.2109</td>
<td></td>
</tr>
<tr>
<td>Integration Local R=3 Mean</td>
<td>1.7482</td>
<td>1.7657</td>
<td>1.7837</td>
<td>2.0393</td>
<td>2.1610</td>
<td>2.2885</td>
<td>2.1498</td>
<td>1.8515</td>
<td></td>
</tr>
<tr>
<td>Std. deviation</td>
<td>0.6615</td>
<td>0.6709</td>
<td>0.6105</td>
<td>0.7069</td>
<td>0.7307</td>
<td>0.7593</td>
<td>0.7540</td>
<td>0.6848</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.3 Syntactic Measures of Dhaka in 2007

<table>
<thead>
<tr>
<th>Syntactic Measure</th>
<th>Minimum</th>
<th>Average (Mean)</th>
<th>Maximum</th>
<th>Std Dev.</th>
<th>Count/Segment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity</td>
<td>1.0</td>
<td>3.1294</td>
<td>43</td>
<td>2.434</td>
<td>12895</td>
</tr>
<tr>
<td>Control</td>
<td>0.026</td>
<td>1.0</td>
<td>15.116</td>
<td>0.913</td>
<td>12895</td>
</tr>
<tr>
<td>Controllability</td>
<td>0.026</td>
<td>0.268</td>
<td>0.727</td>
<td>0.110</td>
<td>12895</td>
</tr>
<tr>
<td>G. Integration (Rn)</td>
<td>0.210</td>
<td>0.539</td>
<td>0.838</td>
<td>0.101</td>
<td>12895</td>
</tr>
<tr>
<td>L. Integration (R3)</td>
<td>0.333</td>
<td>1.605</td>
<td>4.399</td>
<td>0.585</td>
<td>12895</td>
</tr>
<tr>
<td>Line Length</td>
<td>0.003</td>
<td>0.265</td>
<td>7.647</td>
<td>0.303</td>
<td>12895</td>
</tr>
<tr>
<td>Mean Depth</td>
<td>1.5</td>
<td>2.429</td>
<td>2.923</td>
<td>0.217</td>
<td>12895</td>
</tr>
</tbody>
</table>

5.1.2.4 Connectivity

Connectivity simply measures the level of connection between different axial segments or streets. Although the highest connectivity of Dhaka is 43, the mean connectivity (CN=3.129) is quite low (Table 5.3). These roads of maximum connection are situated within the geographic centre of Dhaka and helped to form the global integration core. The axial segments with maximum connections also exhibit the highest level of integration. These axial segments are more continuous and long rather than fragmented. Thus, it is evident that the average connectivity of local systems for the case of the central part is higher than for the peripheral counterparts. This seems to be supported mainly by the presence of long segments of a super-grid cutting across the fabric of the geographic core and simultaneously being part...
of the locality based spatial systems. Hence, the maximum connected integration hub represents a framework of longer segments, where long streets pass along the boundary of local areas in comparison to the peripheral fragmented streets.

5.1.2.5 Intelligibility

'Intelligibility’, is one of the principle measures related to the configuration of the spatial structure that plays an important role in determining the legibility of any city. In syntactic terms, intelligibility is the theoretical inter-relationship of the local and global spatial configuration. The value of intelligibility is that it can reveal how the constituted local and global parts are embedded within the urban system as a whole. According to Kim, other than reflecting the local and global relationships of the spatial configuration, intelligibility plays an important role in shaping the ways in which people perceive and use space (Kim, 1999). An intelligible system exhibits a smooth relationship between the local and global measures and the scale of movement (Hillier, 1996).

Analyses of the scattergrams of the urban layout of Dhaka city (Figure 5.9, 5.10) shows that, the spatial configuration of Dhaka as a whole is of moderate intelligibility. The gentle slope of the regression line further confirms the perceived continuity between the local and global configurations of Dhaka. The tangent of the slope of $R^2$ for the scattergram (Figure 5.9) is $(R_{n-CN} = 0.0339)$ and this low value is further signified by the gentle and flat slope. In contrast, the comparatively steeper slope of $R^2$ $(R_{n-R3} = 0.1673$ in Figure 5.10) for the scattergram highlights the moderate intelligibility between the local and the global system. According to space syntax theory, in any unintelligible system, individuals face difficulty when inferring the overall structure and trying to orient themselves to their immediate contexts. This can be explained by the relatively low consistency of morphological structure where, the urban system comprises relatively segregated or excessively locally oriented areas, which fail to relate to the whole. Therefore, the spatial configuration of Dhaka is relatively discontinuous and partially fragmented.
5.1.2.6 Spatial nature of integration core

The integration core of a city is mainly formed along the highest integrated axial lines and conventionally comprises 5%-20% of the most integrated lines depending on the size of the axial map. By examining the core features, the distribution of relative accessibility and the
size, shape and location of highly integrated streets can be identified, which can provide an understanding of the configuration of a plan layout of any city. The 5% to 20% most integrated streets of the urban system are highlighted by thick lines in Figure 5.11, 5.12 and 5.13 show how the syntactic core is clustered.

In the case of Dhaka, the highest integration is clustered mostly around an arc of the perimeter of the geographic centre; the curvilinear arc shape integration core (5% highest integrated line) follows a pattern of linear commercial interface (Figure 5.11). The form of this spinal core shifts into a hollow, deformed wheel shape when considering the 15% most integrated lines (Figure 5.12). Here, the integration core acts as a skeleton, shaping the spatial structure of Dhaka. When the core analysis is concerned with the 20% most integrated lines of the whole system, the deformed core loses its hollowness and concentrates densely in the centre and begins to extend to the North (Figure 5.13). The following key points can be inferred from the core analysis of Dhaka city.

a. The curvilinear arc shape of the integration core forms a continuous concentrated core at the geographical centre of Dhaka.
b. The pattern of global integration of Dhaka divides the city into four major morphological 'regions' or sectors towards its north, south, east and west, the central area within the core acts as the syntactic heart of the city. Other than the central area, most of the segments are loosely segregated by the core.

c. The centre of this core could be termed the 'syntactic heart' of the city that passes mainly through the commercial interface. The core is mainly formed around the globally important commercial road networks with a comparatively large axial segment.

d. The newly developed localities in Dhaka are more connected to their surroundings and the older counterparts are rather isolated. Therefore, in comparison to the apparently densely knit spatial network of older areas, the contemporary settlements are more permeable to their surroundings.

e. The globally important larger segments show maximum connectivity. Hence, the urban core of Dhaka is formed by the maximally integrated and connected larger axial commercial segments or bazaar streets.

Figure 5.13 The dark lines are the 20% most integrated streets. (Ferdous, 2011)
5.2 Morphological Analysis and Spatial Structure of the Urban Open Space of Dhaka City

5.2.1 Spatial Structure of the Study Areas

The previous section concentrated on the spatial configuration of Dhaka city, the nature of its integration core as well as different morphological analyses of the total urban system. The analysis in this section will focus on the morphological features and the spatial configuration of the eight study areas within the spatial structure of Dhaka city. The space syntax methodology and associated methods are conceived here as providing suitable tool to understand the complex socio-spatial patterning of the study areas, as this approach addresses both social as well as morphological causes behind the spatial structure. Space syntax also defines morphological order through analysing spatial patterns with an emphasis on the local morphological relations and global patterns.

This present part of the study explores the possibility that there are relationships between spatial morphology and social disposition that can objectively identify areas that are currently subjectively defined. It could be conjectured that Dhaka city might have powerful spatial patterning of functional and social order for the urban system. The general syntactic features of different urban spaces are synthesized here through an overview of the syntactic values. To analyse the spatial configuration of the study areas, the surrounding road network and their average syntactic values are considered (Figure 5.15-5.17 and Table 5.4). The physical properties of eight study areas have been discussed in Chapter 3. In this section, the spatial and morphological characteristics of the urban open spaces will be analysed in relation to the configurational measurement. The location of each study area in relation to the global integration map and the names of famous, popular streets that identify the local and global integration values are highlighted in Figure 5.14. Here the most integrated red lines are considered as zero depth, the second highest integrated orange lines as one step depth and the yellow lines as two step depths and so on. In the following sections, the location and maps of the eight urban open spaces in relation to syntactic order and global integration are graphically represented. For each study area, the average syntactic value of the surrounding segment has been considered (Table 5.4) This research concentrated observation on the most active and vibrant spots of the study areas, which are highlighted by red lines on each location map (Figure 5.18 to 5.41). The street segments, their location in relation to the study areas, and syntactic properties are indicated following.
The Evaluative Image of Designed Open Spaces: Bangladesh

Figure 5.14 Location of the eight urban open spaces within the global integration map of Dhaka city.

Table 5.4 The Average Syntactic Values of the Eight Study Areas

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>G. Integration (R=n)</th>
<th>L. Integration (R=3)</th>
<th>Connectivity (CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhanmondi 8</td>
<td>0.71506</td>
<td>2.8955</td>
<td>12.78</td>
<td>3.9215</td>
<td>2.5343</td>
</tr>
<tr>
<td>Dhanmondi 32</td>
<td>0.69546</td>
<td>2.7831</td>
<td>14.33</td>
<td>4.5252</td>
<td>2.5107</td>
</tr>
<tr>
<td>Sangshad Bhaban</td>
<td>0.74852</td>
<td>2.6518</td>
<td>8.11</td>
<td>2.3648</td>
<td>2.6998</td>
</tr>
<tr>
<td>Zia Uddan</td>
<td>0.73854</td>
<td>2.9586</td>
<td>9.43</td>
<td>2.5948</td>
<td>2.6504</td>
</tr>
<tr>
<td>Rayer Bazaar</td>
<td>0.54284</td>
<td>2.1089</td>
<td>3.25</td>
<td>0.7355</td>
<td>2.3507</td>
</tr>
<tr>
<td>Ramna</td>
<td>0.69412</td>
<td>1.4667</td>
<td>5.33</td>
<td>1.4418</td>
<td>2.3685</td>
</tr>
<tr>
<td>Shahid Minar</td>
<td>0.73078</td>
<td>1.8677</td>
<td>4.75</td>
<td>1.0801</td>
<td>2.4903</td>
</tr>
<tr>
<td>TSC</td>
<td>0.72553</td>
<td>1.7095</td>
<td>4.13</td>
<td>1.0156</td>
<td>2.4471</td>
</tr>
</tbody>
</table>
Figure 5.15 Zone 1: Detail of surrounding road networks.

Figure 5.16 Zone 2: Detail of surrounding road networks.

Figure 5.17 Zone 3: Detail of surrounding road networks.
**i. Urban Open Space 1: Dhanmondi 8**

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar
Urban open space 8: TSC

Figure 5.18 Location of Dhanmondi 8 on global integration map.

Figure 5.19 Detail map showing the study area.

Figure 5.20 Syntactic order and road network.

Table 5.5 Mean Syntactic Value of the Surrounding Road Network of Dhanmondi 8

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>G. I (R=n)</th>
<th>L.I (R=3)</th>
<th>Con. (CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement/ hr</th>
<th>R^* of Rn – R3</th>
<th>R^* of Rn – CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Open Space</td>
<td>7140</td>
<td>0.7943</td>
<td>3.8978</td>
<td>34</td>
<td>11.019</td>
<td>2.5468</td>
<td>584</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7138</td>
<td>0.7971</td>
<td>3.7145</td>
<td>21</td>
<td>6.151</td>
<td>2.5404</td>
<td>464</td>
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<tr>
<td></td>
<td>7178</td>
<td>0.6566</td>
<td>2.0181</td>
<td>5</td>
<td>1.444</td>
<td>2.3714</td>
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</tr>
<tr>
<td></td>
<td>7144</td>
<td>0.7027</td>
<td>3.2314</td>
<td>17</td>
<td>5.155</td>
<td>2.5088</td>
<td>305</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7148</td>
<td>0.7204</td>
<td>3.1369</td>
<td>20</td>
<td>6.488</td>
<td>2.4384</td>
<td>398</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7155</td>
<td>0.6241</td>
<td>2.3619</td>
<td>9</td>
<td>2.676</td>
<td>2.4482</td>
<td>178</td>
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<td></td>
<td>7179</td>
<td>0.7412</td>
<td>2.6778</td>
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<td>0.529</td>
<td>2.7342</td>
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<td>7556</td>
<td>0.7412</td>
<td>2.7926</td>
<td>4</td>
<td>0.946</td>
<td>2.6866</td>
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<tr>
<td></td>
<td>7534</td>
<td>0.6584</td>
<td>2.2292</td>
<td>3</td>
<td>0.883</td>
<td>2.5344</td>
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</tr>
<tr>
<td>Mean</td>
<td>0.7151</td>
<td>2.8955</td>
<td>12.78</td>
<td>3.921</td>
<td>2.5343</td>
<td>305</td>
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</tbody>
</table>
ii. *Urban Open Space 2: Dhanmondi 32*

Urban open space 1: Dhanmondi 8

**Urban open space 2: Dhanmondi 32**

Urban open space 3: Sangshad Bhaban

Urban open space 4: Zia Uddan

Urban open space 5: Rayer Bazaar

Urban open space 6: Ramna

Urban open space 7: Shahid Minar

Urban open space 8: TSC

Figure 5.21 Location of Dhanmondi 32 on global integration map.

Figure 5.22 Detail map showing the study area.

Figure 5.23 Syntactic order & road network.

### Table 5.6 Mean Syntactic Value of the Surrounding Road Network of Dhanmondi 32

<table>
<thead>
<tr>
<th>Urban Open Space Segment No.</th>
<th>G. L (R=n)</th>
<th>L.I (R=3)</th>
<th>(CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement/hr</th>
<th>R^ of Rn - R3</th>
<th>R^ of Rn - CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>7140</td>
<td>0.7943</td>
<td>3.897</td>
<td>34</td>
<td>11.019</td>
<td>2.5468</td>
<td>584</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7174</td>
<td>0.7412</td>
<td>2.726</td>
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<td>0.4794</td>
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<td>178</td>
<td></td>
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</tr>
<tr>
<td>7157</td>
<td>0.5906</td>
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</tr>
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<td>7144</td>
<td>0.7027</td>
<td>3.231</td>
<td>17</td>
<td>5.1553</td>
<td>2.5088</td>
<td>305</td>
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<td>6.4866</td>
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</tr>
<tr>
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<td>9</td>
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</tr>
<tr>
<td><strong>Mean</strong></td>
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<td><strong>2.783</strong></td>
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<td><strong>2.5107</strong></td>
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<td></td>
</tr>
</tbody>
</table>

Chapter 5: Morphological and spatial analysis of Dhaka City and the study areas
iii. Urban Open Space 3: Sangshad Bhaban

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar
Urban open space 8: TSC

Figure 5.24 Location of Sangshad Bhaban on global integration map.

Table 5.7 Mean Syntactic Value of the Surrounding Road Network of Sangshad Bhaban

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>G.I (R=1)</th>
<th>L.I (R=3)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement /hr</th>
<th>R^ of Rn – R3</th>
<th>R^ of Rn – CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>3: Sangshad Bhaban</td>
<td>6589</td>
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<td>2.5193</td>
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<tr>
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<td>2.6883</td>
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<td>2.5468</td>
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<tr>
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<td>6658</td>
<td>0.7298</td>
<td>1.9697</td>
<td>3</td>
<td>0.9583</td>
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</tr>
<tr>
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<td>2.3647</td>
<td>2.6998</td>
<td>269</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chapter 5: Morphological and spatial analysis of Dhaka City and the study areas
iv. Urban Open Space 4: Zia Uddan

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar
Urban open space 8: TSC

Figure 5.27 Location of Zia Uddan on global integration map.

Figure 5.28 Detail map showing the study area.

Figure 5.29 Syntactic order & road network.

Table 5.8 Mean Syntactic Value of the Surrounding Road Network of Zia Uddan

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>G. I (R=n)</th>
<th>L. I (R=3)</th>
<th>(CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement/hr</th>
<th>R^ of Rn - R3</th>
<th>R^ of Rn - CN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6631</td>
<td>0.6837</td>
<td>2.2984</td>
<td>6</td>
<td>2.257</td>
<td>2.6751</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6591</td>
<td>0.7569</td>
<td>2.8785</td>
<td>8</td>
<td>2.122</td>
<td>2.7052</td>
<td>343</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>6179</td>
<td>0.7493</td>
<td>2.8369</td>
<td>6</td>
<td>1.118</td>
<td>2.7386</td>
<td>289</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7141</td>
<td>0.7743</td>
<td>3.5656</td>
<td>16</td>
<td>3.709</td>
<td>2.5864</td>
<td>374</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>907</td>
<td>0.7285</td>
<td>3.2136</td>
<td>11</td>
<td>3.787</td>
<td>2.5469</td>
<td>318</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zia Uddan</td>
<td>Mean</td>
<td>0.7385</td>
<td>2.9586</td>
<td>9.4</td>
<td>2.595</td>
<td>2.6504</td>
<td>314</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chapter 5: Morphological and spatial analysis of Dhaka City and the study areas
v. Urban Open Space 5: Rayer Bazaar

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar
Urban open space 8: TSC

Figure 5.30 Location of Rayer Bazaar on global integration map.

Figure 5.31 Detail map showing the study area.

Figure 5.32 Syntactic order & road network.

Table 5.9 Mean Syntactic Value of the Surrounding Road Network of Rayer Bazaar

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>G. I (R=n)</th>
<th>L. I (R=3)</th>
<th>(CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement/ hr</th>
<th>( R^2 ) of Rn – R3</th>
<th>( R^2 ) of Rn – CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>5: Rayer Bazaar</td>
<td>8212</td>
<td>0.549</td>
<td>2.369</td>
<td>6</td>
<td>1.0</td>
<td>2.279</td>
<td>118</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7400</td>
<td>0.546</td>
<td>2.178</td>
<td>3</td>
<td>0.883</td>
<td>2.2187</td>
<td>87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8056</td>
<td>0.550</td>
<td>2.019</td>
<td>2</td>
<td>0.529</td>
<td>2.4054</td>
<td>93</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7612</td>
<td>0.524</td>
<td>1.868</td>
<td>2</td>
<td>0.529</td>
<td>2.50</td>
<td>78</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>0.542</strong></td>
<td><strong>2.108</strong></td>
<td><strong>3.25</strong></td>
<td><strong>0.736</strong></td>
<td><strong>2.3507</strong></td>
<td></td>
<td><strong>94</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
vi. Urban Open Space 6: Ramna

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar
Urban open space 8: TSC

Table 5.10 Mean Syntactic Value of the Surrounding Road Network of Ramna

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>GI (R=n)</th>
<th>LI (R=3)</th>
<th>CN</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement/hr</th>
<th>R^n of Rn – R3</th>
<th>R^n of Rn – CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>6: Ramna</td>
<td>2408</td>
<td>0.7244</td>
<td>2.0202</td>
<td>8</td>
<td>2.6761</td>
<td>2.3333</td>
<td>149</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2407</td>
<td>0.6754</td>
<td>1.4724</td>
<td>5</td>
<td>0.8334</td>
<td>2.3334</td>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2409</td>
<td>0.7042</td>
<td>1.3938</td>
<td>6</td>
<td>1.4747</td>
<td>2.3125</td>
<td>128</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2411</td>
<td>0.6751</td>
<td>1.0697</td>
<td>4</td>
<td>1.1666</td>
<td>2.4166</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2410</td>
<td>0.6561</td>
<td>1.1365</td>
<td>4</td>
<td>1.1666</td>
<td>2.3333</td>
<td>47</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2379</td>
<td>0.7296</td>
<td>1.7081</td>
<td>5</td>
<td>1.3333</td>
<td>2.4827</td>
<td>137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.6941</td>
<td>1.4667</td>
<td>5.33</td>
<td>1.4417</td>
<td>2.3685</td>
<td>102</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
vii. Urban Open Space 7: Shahid Minar

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar
Urban open space 8: TSC

Table 5.11 Mean Syntactic Value of the Surrounding Road Network of Shahid Minar

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>G. I (R=n)</th>
<th>L.I (R=3)</th>
<th>(CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement / hr</th>
<th>R^ of Rn - R3</th>
<th>R^ of Rn - CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shahid Minar</td>
<td>2417</td>
<td>0.6854</td>
<td>1.425</td>
<td>3</td>
<td>0.8333</td>
<td>2.4211</td>
<td>61</td>
<td>0.9632</td>
<td>0.7597</td>
</tr>
<tr>
<td></td>
<td>2422</td>
<td>0.7294</td>
<td>1.834</td>
<td>3</td>
<td>0.6761</td>
<td>2.5277</td>
<td>73</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2613</td>
<td>0.7581</td>
<td>2.257</td>
<td>8</td>
<td>1.4777</td>
<td>2.5254</td>
<td>148</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2376</td>
<td>0.7502</td>
<td>1.953</td>
<td>5</td>
<td>1.3333</td>
<td>2.4871</td>
<td>124</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.7308</td>
<td>1.867</td>
<td>4.75</td>
<td>1.080</td>
<td>2.4901</td>
<td></td>
<td>102</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
viii. Urban Open Space 8: Teacher Student Centre (TSC)

Urban open space 1: Dhanmondi 8
Urban open space 2: Dhanmondi 32
Urban open space 3: Sangshad Bhaban
Urban open space 4: Zia Uddan
Urban open space 5: Rayer Bazaar
Urban open space 6: Ramna
Urban open space 7: Shahid Minar

Urban open space 8: TSC

Table 5.12 Mean Syntactic Value of the Surrounding Road Network of TSC

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Segment No.</th>
<th>G. I (R=n)</th>
<th>L. I (R=3)</th>
<th>(CN)</th>
<th>Control (CV)</th>
<th>Mean Depth</th>
<th>Movement /hr</th>
<th>R^ of Rn – R3</th>
<th>R^ of Rn – CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. TSC</td>
<td>2605</td>
<td>0.7427</td>
<td>1.7938</td>
<td>4</td>
<td>1.0833</td>
<td>2.5428</td>
<td>235</td>
<td></td>
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<tr>
<td></td>
<td>2607</td>
<td>0.7293</td>
<td>1.6211</td>
<td>3</td>
<td>0.75</td>
<td>2.5357</td>
<td>187</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>2608</td>
<td>0.6901</td>
<td>1.4028</td>
<td>3</td>
<td>0.8333</td>
<td>2.3529</td>
<td>131</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2610</td>
<td>0.7204</td>
<td>1.7257</td>
<td>4</td>
<td>0.95</td>
<td>2.3043</td>
<td>178</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2612</td>
<td>0.7493</td>
<td>1.6434</td>
<td>3</td>
<td>0.75</td>
<td>2.5666</td>
<td>217</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2606</td>
<td>0.7227</td>
<td>1.6071</td>
<td>4</td>
<td>1.1666</td>
<td>2.3333</td>
<td>198</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2609</td>
<td>0.6921</td>
<td>1.6249</td>
<td>4</td>
<td>1.1166</td>
<td>2.4166</td>
<td>157</td>
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</tr>
<tr>
<td></td>
<td>2613</td>
<td>0.7581</td>
<td>2.2572</td>
<td>8</td>
<td>1.4747</td>
<td>2.5254</td>
<td>287</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>0.7255</td>
<td>1.7095</td>
<td>4.13</td>
<td>1.0155</td>
<td>2.4471</td>
<td>199</td>
<td>0.7226</td>
<td>0.4824</td>
</tr>
</tbody>
</table>
5.2.1.1 Global (R=n) and Local (R=3) integration pattern

As already mentioned, integration in general is a depth measure of different spatial systems. The mean global integration (R=n) of a system is a crude interpretation of the level of hierarchy present in the system as a whole by representing average directness or indirectness of connections between spaces (Hanson, 1989). The idea of local integration comes from the conjecture that the traditional city typically consists of a super grid or network for strong primary movement routes, and that those axes off these major routes are seldom more than two steps deep from a strong structural axis. Therefore, the global integration represents the hierarchical variation of integration within the total city structure, whereas local integration signifies the local importance of the road network (Bafna, 2003). The following Table 5.13 and 5.14 represent different variables and correlations of syntactic measures of the study areas.

<table>
<thead>
<tr>
<th>Urban Space</th>
<th>Rn Value</th>
<th>Depth Measure</th>
<th>Hierarchical Order of Local Integration (R3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sangshad Bhaban</td>
<td>0.7485</td>
<td>1 step</td>
<td>Zia Uddan</td>
</tr>
<tr>
<td>Zia Uddan</td>
<td>0.7385</td>
<td>1 step</td>
<td>Dhanmondi 8</td>
</tr>
<tr>
<td>Shahid Minar</td>
<td>0.7308</td>
<td>1 step</td>
<td>Dhanmondi 32</td>
</tr>
<tr>
<td>TSC</td>
<td>0.7255</td>
<td>1 step</td>
<td>Sangshad Bhaban</td>
</tr>
<tr>
<td>Dhanmondi 8</td>
<td>0.7151</td>
<td>2 steps</td>
<td>Rayer Bazaar</td>
</tr>
<tr>
<td>Dhanmondi 32</td>
<td>0.6955</td>
<td>2 steps</td>
<td>Shahid Minar</td>
</tr>
<tr>
<td>Ramna</td>
<td>0.6941</td>
<td>2 steps</td>
<td>TSC</td>
</tr>
<tr>
<td>Rayer Bazaar</td>
<td>0.5428</td>
<td>3 steps</td>
<td>Ramna</td>
</tr>
</tbody>
</table>

Note: Different shades represent the similarity of urban open spaces in terms of syntactic and depth measures.

By comparing the global integration core of the study areas it is evident that, Sangshad Bhaban encompasses the highest integration value globally (Rn=0.7485). The surrounding roads of this open space fall within the integration core and the entrance point of this open space is connected with Manik Mia Avenue, which is globally one of the most integrated streets for Dhaka city (Figure 5.14). From Figure 5.16 it is evident that Zia Uddan is located in very close proximity to Sangshad Bhaban. This proximity increases the global significance
of Zia Uddan (Rn = 0.7385). The third most highly integrated area is Shahid Minar (Rn = 0.7308). The location of the national monument makes this urban open space globally important. The teacher student centre (TSC) is the fourth highest integrated space (Rn = 0.7255), both the TSC and Shahid Minar are located within the institutional area of the city (Table 5.13).

Dhanmondi 8 and 32 are two urban open spaces located in Dhanmondi residential area. Both of these spaces are globally important (Rn = 0.7151 and Rn = 0.6955 respectively) and are located within the second order global integration core (orange to yellow colour). Ramna is a comparatively newly developed urban area also situated within the institutional area of Dhaka. The historical importance (Chapter 3) makes this area globally significant (Rn = 0.6941). The least globally important space within the study areas is Rayer Bazaar, which is located near the Buriganga River on the western edge of Dhaka. The residential development isolated the total area from the main global integration core. This space is located in a globally segregated area (green in colour). This is most probable reason that makes this space globally less important (Rn = 0.5428) (Table 5.13).

Global integration represents the importance of any space globally (or as a whole), whereas local integration highlights the significance of any space with respect to its surroundings (or as a part). According to this concept, Zia Uddan is considered to be the most locally important space (R3 = 2.9586) and is therefore equally important as globally. The highest local integration value shows the importance of this segment i.e. a road also at the local level. The next two locally important spaces are located within the residential area of Dhanmondi. From the syntactic accessibility viewpoint, Dhanmondi 8 and 32 are locally (R3 = 2.8955 and R3 = 2.7831 respectively) the most important in comparison to the whole urban system. Sangshad Bhaban, which is the most highly integrated urban space is locally comparatively less significant (R3 = 2.6518).

On the other hand Rayer Bazaar is located just next to the residential locality. This makes Rayer Bazaar locally more important (R3 = 2.1089) than it is globally. Shahid Minar as a national monument and TSC as a meeting point, possess global importance, whereas locally these spaces are not very important (R3 = 1.8677 and R3 = 1.7095 respectively). According to the hierarchical order, Ramna is the least locally important urban open space (R3 = 1.4667). Figure 5.15 shows the location of Dhanmondi 8, Dhanmondi 32 and Rayer Bazaar in relation to the global integration (Rn) pattern of Dhaka city.
5.2.1.2 Connectivity (CN) and Control (CV)

The connectivity of a space literally means how many spaces intersect with it and mathematically represents the number of direct intersecting lines. When the embedded structures of a local area are considered in relation to the connectivity of the peripheral segments, they include those axes that are part of the local system. However, in order to further understand the connectivity i.e. the permeability of segments which form part of the local spatial systems, all segments one step outside are considered. From this perspective, the mean connectivity of Dhaka city is 3.1294 and the maximum connectivity is 43 (Table 5.14).

Among the study areas, the two urban open spaces in Dhanmondi 8 and 32 have the highest connectivity (CN 12.78 and 14.33 respectively), thereby greater permeability within and with the outside than the other study areas. These two urban areas are located within the well-connected residential area that ultimately increases the connectivity level of these spaces. These areas are expected to be highly used by the people and the use pattern will be revealed in the next section. The next highest connected areas are Zia Uddan (CN 9.4) and Sangshad Bhaban (CN 8.11). These two urban areas are located almost at the geographic centre of Dhaka city. Together with Dhanmondi 8 and 32, the average connectivity level of these four spaces is comparatively higher than for the rest of the study spaces. These four areas in turn, are expected to be used more often than others are. Therefore, these areas can be termed as ‘first order connected’ spaces. In contrast, the connectivity level of rest of the spaces varies from 3.25 to 5.33. Therefore, these spaces are not as well connected to the other street network of Dhaka city and are less accessible from different directions and therefore offer less choices of movement that already appears.

Along with connectivity, control, as another aspect of space syntax, might be expected to identify important streets within locality-based sub-areas. It takes into account the amount of choice a space represents to its immediate neighbours as somewhere to go. When the mean and maximum control values (CV) of the local areas are considered; Dhanmondi 8, Dhanmondi 32, Zia Uddan and Sangshad Bhaban exhibits higher control values (Table 5.14). This presents another indication of greater connectedness of four areas than rest of the study areas. Thus, the areas with higher control values present as rather permeable and with a greater choice of route within the overall urban system. Study areas like Ramna, Shahid Minar, TSC and Rayer Bazaar have comparatively lower control values hence less connectedness with rest of the street network. Probably such spatial distinctiveness, i.e. a
relatively controlled approach, reinforces a higher level of social connections of these locality-based communities of Dhaka. It can be argued that societies are either limited by or are liberated from the boundary of local areas and this seems to have an association with their relative permeability to and from their surroundings. These social and spatial aspects seemingly reinforcing each other and are discussed in more detail in the discussion chapter.

Table 5.14 Connectivity and Control Measure of the Study Areas

<table>
<thead>
<tr>
<th>Hierarchical Order of Connectivity (CN)</th>
<th>Hierarchical Order of Control (CV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhanmondi 32</td>
<td>14.33</td>
</tr>
<tr>
<td>Dhanmondi 8</td>
<td>12.78</td>
</tr>
<tr>
<td>Zia Uddan</td>
<td>9.4</td>
</tr>
<tr>
<td>Sangshad Bhaban</td>
<td>8.11</td>
</tr>
<tr>
<td>Ramna</td>
<td>5.33</td>
</tr>
<tr>
<td>Shahid Minar</td>
<td>4.75</td>
</tr>
<tr>
<td>TSC</td>
<td>4.13</td>
</tr>
<tr>
<td>Rayer Bazaar</td>
<td>3.25</td>
</tr>
<tr>
<td>Dhanmondi 32</td>
<td>4.5252</td>
</tr>
<tr>
<td>Dhanmondi 8</td>
<td>3.9215</td>
</tr>
<tr>
<td>Zia Uddan</td>
<td>2.5948</td>
</tr>
<tr>
<td>Sangshad Bhaban</td>
<td>2.3648</td>
</tr>
<tr>
<td>Ramna</td>
<td>1.4418</td>
</tr>
<tr>
<td>Shahid Minar</td>
<td>1.0801</td>
</tr>
<tr>
<td>TSC</td>
<td>1.0156</td>
</tr>
<tr>
<td>Rayer Bazaar</td>
<td>0.7355</td>
</tr>
</tbody>
</table>

Note: Different shades represent the similarity of urban open spaces in terms of connectivity and control value.

5.2.1.3 Intelligibility

The urban environment to some extent can facilitate or limit one's orientation depending on the structure and characteristics of the physical elements of the city (Devlin, 2001; Lynch, 1960, 1981; Rapoport, 1977). According to Lynch, the imageability refers to the visual quality or legibility of the urban environment that could facilitate human orientation in the cityscape (Lynch, 1960). The degree of imageability is very similar to the spatial measures of intelligibility. Intelligibility literally means clarify, simplicity or transparency. An intelligible layout is easily comprehensible by gleaning the structure of the global system on the basis of the local structure (Bafna, 2003; Haq & Girotto, 2003; Long, 2007; Long, Baran, & Moore, 2007; Tuncer, 2007).
Figure 5.42 The scatter of correlation between local and global measures (Rn-R3) and (Rn-CN) in eight study areas.
The relationship between local and global integration according to the theory of space syntax, can generate ‘part and whole’ or ‘local-global’ association in the axial map (Hillier, 1996, 2001). Thus, local areas yield a linear and tight scatter of local and global integration in the context of the city as a whole. Figure 5.42 shows a number of scattergrams plotting each line.

(Figure 5.42 end)
in the study areas as a point located according to its degree of global integration \((R = n)\) on the horizontal axis and its degree of local integration \((R = 3)\) and connectivity \((CN)\) on the vertical axis. The correlation coefficients in relation to the local and global syntactic measures are employed here in order to decipher socially defined localities as well as neighbourhoods with reference to their locational importance. From the scattergrams it is apparent that apart from the TSC and Rayer Bazaar, the results from rest of the study areas form tight linear scattergrams that cross the main regression lines at steeper angles. The minimum correlation coefficients \((R^* of R_n - R_3 and R^* of R_n - C_n)\) of the study area are Rayer Bazaar \((0.7216, 0.4483)\) and TSC \((0.7226, 0.4824)\). These two study areas are exceptional because they form a much flatter scatter, which seems to be the consequence of being substantially more segregated than the rest of the urban surface. It also seems that the larger extent of this locality along with its peripheral location might act against its intensification as a local area as defined by syntactic theory.

5.2.1.4 Presence of attractor and movement

In Chapter 2, the theory of natural movement was discussed where it was argued that configuration has a more obviously dominant influence on movement. Besides this, it is the configurational properties of an urban grid that can influence the presence of an attractor. Here attractor means any kind of structure, function, facility or service provided within the urban system for the city dwellers. It could be a shopping centre, recreational ground, art gallery, educational institute, food court, sports centre or even an urban open space. Movement refers to the presence of people either static or moving in any space.

![Figure 5.43](image)

**Figure 5.43** The interrelationship between attractor, configuration and movement in an urban grid. Adapted from (Hillier, Penn, Hanson, Grajewski, & Xu, 1993, p. 31)

In many urban areas, attractors tend to be clustered in a specific location that may be influenced by the configurational properties of the surrounding urban grid (Hillier, *et al.*, 1993).
1993). Therefore, the urban grid configuration can influence the natural movement along the grid and the location of attractor within it. The relationship between movement and attractor is twofold, where the presence of an attractor may generate the movement (both vehicular and pedestrian) or, movement may influence the location of the attractor. Therefore, both the configurational properties of an urban grid and the location of an attractor along the grid may contribute to generate movement in the urban system (Figure 5.43). The relationship between configuration, attractor and movement of eight urban open spaces will be explored in the following section.

**Dhanmondi 8:** Open space near Dhanmondi 8 is located within the residential area of Dhanmondi. The pedestrian movement in this area is high due to the position of different amenities for the surrounding neighbourhood such as, schools, playgrounds, sports grounds, restaurants and other educational institutions. Sometimes these amenities act as an attractor to non-residential people. *Rabindra Sarobar* is a famous designed open space just next to the water body for the people of the surrounding neighbourhood. The open amphitheatre of this designed open space is used as a cultural ground for different national festivals. The designed plaza near Dhanmondi 8 and the surrounding open space acts as a vibrant place for the general public almost all year round. Figure 5.44 is a scattergram plotting integration and connectivity values against movement rates for the observed spaces near this designed urban open space. The point that is particularly worth noting about the scattergram and correlation coefficient is the steeper slope of the scattergram, which is positively correlated with the global integration and connectivity of the designed urban open space. In spite of the presence of an attractor, it seems that the relationship between the pattern of integration of the urban grid configuration and the pattern of observed movement is strong, clear and persuasive.

**Dhanmondi 32:** The designed urban open space near Dhanmondi 32 is a part of an extension of the lake-side development of the Dhanmondi area. Like Dhanmondi 8, the pedestrian movement is also high due to the presence of attractors, the water body and different kinds of amenities for the neighbourhood. The *Shatayu Prangon* is the sports ground, which is used by the young and aged people for exercise, playing cricket and other recreation purposes. Within the lake-side development of this residential area, the open space near Dhanmondi 32 is a most lively and remarkable place for strolling. By analysing the scattergram and correlation coefficient, a steeper slope and positive relationship between the spatial configuration and
movement can be observed (Figure 5.44). This means that the movement rate along any street can be explained by the spatial configuration of that street.

![Graphs showing movement rate against integration and connectivity for Dhanmondi 8, Dhanmondi 32, Sangshad Bhaban, and Zia Uddan.](image)

Figure 5.44 The scatter of correlation between movement rate and spatial measures (Rn and CN) in eight study areas.
Sangshad Bhaban: The south plaza of Sangshad Bhaban or parliament building was once a very popular place for leisurely walks and recreation for all age groups. For security reasons, the general public is restricted from entering the parliament building. However, the south plaza, nearby garden and the surrounding roads are still very popular place for city dwellers.
The parliament building designed by architect Louis I. Khan acts as an attractor. The dense movement can be explained by the geographic centrality and attractor of this urban space. The regression line of the scattergram is very steep and represents a linear positive relationship between the spatial configuration and movement (Figure 5.44).

**Zia Uddan:** Zia Uddan is located next to the Sangshad Bhaban and this space is famous for the mausoleum of the former Bangladeshi president Ziaur Rahman. The adjacent garden and greenery is an integral part of the complex. In fact a major road divides the Sangshad Bhaban and Zia Uddan complex. Therefore in addition to the parliament building, the mausoleum also acts as an attractor for this urban open space. The density of movement and the configurational properties of Sangshad Bhaban and Zia Uddan are similar. However, the regression line of Zia Uddan is less steep when compared to the regression line of Sangshad Bhaban, which exhibits a smaller correlation coefficient (Figure 5.44).

**Rayer Bazaar:** Among the eight study areas, Rayer Bazaar is located on the western edge of Dhaka city near the river **Buriganga.** Due to its peripheral location, this urban open space is used mainly by local people and is seldom used by the people who live far away. However, the martyr monument acts as an attractor that makes this designed public open space very active and vibrant on some specific days of the year. Due to the edge location, the movement density around this urban space is quite low, which produces a gentle slope in the scattergram (Figure 5.44). In spite of the positive relationship between pedestrian movement and spatial configuration, the R squared value or tangent of the slope \( R^2 = 0.458 \) represents a moderate correlation with a comparatively flat regression line (Figure 5.44).

**Ramna:** The urban open space of Ramna is located within the institutional area of Dhaka city. The historical importance makes this area notable however; the absence of any specific attractor ultimately creates a dull, monotonous and tedious environment. Other than the absence of an attractor, due to the lax security and management, people do not feel comfortable in this designed open space especially after nightfall. The spatial configuration i.e. integration and connectivity is low, which can be explained by the slow movement rate. The correlation coefficient between movement and the surrounding configuration being unremarkable ultimately produces a gentle slope \( R^2 = 0.671 \) with relatively flat regression line (Figure 5.44).
Shahid Minar: This designed urban open space is located very close to the Teacher Student Centre (TSC) of Dhaka University, which was designed as a memorial space. The martyr monument acts as an attractor and makes this space globally important on particular days of the year. The scattergram indicates a positive correlation between the spatial configuration and movement. However, the regression line is moderately steep and can be explained by a medium coefficient and comparatively higher R-squared value ($R^2 = 0.788$ and $0.898$ in Figure 5.44).

TSC: The Teacher Student Centre (TSC) is located at the core of Dhaka University and the place itself acts as an attractor for the entire area. The pedestrian movement is mainly dominated by students with different kinds of campus activities. Although the spatial connectivity is low (CN = 4.13), the higher global integration value correlates positively with the movement density. The scattergram generates a moderate slope where the R-squared value for integration-movement is comparatively higher ($R^2 = 0.856$) than the connectivity-movement ($R^2 = 0.556$) value. Therefore, the pedestrian movement is mainly dominated by the strong influence of global integration rather than the connectivity (Figure 5.44).

5.2.2 Spatial Function, Social Use and Activity Patterns of the Study Areas

The spatial structure and morphological analysis of the sample designed urban open spaces were analysed in the previous section. This section focuses more on the functional aspects of the studied urban spaces and investigates the relationship between spatial function and social use of the study areas. This section is divided into three parts. In the first part, different aspects of the use pattern and activities identified by the users were discussed. The opinions of the respondents are used to compare the use pattern of the sample spaces. By analysing the data collected from the use pattern and accessibility of each space, this second part highlighted the interrelationship between the urban grid configuration and the users’ choice of routes. This part was followed by a comparative analysis of different factors of use in relation to the spatial structure. Here respondents’ opinions are collected in relation to the spatial function of urban morphology by simplifying the technical syntactic terms, such as global and local integration represented by central location or close to residential areas and connectivity is replaced by accessibility to the surroundings.
5.2.2.1 A brief description of the use pattern

The aim of this section is to give a brief description of the use pattern of each sample space based on the data collected from the field survey.

Frequency of using the open space: By analysing the data collected from eight sample spaces, it has been observed that the frequency of visits to each space varies according to different factors. The survey was conducted among people who actively used the study areas at the time of the survey. The climate and other environmental factors are not considered and are beyond the scope of this research. The use pattern of urban open space mainly concerns location, morphology, street network and other physical characteristics of each study area.

From Figure 5.45, Dhanmondi 8, Dhanmondi 32 and Zia Uddan are used very frequently by the respondents. Sangshad Bhaban and TSC are also heavily used. TSC is located within the heart of institutional space therefore the user groups are mainly apprentices. Ramna and Shahid Minar are used occasionally. The historic importance of these areas makes them globally important on special days. Rayer Bazaar is also comparatively restricted in use due to the edge location.

Time, day and way of use: There is no specific time and day for using all the study areas. These urban open space acts as a breathing space for city dwellers therefore, in most cases people prefer to use these spaces in the evening and almost every day. Working people use the
spaces every day and especially after office hours when all spaces show a little higher level of occupancy. The number of users rises between 4 pm and 6 pm every day, which seems to be a favourite time to access recreational open spaces. Some of the spaces are occupied by the elderly, housewives and students who prefer to use the space in the morning and afternoon on the week days. In the early morning, some places are highly occupied by a large number of users for exercises. It has been noted that Dhanmondi 8, Sangshad Bhaban, Zia Uddan and Rayer Bazaar are heavily used and have their peak occupancy in the evening rather than in the morning. This can be explained by their location and local accessibility in comparison to other areas.

![Time of Visit](image)

**Figure 5.46** Different time and day of visiting the eight study areas according to the respondents.
From Figure 5.46 and 5.47 it can be summarized that the preferred mode of transport is rickshaw or trishaw (a kind of tri-cycle) although walking is also very popular. The respondents preferred to spend time with family members or friends and some respondents preferred to be alone. In summary, we could say that most of the spaces are favourite public place for all aged group to wandering and recreation with friends and family preferably in the evening.

**Use pattern of open space:** From the preliminary study, previous literature, applying factor analysis and by measuring internal consistency of scale, it has been identified that the social use pattern of any space can be broadly divided into two groups and seven types. Walking,
relaxing, sitting, wandering, talking, eating and watching are the most popular ways of using any public space. Other than that; reading, sleeping, knitting, sunbathing etc are minor types of use that could be broadly classified under the ‘relaxing’ group.

The different types of social use pattern inside the eight study areas have been recorded. Among the variety of use, ‘talking’ or ‘chatting’ is considered the most popular means of social use by the respondents. ‘Sitting’ is another essential activity, which is considered as an all-important factor in evaluating the quality of the public environment in any area (Gehl, 2006). ‘Relaxing’ is also very much associated with sitting activities where Sangshad Bhaban, Dhanmondi 8 and the TSC are considered as an important location for ‘sitting’ and ‘relaxing’. Rayer Bazaar and the TSC is not a very popular place for ‘walking’. ‘Wandering around’ is very similar to exploring architecture and the spaces with famous beautiful architecture such as Sangshad Bhaban, Zia Uddan, Rayer Bazaar and the TSC usually get higher preference for the use pattern ‘wandering’. ‘Eating’ is very much associated with sitting or other types of social activity. Among the eight study areas Zia Uddan, Dhanmondi 32 and TSC are the most popular place for having food or drinks with friends and family (Figure 5.47 and 5.48).
5.2.2.2 The interrelationship between accessibility (CN) and the use of open spaces

The relationship between the accessibility and use of open space can easily be explained by Figure 5.45 and the following Table 5.15. According to Hillier's theory (1996), the more integrated or connected any space is, the greater are the chances to densely occupy that space by people moving. Usually, connectivity (CN) of a street measures the number of direct intersections to other streets and local integration (Radius 3) highlights only those spaces that are up to three changes of direction away from each line under consideration. Control (CV) represents the degree of importance for accessing a neighbouring line. From Table 5.15, it is evident that Dhanmondi 8, Dhanmondi 32, Zia Uddan and Sangshad Bhaban are the most highly ‘connected’ spaces and their local integration is also considerably higher than rest of the study areas.

Table 5.15 Order of Different Syntactic Measures (CN, CV, R3) of the Eight Study Areas

<table>
<thead>
<tr>
<th>Urban Open Space</th>
<th>Connectivity (CN)</th>
<th>Control (CV)</th>
<th>local Integration (R3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhanmondi 32</td>
<td>14.33</td>
<td>4.5252</td>
<td>2.7831</td>
</tr>
<tr>
<td>Dhanmondi 8</td>
<td>12.78</td>
<td>3.9215</td>
<td>2.8955</td>
</tr>
<tr>
<td>Zia Uddan</td>
<td>9.4</td>
<td>2.5948</td>
<td>2.9586</td>
</tr>
<tr>
<td>Sangshad Bhaban</td>
<td>8.11</td>
<td>2.3648</td>
<td>2.6518</td>
</tr>
<tr>
<td>Ramna</td>
<td>5.33</td>
<td>1.4418</td>
<td>1.4667</td>
</tr>
<tr>
<td>Shahid Minar</td>
<td>4.75</td>
<td>1.0801</td>
<td>1.8677</td>
</tr>
<tr>
<td>TSC</td>
<td>4.13</td>
<td>1.0156</td>
<td>1.7095</td>
</tr>
<tr>
<td>Rayer Bazaar</td>
<td>3.25</td>
<td>0.7355</td>
<td>2.1089</td>
</tr>
</tbody>
</table>

According to the hierarchical order of connectivity, Dhanmondi 32 and Dhanmondi 8 achieved the highest global connectivity (14.33 and 12.78) and Zia Uddan and Sangshad Bhaban are in a second order connectivity (9.4 and 8.11). This can be explained by higher syntactic accessibility and a higher degree of connectedness i.e. circulation with the surroundings. The higher control values of these four urban open spaces also indicate the importance and necessity of those spaces for the surrounding neighbourhood. The higher local integration values of the study areas indicate that these areas are accessible with the least number of connections from all other lines in their surroundings (Baran, Rodriguez, & Khattak, 2008). In contrast, Ramna, Shahid Minar, TSC and Rayer Bazaar express comparatively lower connectivity and a smaller control value with the surroundings. The local integration is also low, in comparison to the first four study areas. In spite of less connectivity, Rayer Bazaar is the only exception and locally is much more accessible.
Figure 5.45 highlighted the responses of the respondents towards the frequency of using each of the study areas as already explained. Dhanmondi 8, Dhanmondi 32, Zia Uddan and Sangshad Bhaban are the most highly visited and the most popular space for strolling. The respondents also frequently use those spaces that achieved the highest morphological properties in terms of connectivity, control and local integration. By observing Figure 5.45 and Table 5.15 it can be assumed that frequency of using any space can be influenced by the morphological properties of the urban system. According to Hillier’s theory (1996) movement along the street can be explained by its configuration or the presence of an attractor in the surroundings. The larger the number of moving people, the greater the chances are of using any space frequently. Therefore, for the first four study areas, the configuration of the urban grid is favourable and can easily explain the higher level of use. On the other hand, the morphological properties of Ramna, TSC, Shahid Minar and Rayer Bazaar are comparatively low, which also correlates with the lower level of use.

5.2.2.3 A comparative analysis of different factors of use in relation to the spatial structure

Instead of using technical syntactic properties like global integration, local integration and connectivity; this research uses generalized terms so that it can be easily explained to the general public. From Figure 5.49 it is evident that the respondents identified the central location of Zia Uddan, Sangshad Bhaban, Dhanmondi 32, and Shahid Minar as being the most important. The historical importance of Rayer Bazaar, Shahid Minar and TSC act as attractors and identify them as important. The monumental effects of Zia Uddan and Sangshad Bhaban are equally significant for the respondents. In contrast, the central location of Dhanmondi 8 and Ramna is not important for users, as these spaces are already popular. By observing the configuration of the urban system from Table 5.15, it is easy to see the hierarchical order of global integration, which is very close to the users’ responses.
Figure 5.49 Importance of being centrally located of the eight designed urban open spaces in Dhaka city.

Figure 5.50 Importance of being close location of the eight designed urban open spaces from the inhabited areas.

Figure 5.51 Importance of accessibility and connectivity of eight designed urban open spaces in Dhaka city.
Figure 5.50 explained the local importance of the urban spaces to the users and the respondents identified Dhanmondi, Rayer Bazaar and Shahid Minar as important. The edge location of Rayer Bazaar makes it locally important to the users rather than globally. However, the martyr monument sometimes acts as an attractor on specific days of the year to city dwellers. Similarly the location of Ramna, Shahid Minar and TSC is locally less important due to their global position and the presence of monuments, which act as attractors and makes them globally more significant. The syntactic values of the local integration (R3) correlate with the respondents’ responses however, some variation may occur due to socio-cultural differences.

Figures 5.51 and 5.52 represent the connectivity and aesthetic value of the study areas. According to the respondents, accessibility and connectivity is vital for any urban open space. The greater the connectivity of a space, the more it can offer a choice of routes to users. It is assumed that with longer streets and greater strategic value, the more streets link with any space, and the more accessible that space is to users. By analysing the respondents’ opinions of accessibility to the study areas, it can be observed that for each study area, connectivity is the most important issue. None of the respondents mentioned any of the study areas being less important in terms of connectivity. Therefore, among the numerous syntactic measures, connectivity is one of the most fundamental measures for the urban open spaces of Dhaka city. In contrast, aesthetic and visual qualities are relatively lower priorities than the other spatial configuration of urban open spaces. This is extensively discussed in Chapter 4. Hence,
it can be concluded that the use of urban open space depends mostly on the urban grid configuration of the surrounding areas i.e. connectivity, the presence of attractors and local and global integration. These higher syntactic properties of the street network influence movement density along the grid and this ultimately increases social use near those configurational properties. The aesthetic or pleasant visual qualities are considered as additional rather than obvious properties that motivate people to stay longer in the studied urban spaces.

5.3 Summary and Key Findings

- The curvilinear arc shape of the integration core forms a continuous concentrated core at the geographical centre of Dhaka that passes mainly through the commercial interface. The shifting position of the global integration core or 'syntactic heart' of Dhaka city clearly clusters in the central area that follow market centres and different bazaar streets rather than being on the periphery. As Dhaka city extends toward the north, the integration core follows the most connected and integrated commercial interface of the city. Therefore, the core is mainly formed by a globally important and connected commercial network with a comparatively larger axial segment.

- Dhaka has grown in size and scale during the last four hundred years and urban morphology of old and new Dhaka is quite different. In old Dhaka, streets which are internal to an area rarely cross a perceived boundary and tend to be less long and less differentiated in length than some of the more localized streets. Whereas in new Dhaka at least some axial lines, which are part of the local areas, continue into neighbouring areas, this illustrates a pervasive disposition for longer streets. The more localized shorter axial lines or streets tend to be incident at or close to right angles.

- The longest axial line possesses higher global integration (Rn) values that pass mainly from the commercial hub of the city and are concentrated within the area of the later part of Dhaka. The most integrated line connects the eastern and western part of Dhaka city and gives direction to extend the core towards the north. The highly local integrators (R3) tend to be dispersed all over the city rather than concentrating on a specific location. The most segregated lines are mainly distributed on the periphery of the city. The average connectivity of local systems in the central part is also higher than for the peripheral counterparts. The maximum connected roads exhibit the highest level
of integration and are sited within the geometric centre of Dhaka and therefore helped to form the global integration core. These axial segments are more continuous and long rather than fragmented.

- The spatial configuration of Dhaka as a whole is of low intelligibility. The lower slopes of the regression lines further confirm low continuity between the local and global configuration of Dhaka. The spatial configuration of Dhaka is relatively discontinuous and partially fragmented. It is revealed by the scattergrams that other than the TSC and Rayer Bazaar, the rest of the six study areas form good linear tight scattergrams and cross the main regression line at steeper angles.

- The urban grid configuration can influence the natural movement along the grid and the location of an attractor within the grid. The configurational properties of the urban grid and the location of an attractor along the grid may both contribute to generate movement in the urban system. For each of the study areas, different urban attractors generate movement along the configuration of urban grid. The user groups i.e. the respondents, very frequently and recurrently used Dhanmondi 8, Dhanmondi 32, Zia Uddan, Sangshad Bhaban and the TSC. The steeper slopes and positive correlations of the scattergrams signify the strong relationship between pedestrian movements and the configuration of the urban network.

- The more the number of moving people, the greater the chances are of using any space frequently. Dhanmondi 8, Dhanmondi 32, Zia Uddan and Sangshad Bhaban are the highly ‘connected’ spaces and their local integration is also very high in comparison to the rest of the study areas. These spaces are the most highly visited and the most popular public places for all age groups to stroll with friends and family members preferably in the evening.

- The study also identifies seven types of social-use pattern and walking, relaxing, sitting, wandering, talking, eating and watching are the most popular ways of using any public space. The respondents frequently use those spaces that achieved the highest morphological properties in terms of connectivity, control and local integration. The study also shows that the frequency of use of any space can be influenced by the morphological properties of the urban system.
For each study area connectivity is the prime important issue. According to respondents, accessibility and connectivity is vital for any urban open space. The greater the connectivity of a space, the greater the choice of routes are available to users. Among the numerous syntactic measures, connectivity is one of the most fundamental measures for the designed urban open spaces of Dhaka city. Contrary to this, aesthetic and visual qualities are a relatively low priority when compared to other spatial configurations of urban open spaces. The use of urban open space depends mostly on the urban grid configuration of the surrounding areas i.e. on connectivity and on local and global integration and the presence of attractors. These higher syntactic properties of the street network influence the movement density along the grid that ultimately increases the social use near those configurations. The aesthetic or pleasant visual qualities are considered an additional rather than a primary property that encourages people to stay longer in the studied urban open spaces.
6.1 Introduction

This research is an empirical and spatial study of architectural, morphological and other physical features of the built environment and configurational properties of urban grid to evaluate aesthetic response to and social use of designed urban open spaces. The first aim was to identify the salient physical, visual and architectural attributes of formally designed urban open spaces and their levels of association with aesthetic response and social use. The study provided a comprehensive overview of theoretical perspective, by developing major conceptualizations and understanding of the research constructs; aesthetic response and social use. By using mixed-methods approach: qualitative and quantitative, it addressed both the subjective and objective attributes that can influence users’ aesthetic response and social use. It explored naturalistic inquiry to identify the physical, architectural and visual attributes of designed urban plazas and public open spaces from users’ viewpoints. With a comprehensive review of existing research literature, this study summarizes the most important physical and visual attributes of designed urban plazas, squares and pedestrian malls from ‘aesthetic likeability’ and ‘social usability’ points of view.

In the second phase, the physical and visual attributes were objectively assessed to identify the levels of association and patterns of relationship between aesthetic response, social use, and morphological configurations in the eight study areas of Dhaka, Bangladesh. This research also identifies the geographic location of study areas in relation to the wider city context to ascertain how their configurational properties affect the uses of the selected spaces. To identify the objective properties, SPSS Statistics 17 and UCL Depthmap (for Space Syntax) soft-ware was used. The morphological and spatial configuration of urban grids, the location of urban attractors and observation of pedestrian movements along the grids provided a spatial dimension in this research. By using space syntax, the configurational objective properties of designed urban open spaces and surrounding urban grids were identified that subjectively hypothesized its relationship with the natural movement; hence, the social use pattern of those urban open spaces.

This research extends the notion of designed paved urban open spaces by considering perceptual and behavioural approach with the interaction of spatial morphological dimensions and addresses the lack of any prior empirical approach in designing urban plazas and public open spaces in Bangladesh. This mixed-method research approach, by integrating both qualitative and quantitative inquiry, offers the levels of information that can be used in future
design and development of paved urban open spaces, not only in a developing country like Bangladesh, but also in other cities with similar social contexts and cultural settings. By analysing users’ viewpoints and respondents’ perceptions with an interaction of SPSS and space syntax, this study incorporated both subjective and objective properties for the design of paved urban open spaces, which is an important research consideration in a 21st century context. By following the major steps of research process, this research could be applied to any part of the world to evaluate the image of designed urban open space. The final chapter briefly reviews and summarizes the major findings of the research by depicting the key outcomes as research models. It also discusses the implications and outlines the future directions for designing urban plazas and public open spaces by providing a comprehensive interactive model, which could be applied to different socio-cultural contexts.

6.2 Physical and Visual Characteristics of Designed Urban Plazas and Public Open Spaces

This research began by identifying the factors and assumptions that may influence the aesthetic response and social use of designed urban open spaces. A preliminary study was conducted and the respondents indicated some of the important ‘most liked’ architectural, visual and other physical characteristics of the built environment of urban plazas, squares and pedestrian malls that can influence their aesthetic response and social use. The aim of this study was to identify the aesthetically and socially preferred physical characteristics of the built environment of designed urban plazas and paved open spaces and to evaluate the aesthetic response and social use of those spaces from the users’ standpoint.

With the increasing volume of literature in urban design, physical characteristics are considered the most important in determining the visual qualities of the built environment, and by extension, its use. Physical characteristics of urban open spaces in this study included the landscape, architectural, morphological and other design elements identified by the respondents. Among the numerous physical characteristics, this research includes only the following physical characteristics of designed urban plazas and public open spaces that were most frequently mentioned by respondents that influenced the dependent variables of this research, aesthetic response and social use.

a. A good sense of enclosure

b. The height of the surrounding enclosure
c. Good coverage of vegetation, greenery and naturalness

d. Inclusion of water features and fountains

e. The presence of any monuments or sculpture works

f. Availability of seating arrangements

It should be noted that respondents identified 'availability of seating spaces' as one of the most important physical features for the social use of those spaces and not for aesthetic response. Apropos of the notion of aesthetic response and social use, these are the highest rated physical features and other research literature corroborates these findings (Collins & Collins, 1986; Herzog, 1992; Lynch & Hack, 1984; Mehta, 2006, 2007; Moughtin, 2003; Nasar, 1994; Sitte, 1889, 1898; Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991). In addition to determining the most important physical elements, the respondents identified their anticipated use pattern, likely activities and desired companionship they would seek to enjoy those spaces.

From the key findings of the preliminary study, it can be concluded that a physically well-designed open space is usually comprised of a medium height enclosure that provides a partially enclosed space for users with a generous amount of vegetation, water features, presence of monuments or sculptures and adequate seating arrangements. Although the findings are based on the specific surveyed contexts, according to this study, these are the most fundamental identified visual, physical and functional dimensions. These features act as vital architectural, physical and morphological attributes in the design of the surveyed urban plazas, squares, pedestrian malls and other types of paved urban open spaces.

6.3 Levels of Association between the Constructs and Designed Urban Open Spaces

The next phase of the study was to identify the designed urban plazas and public urban open spaces in Dhaka. Therefore, the author commenced a short informal interview with 15 architects and 15 randomly selected people in Dhaka, Bangladesh. The objective of this interview was to identify the most important and frequently used designed urban open spaces, where people prefer to visit and relax. To evaluate the physical characteristics of the eight study areas, space inventory observation was conducted among a cohort of 25 Bangladeshi architects. Given their educational background, experience and cultural familiarity of those
spaces, the group of architects successfully identified the space-matrix of the eight designed urban open spaces based on the above-mentioned six physical characteristics (Table 6.1).

After finalizing the physical characteristics of designed urban plazas and public open spaces as independent variables, this study finalized the variables of the dependent constructs, aesthetic response and social use, from the previous literature and the preliminary study. By applying three different techniques (Cronbach’s alpha, Factor analysis, and Correlation coefficient), it has been determined whether it was statistically appropriate to link the variables used in this study to the dependent constructs: aesthetic response and social use. In the relevant literature, Cronbach’s Alpha (α) score of 0.7 or above indicates reliability of the measuring instrument (Coolican, 2004; Hinton, 2004; Kinnear & Gray, 2009; Tabachnick & Fidell, 2007). In this study, the alpha level for aesthetic response (4 items) is 0.916 and social use (7 items) is 0.858 respectively indicating a very high level of internal reliability of the measuring instruments. An exploratory data reduction technique, Factor Analysis, summarizes the data and extracts the key components into three types: aesthetic response, active social use and passive social use. In addition, to identify the levels of association between the variables, a Pearson Product-Moment correlation analysis was applied and the strength of correlation between the variables (4 for aesthetic response and 7 for social use) was found to be quite strong (with the coefficients ranging from .65 to .81). Therefore, linking the four variables to the construct aesthetic response and seven variables to social use is appropriate.

In the next phase, ANOVA was applied to identify the levels of association between the dependent constructs and designed urban open spaces. For aesthetic response changes in the levels of identified physical characteristics appear to be strongly associated with variation in aesthetic response such as, ‘pleasant-unpleasant’, ‘beautiful-ugly’, ‘like-dislike’, and ‘desirable-undesirable’ at the significance level of p < 0.001. Therefore, partially open, low height surrounding enclosure, moderate amount of water features, moderate to great amount of monuments and sculptures with plentiful vegetation are very strongly associated with the construct aesthetic response. For aesthetically appealing, user-sensitive design solutions for paved urban open spaces, designers need to consider the following design features to generate positive aesthetic response (Figure 6.1).
By analysing the aesthetic response across eight designed urban open spaces, it can also be observed that the mean scores of four spaces, Dhanmondi 32, Sangshad Bhaban, Zia Uddan and Ramna are significantly different. Although the contextual settings of these four study areas are different, it is noticeable that these designed urban open spaces possess similar kinds of physical and visual characteristics that can generate positive aesthetic response. From the ANOVA, the highest aesthetic response for each of the five variables also highlighted the existence of these aesthetically preferred physical characteristics of Dhanmondi 32, Sangshad Bhaban, Zia Uddan and Ramna (Table 6.1).

Table 6.1 Types of Physical Characteristics of Eight Study Areas According to Space Inventory Observation

<table>
<thead>
<tr>
<th>Urban Plaza</th>
<th>Surrounding Enclosure</th>
<th>Height of Enclosure</th>
<th>Water Feature</th>
<th>Vegetation</th>
<th>Monuments/Scultures</th>
<th>Sitting Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Dhanmondi 8</td>
<td>Moderate enclosure</td>
<td>Moderate height</td>
<td>Quite a lot</td>
<td>Quite a lot</td>
<td>None at all</td>
<td>Great amount</td>
</tr>
<tr>
<td>2: Dhanmondi 32</td>
<td>Partially open</td>
<td>Low</td>
<td>Great amount</td>
<td>Great amount</td>
<td>Moderate amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>3: Sangshad Bhaban</td>
<td>Partially open</td>
<td>Low</td>
<td>Moderate amount</td>
<td>Quite a lot</td>
<td>Moderate amount</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>4: Zia Uddan</td>
<td>Partially open</td>
<td>Extremely Low</td>
<td>Moderate amount</td>
<td>Great amount</td>
<td>Quite a lot</td>
<td>Very few</td>
</tr>
<tr>
<td>5: Rayer Bazaar</td>
<td>Partially enclosed</td>
<td>Moderate height</td>
<td>Very few</td>
<td>Moderate amount</td>
<td>Great amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>6: Ramna</td>
<td>Partially open</td>
<td>Low</td>
<td>Moderate amount</td>
<td>Quite a lot</td>
<td>Moderate amount/size</td>
<td>Moderate amount</td>
</tr>
<tr>
<td>7: Shahid Minar</td>
<td>Completely open</td>
<td>Extremely Low</td>
<td>None at all</td>
<td>Very few</td>
<td>Great amount/size</td>
<td>Very few</td>
</tr>
<tr>
<td>8: TSC</td>
<td>Moderate enclosure</td>
<td>Low</td>
<td>None at all</td>
<td>Moderate amount</td>
<td>Very few</td>
<td>Great amount</td>
</tr>
</tbody>
</table>
For the construct social use, this research looked at both active and passive social use of the eight study areas. This study recorded the highest score for active social use: 'eating' and 'talking' in Dhanmondi 8, Zia Uddan and TSC and the lowest mean score for 'walking around' was in Rayer Bazaar and TSC. Hence, TSC is important for 'eating' and 'talking' but not for 'walking around'. Variations in passive social use are strongest and differ significantly from other urban open spaces, and do not significantly differ for Dhanmondi 8, Sangshad Bhaban and TSC, which means these spaces are most favoured for social use. Therefore, according to the study, the highest score for active and passive social uses are for Dhanmondi 8, Sangshad Bhaban, Zia Uddan and TSC. From Table 6.1, these four spaces possess very few similar kinds of physical characteristics. Hence, in addition to physical features, there may be other reasons that encourage people to use these designed urban open spaces and to experience them as vibrant. In the quest to identifying these reasons, the research investigated the relationship among the morphological configuration of surrounding urban grid of study areas, the presence of urban attractors, natural pedestrian movements and social use.

![Figure 6.2 Probabilistic relationships among morphological configurations, physical characteristics, social use.](image)

6.4 Relationship between Aesthetic Response and Social Use of Designed Urban Open Spaces

One of the hypotheses of this research was that frequency and types of social use and patterns of aesthetic response in designed urban open spaces can influence each other. To identify the levels of association between the two dependent variables aesthetic response and social use, the *Pearson product-moment correlation* was applied, as it is the most appropriate method to determine the strength of the correlation between the variables. Although there is a strong correlation among the four variables of aesthetic response and the seven variables of social use, the correlation coefficient between \((4+7 = 11\) variables) for aesthetic response and social use is less significant in comparison to their own internal correlation values. Only two types
of active social use pattern 'walking' and 'eating' posses a medium to strong relationship with aesthetic response however, the other five variables for social use indicated a comparatively weak relationship with aesthetic response. Therefore, findings of this research suggest the following flow diagram where physical and visual characteristics both influence social use and aesthetic response in designed urban plazas and public open spaces. However, social use and aesthetic response are considered as individual factors for designed public open spaces without any major influence on each other. This proposition rejects one of the hypotheses of this research that aesthetic response and social use influence each other.

![Diagram showing physical & visual characteristics influencing social use and aesthetic response](image)

**Figure 6.3 Proposed relationships among physical characteristics, social use and aesthetic response where aesthetic response and social use do not influence each other.**

### 6.5 Levels of Association between Social Use, Morphological Configurations and Designed Urban Open Spaces

Based on the Hillier's (1996) theory, to identify the other influential factors of social use, this study introduced the morphological configuration of the study spaces and their surroundings as an independent variable. By revealing the historical and syntactic analysis of different phases of urban development of Dhaka city, it was observed that the evolution and changes in urban morphology clearly clustered in the central area rather than on the periphery. The shifting position of the global integration core or 'syntactic heart' of Dhaka city follows the most connected and integrated market centres and bazaar streets. Therefore, a globally important and connected commercial network with a comparatively larger axial segment forms most of the core.

The eight study areas are located on the newly developed area of Dhaka city and are mostly concentrated near the global integration core except for the Rayer Bazaar. The most segregated axial lines are mainly distributed on the periphery of the city where the Rayer
Bazaar is located. The average connectivity of local systems in the central part is also higher than for the peripheral counterparts. Hence, other than the Rayer Bazaar the rest of the study areas exhibit greater integration and connectivity. It is also notable that according to the depth measures of the global integration value, Rayer bazaar is located three steps deep therefore; the social use pattern of this area is concentrated within the locality. Dhanmondi 8, Dhanmondi 32, Zia Uddan and Sangshad Bhaban, exhibit a higher frequency of social use according to the respondents. By further investigating the syntactic properties, it is noticeable that among all the study areas, these four areas obtained the highest configurational properties i.e. local integration, connectivity and control value. In addition, according to the depth measure, these spaces are located within one and two steps deep in relation to the overall urban structure. The tight, linear and steeper angle of regression lines of the scattergrams that showed the maximum correlation coefficients also highlighted the highest correlation of these four urban open spaces in relation to the local and global syntactic measures. The respondents frequently use those spaces that achieved the highest morphological properties in terms of connectivity, control and local integration. Among the numerous syntactic measures, connectivity is one of the most fundamental measures for the paved urban open spaces of Dhaka city, and for each study area, connectivity is the primary important issue. The greater the connectivity of a space, the greater the choice of routes are available to users. Dhanmondi 8, Dhanmondi 32, Zia Uddan and Sangshad Bhaban are highly ‘connected’ spaces and their local integrations are also higher in comparison to the rest of the study areas.

In addition to the syntactic properties, presence of an attractor is another important determinant that can influence movement along urban grid, hence its use pattern. The greater the number of moving people, the greater the chances are of using any space frequently. The urban grid configuration can influence natural movement along the grid and the location of an attractor within the grid. The user groups or the respondents, very frequently and recurrently used Dhanmondi 8, Dhanmondi 32, Zia Uddan, Sangshad Bhaban and the TSC. The steeper slopes and positive correlations of the scattergrams signify the strong relationship between pedestrian movements and the configuration of the urban network. For some of the study areas, the presence of attractors such as the historical significance, the position of national martyr monuments and sculptures influence the movement along the urban open spaces on specific days of the year to the city dwellers. The historical importance, central meeting points for university students and the presence of monuments in Ramna, Rayer Bazaar, Shahid Minar and TSC act as attractors and identify these spaces both locally and as globally more
significant than other places in the context of Dhaka city. In addition to the morphological configuration of urban grids, the effects of attractors or monuments at Zia Uddan and Sangshad Bhaban are identified as equally significant for the respondents.

The designed public urban open spaces - Dhanmondi 8, Dhanmondi 32, Sangshad Bhaban, Zia Uddan and TSC, are the most highly visited and the most popular public places for all age-groups to stroll with friends and family members. These five designed spaces possessed most of the key physical characteristics that generate positive aesthetic response (Table 6.1). However, the relative configurational importance of their spatial position in relation to the wider city context of Dhaka is even more important for social use and activities (Figure 6.4). Therefore, aesthetic and visual qualities are a relatively low priority when compared to other spatial configurations of urban open spaces. The use of urban open space depends mostly on the urban grid configuration of the surrounding areas including, connectivity, local-global integration, depth measures and the presence of attractors. These higher syntactic properties of the street network influence the movement density along the grid that ultimately increases social use near those configurations. In addition to the physical and visual properties, the aesthetic or pleasant visual qualities are considered an additional rather than a primary property that encourages people to stay longer in the studied urban open spaces. Therefore, the morphological configuration, natural pedestrian movement along the grids and the location of attractors can influence the frequency of social use and types of social activities in designed urban plazas and public open spaces. This relationship can be further represented by the following flow diagram.

![Figure 6.4 The relationships among morphological configurations, attractors and pedestrian movement in designed urban open spaces for social use and activities.](image-url)
Therefore, other than the physical properties, social use and activity pattern can also
determined by the morphological configurations of urban structures. The following diagram
highlighted the different aspects of social use and activities (Figure 6.5).

6.6 Limitations and Significance of this Research

In addition to the practical considerations including limited time and resources, common to
many research projects, this study also has some limitations. The independent variables
‘physical characteristics’ of this research were mainly identified in the preliminary study by
using photographic images of 24 urban plazas, squares and pedestrian malls from photo­
simulation techniques. It is acknowledged that using two-dimensional images for photo­
simulations are not exact substitutes for the physical environment. Although these images can
capture a vast amount of visual information to represent the existing environment, they are not
comprehensive representatives of physical environments.

Referring to the construct ‘social use’ in this research, the researcher asked participants and
relied on their statements about their use, activity and enjoyment of those selected visual
stimuli in the preliminary study. In addition, in the main study there was no physical
observation of the ways in which the respondents used the eight urban plazas or designed
public open spaces. Therefore, the findings and conclusions are based on the statements of the
users and the respondents, not on the use pattern observed by the researcher. Furthermore, the
number of variables to measure the construct social use was limited to seven and had not been previously used or tested. Therefore, this cannot yet be considered as standardized. Hence, it was not possible to determine whether the data obtained from the main study is truly representative of all contexts.

The meanings and definitions of the term aesthetic response varies not only between the research domains in which it appears, it also varies within them. This research examined the pattern of aesthetic response without investigating the reasons for such responses. Moreover, the number of variables used to measure the aesthetic response was limited to four. As discussed before, it is a complex perceptual experience and limiting the complexity of such response to four variables could be identified as an important limitation of this research. In addition, it is fully acknowledged that both aesthetic response and social use are subjective features that may vary over time with diverse situations, life cycle, seasonal changes and changing nature of values and attitude with an interaction with socio-economic-environmental factors. This research is not concerned with how people perceive and evaluate different visual characteristics; rather the pattern of response and social use are limited to a range of variables. This opens possibilities for future research by considering various moderating factors of the environment and different respondents.

Due to the lack of public urban open spaces in Dhaka city in terms of diversity and numbers, this research used the broader term ‘designed urban open space’ and the number of study areas was limited to eight. This study has drawn conclusions based on the combined surveyed population for the eight study areas (8 x 35 = 280). The total sample size for the eight study areas was 280 and this was statistically a sound sample size from which to derive general conclusions.

Within the available time, for space syntax and morphological analysis of the urban structure of Dhaka, only the rudimentary concepts and theories are discussed and applied. Limited time meant that it was not possible to investigate other complex syntactic measures. This is a further limitation of this study; however, this also stands as an opportunity for future research. The data and results obtained from the questionnaire relating to the spatial analysis of the urban structure, had not been used, crosschecked or tested before. Therefore, it is not possible to determine the generalizability of the findings. Moreover, the main study was conducted in Dhaka, Bangladesh, which is well known for its dense urban neighbourhoods and complex
urban structure. The results of the study are therefore most applicable and suitable to dense urban neighbourhoods with similar urban contexts and spatial settings.

Although respondents of both genders and a wide range of age and educational background were considered for the main study, all respondents were Bangladeshi. Culture, age, gender and ethnicity play a significant role in determining attitude, perception and use hence, the results of this study could be different in different social contexts and cultural settings. Furthermore, it is likely that in similar environmental settings with respondents of different ethnic and cultural backgrounds, the aesthetic response and social use pattern could be different. The complexity of such perceptual and use pattern may vary over time with diverse situations and with an interaction of socio-economic-environmental and other factors. Therefore, the levels of social use, activities and pattern of aesthetic response as identified from this study may not be universally applicable.

In spite of the above-mentioned limitations, the significance of this research is widely considerable even if only known as directly applicable in the context of Bangladeshi respondents in designed urban open spaces of Dhaka. From a theoretical perspective, this research determined the physical-visual properties of designed urban open spaces and their relationship with aesthetic response and social use. In addition, it also provides an understanding of configurational properties of urban grid structures, distribution of pedestrian movement along the grids and hence the use pattern of surrounding urban spaces. From the design or practical perspective, the research findings could conceivably be used as a comprehensive model for future design of urban plazas and paved urban open spaces in different socio-cultural contexts. The findings of this research could be applicable to architecture, urban design, urban planning and the environment behaviour field; it provides new knowledge and ways of thinking in relation to the design of future public urban open spaces.

6.7 Proposed Model and Future Research

By addressing the limitations of this study, some directions for future research have already been mentioned. In addition to this, the preliminary study of this research could be expanded by surveying a wide variety of existing urban open spaces, not only limited to plazas, squares and pedestrian malls. Instead of using photo simulation, an extensive in-situ preliminary study could be conducted by examining and including a variety of public urban open spaces.
Moreover, to test, validate and generalize the findings, this study could be used to offer even more and diversified opportunities for future research. By repeating the steps and approaches of the research method, this research design could be applied to different towns, cities and other types of urban open spaces within different socio-cultural contexts. Hence, future research could include other influential relevant constructs not examined in this study.

This study demonstrates the relationship between aesthetic response, physical features and social use of designed urban open space, and identifies morphological configuration, location of attractors and pedestrian movements as key determinants of social use. Therefore, the following visualization model can be proposed showing interactions among all of these factors. It is acknowledged that this model is generated based on the study of designed urban open spaces of Dhaka Bangladesh, which is culturally and socially very specific in condition. However, the research results from this project could apply to other places by considering different socio-cultural and other influential factors.

![Figure 6.6 Proposed and revised visualization model for aesthetic response and social use and their relationship with other influential aspects.](image)

This research model could be used as a design protocol for making future decisions on policy as well as being used as a basic model for further academic research. As this study incorporated both qualitative and quantitative methods, it also makes a contribution to the methods of future empirical research in the related field. The successful intervention and use of space syntax as a design and decision-making tool is widely accepted in different Western cities. This study shows that there could be benefits of using space syntax for future design of urban open spaces and to identify their spatial position in relation to the wider city context to ascertain the extent of social use and this could be high, low or moderate. By integration of
The Evaluative Image of Designed Open Spaces: Bangladesh

users’ subjective response with the objective measures analyzed through SPSS and space syntax, urban designers, architects, urban and community planners, social scientists, urban space managers and other related authorities can make future urban open spaces more successful, useful and aesthetically attractive, and appealing. By adopting the measures and directions indicated in this research, urban open spaces can become the most successful and attractive breathing spaces in any city, in any town or country.
Appendix A: Measurement instrument and interview format used in the Preliminary Study

The University of Sydney
Faculty of Architecture, Design & Planning

‘Aesthetic Response’ Interview Format

Date: ___________________ Time duration: ___________________

INTRODUCTION

Introduction: Good.............. My name is Farhana and I am architecture student from the University of Sydney. I am conducting a research project to find out what people feel and think about the architectural characteristics and physical features of urban plazas, and their anticipated social use. The study will take only 10-15 minutes, depending on your answers. Would you like to participate in this study? ____________ [If the answer is ‘yes’; Thanks].

Please read carefully the participant information statement form and if you do not have any objection would you mind to sign the consent form. The information you provided will be kept strictly confidential and be used only for the study purpose.

This survey is interested in your aesthetic response to architectural characteristics of urban open spaces. The questionnaire uses sorting task similar to the example below. After sorting the photographs, I would like to get your opinion by asking few questions about the photographs of urban plazas, squares and malls.

EXAMPLE

Please sort out these four photographs of plazas according to how much you like or dislike.

<table>
<thead>
<tr>
<th>Most Like</th>
<th>Neutral</th>
<th>Least Like/ Dislike</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q. 1. Please sort out these 12 (.....) photographs of plazas according to how much you like or dislike each.

[Please focus on the architectural features and don’t pay attention to the people or what they are doing. There is no limit on number to sort the photographs.]

<table>
<thead>
<tr>
<th>Most Like</th>
<th>Neutral</th>
<th>Least Like/ Dislike</th>
</tr>
</thead>
</table>

Q. 2. What are the physical elements (e.g.: architectural elements, space, landscaping etc.) that you do not like within the ‘dislike’ group of photographs?

a.

b.

c.

d.

e.

f.

Q. 3. What are the important physical elements that you like most from the ‘like’ set of photographs?

a.

b.

c.

d.

e.

f.

Q. 4. According to you, what are the most important building characteristics, design features and detailing obvious in the photographs from your ‘like’ set of photographs?

a.

b.

c.

d.

e.

f.
Date: __________________________ Time duration: __________________________

INTRODUCTION

Introduction: Good............... My name is Farhana and I am architecture student from the University of Sydney. I am conducting a research project to find out what people feel and think about the architectural characteristics and physical features of urban plazas, and their anticipated social use. The study will take only 10-15 minutes, depending on your answers. Would you like to participate in this study? _____________ [If the answer is 'yes'; Thanks].

Please read carefully the participant information statement form and if you do not have any objection would you mind to sign the consent form. The information you provided will be kept strictly confidential and be used only for the study purpose.

This survey is interested in your anticipated social use of urban open spaces. The questionnaire uses sorting task similar to the example below. After sorting the photographs, I would like to get your opinion by asking few questions about the photographs of urban plazas, squares and malls.

EXAMPLE

Please sort out these four photographs of plazas according to how much you may use and may not use.

<table>
<thead>
<tr>
<th>Most Use</th>
<th>Neutral</th>
<th>Least Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q. 1. Please sort out these 12 (....) photographs of plazas according to how much you use or may not use each. [Please focus on the architectural features and don’t pay attention to the people or what they are doing. There is no limit on number to sort the photographs.]

<table>
<thead>
<tr>
<th>Most Use</th>
<th>Neutral</th>
<th>Least Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q. 2. If you were in these urban spaces what **would you like to do**?

________________________
________________________

Q. 3. What types of **activities** might you do in these plazas?
   a. By yourself (alone):
   __________________________
   __________________________
   b. In a group (family friends, colleagues etc.):
   __________________________
   __________________________

Q. 4. What are the most important **design elements and architectural features** of these spaces that would make you to do the above activities?

   a.
   b.
   c.
   d.
   e.
   f.

Any comments/suggestions:

________________________
________________________

Thank you very much for taking part in this interview
Your contribution is greatly appreciated
Appendix B: Participant information statement used in the Preliminary Study

The University of Sydney
Faculty of Architecture, Design and Planning
ABN 15 211 513 464
Farhana Ferdous
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Telephone: +61 2 9351-5287
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PARTICIPANT INFORMATION STATEMENT

TITLE: The Evaluative Image of Urban Open Spaces: The Relationship between Built Environment, Aesthetic Response and Social Use of Designed Urban Open Spaces in Dhaka, Bangladesh

(1) What is the study about?
This research is an empirical study of architectural and other physical features of built environment to evaluate the aesthetic response to urban plazas. The purpose of this research is to evaluate the aesthetic features of urban plazas in addition to identify the architectural characteristics of built environment into two different cross-cultural settings of Sydney and Dhaka.

(2) Who is carrying out the study?
The study is being conducted by Farhana Ferdous, a PhD Candidate from The University of Sydney under the supervision of Professor Gary Moore and Senior Lecturer Rafael Pizarro.

(3) What does the study involve?
This preliminary study uses colour photographs of urban plazas as visual stimuli. You will be asked to respond to a few questions after looking at the photographs. You will also be asked to consent to your answers being audiotaped for clarification and data coding.

(4) Will this study be audio-taped?
For clarification and data coding of this research, the interview will be audio recorded but no personal or identifying information will be recorded.

(5) How much time will the study take?
It will take 15-20 minutes for the interview session. If someone wishes to stop the session before that s/he is most welcome to do that.

(6) Can I withdraw from the study?
Yes, you can withdraw from the study. Participation in this study is entirely voluntary: you are not obliged to participate. If you do participate, you can withdraw at any time without prejudice or penalty.

(7) Will anyone else know the results?
All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants “except as required by law”. Any report of the study submitted for publication will not identify the identity of the participants and the centre.

(8) Will the study benefit me?
Yes, you can benefit from this study because you will have the opportunity to share the findings with the researcher.

(9) Can I tell other people about the study?
Yes.

(10) What if I require further information?
Farhana Ferdous will answer any further information you may have during the survey. For other information please feel free to contact Farhana Ferdous, PhD Candidate at ffer0856@mail.usyd.edu.au (Email).

(11) What if I have a complaint or concerns?
Any person with concerns or complaints about the conduct of a research study can contact the Senior Ethics Officer, Ethics Administration, University of Sydney on (02) 8627 8175 (Telephone); (02) 8627 8180 (Facsimile) or gbridyv@usyd.edu.au (Email).

This information sheet is for you to keep
PARTICIPANT CONSENT FORM

I, ........................................................... [PRINT NAME], give consent to my participation in the research project.

TITLE: The Evaluative Image of Urban Open Spaces: The Relationship between Built Environment, Aesthetic Response and Social Use of Designed Urban Open Spaces in Dhaka, Bangladesh

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or the University of Sydney now or in the future.

4. I understand that my involvement is strictly confidential and no information about me will be used in any ways that reveal my identity.

5. I understand that being in this study is completely voluntary – I am not under any obligation to consent.

6. I understand that I can stop the interview at any time if I do not wish to continue, the audio/video recording will be erased and the information provided will not be included in the study.

7. I understand that the interview will be audio recorded but no personal or identifying information will be recorded.
8. I consent to: –

i) Audio-taping  YES  □  NO  □

ii) Receiving Feedback  YES  □  NO  □

If you answered YES to the “Receiving Feedback Question (ii)”, please provide your details i.e. mailing address, email address.

Feedback Option

Address: ____________________________________________

_____________________________________________________

Email: ____________________________________________

Signed: ............................................................................

Name: ............................................................................

Date: .............................................................................
Appendix D: List of visual stimuli used for photo-simulation in the Preliminary Study

Urban Plazas, Urban Squares and Pedestrian Malls

(Aronson & Stowell, 1998) (Blackett, 2008a)

(Rotenstein, 2010) (Kruse, 2003)

(Pool, 2007) (Fox, 2008)
Appendix D: List of visual stimuli used for photo-simulation in preliminary study

1. (Brianapa, 2007)
2. (Blackett, 2008b)
3. (AtlanticaC5, 2003)
4. (Avais, 2007)
5. (Nast, 2001)
6. (Meowjai, 2006)
Appendix D: List of visual stimuli used for photo-simulation in preliminary study
Appendix D: List of visual stimuli used for photo-simulation in preliminary study

1. (Phatl339, 2006)
2. (Stutts, 2007)
3. (Travalang, 2000)
4. (ninemsn.travel, 2009)
5. (Mattes, 2002)
6. (Doug, 2006)
Appendix E: Measurement instrument and questionnaire used in the Main Study

The University of Sydney

নামঃ________________________ পাঠকর্তর নামঃ________________________

বাংলা অনুচ্ছেদ ১ এবং সামাজিক ব্যবহার প্রশ্নমালা

প্রতিটি প্রশ্নের জন্য দেয়া করার সাপ্তক উচ্চতর পাশে টিক চিহ্ন (✓) দিয়ে আপনার মতামত প্রকাশ করুন। এখানে উল্লেখ্য প্রতিটি প্রশ্ন আপনাকে তিনটি দিয়ে যে আপনি প্রতিটি আপনি কমলা জোরপোজজস্ত মত প্রকাশ করেন। দেয়া করে আপনাকের চিত্ত লক্ষ্য করুন, এবং সাধারণ মত ভাবে এই প্রশ্ন সম্পর্কে ভাবনাধীন ভাবভাবে সময় প্রদর্শন প্রতিটি প্রশ্নের জন্য উচ্চতর সম্পর্কে আপনার অনুভূতি আপনাকে বকুন। এখানে কেন সাপ্তক বা তুল উত্তর নেই, অনুমানোয়া প্রশ্নের পাশে “প্রয়োজন নয়” ঘরে টিক চিহ্ন (✓) দিন।

“নামঃ________________________” প্রশ্নমালটি নীচে উল্লিখিত উদাহরণের মত পরিসর করা হবে। উদাহরন স্বরূপ, আপনার পরিমাণ শার্টটি সম্পর্কে আপনার অনুভূতি কি? [যদি আপনি শার্টটি দুপুর পদ্ধতি করলে তবে সব ডানদিকের “পড়তি” ঘরটির পাশে টিক চিহ্ন (✓) দিন।

<table>
<thead>
<tr>
<th>অনুভূতি</th>
<th>অনেক</th>
<th>কিছুটা নয়</th>
<th>অনেক</th>
<th>অনুভূতি</th>
</tr>
</thead>
<tbody>
<tr>
<td>অনুভূতি</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

“সমস্যার সামাজিক ব্যবহার” প্রশ্নমালটি নীচে উল্লিখিত উদাহরণের মত পরিসর করা হবে। উদাহরন সংক্রান্ত, আপনি কি আপনার পরিমাণ শার্টটি পদ্ধতি পছন্দ করেন? [যদি আপনি নকশাটি পদ্ধতি না করলে তবে নীচে প্রদর্শিত দুইটি (অর্থাৎ প্রথম) ঘরে টিক চিহ্ন (✓)দিয়ে পারেন।]

<table>
<thead>
<tr>
<th>সবচেয়ে কম পদ্ধতি</th>
<th>সবচেয়ে বেশী পদ্ধতি</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐ ✓</td>
</tr>
</tbody>
</table>

আপনার কোন জিন্দগী থাকলে আপনি প্রস্তুত করতে পারেন, আর যদি না থাকে তবে দোকে করে অধিক পৃথিবী আপনার মূলধার অভিজ্ঞ প্রকাশ করুন।

Appendix E: Measurement instrument and questionnaire used in main study

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Appendix F: Participant information statement used in the Main Study

The University of Sydney

Faculty of Architecture, Design & Planning

Aesthetic Response and Social Use Questionnaire

Date: ______________ Location: ______________ Case No: ______________

INSTRUCTIONS

Thank you very much for agreeing to be part of this study. The following questions ask you to evaluate this urban open space. We are interested, first, in your feelings about the visual quality of this place and, second, in the types of things you might do here.

For each question, please indicate your feelings by putting a tick (✓) inside a box. Note that each question asks you to decide how strongly you feel about the item. Put a tick in the box that most clearly captures how you feel about the space. Please look around, think about the space in relation to the question, and tell us as best you can how you feel about this place for each question. There are no right or wrong answers; the questions those are not appropriate for this space, please put tick (✓) mark in the ‘Not Applicable’ (NA) box.

The “aesthetic response” questionnaire uses a rating scale similar to the example below. For example (this is only a sample question):
How do you feel about the design of your shirt in relation to the following item? [If you like the design very much, you would put a tick (✓) in the far right box as below.]

<table>
<thead>
<tr>
<th>Dislike</th>
<th>Extremely</th>
<th>Very</th>
<th>Neither</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
</table>

The “anticipated social use” questionnaire uses a rating scale similar to the example below. For example, (this is only a sample question):
Do you like the design of your shirt? [If you not like the design that much, you would put a tick (✓) in the box 2 (or 1) as below.]

<table>
<thead>
<tr>
<th>Least Preferable</th>
<th>Most Preferable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you like the design of your shirt?</td>
<td></td>
</tr>
</tbody>
</table>

If you have any questions please do not hesitate to ask. If you don’t have any questions please turn to the next page.
### "ন্যায্যিক অনুভূতি" (AESTHETIC RESPONSE)

**প্রথমত, নগরীর এই উদ্যোক্তা ব্যান্ডার বিষয়ে আপনার অনুভূতি সম্পর্কে কিছু বলুন।**

First, please tell us how you feel about this urban open space:

**প্রশ্ন ১: এই বিষয়ে আপনি কিছু বলা চান?**

Q1. First, thinking about this place as a whole, how would you evaluate the space in relation to each of the following four items?

<table>
<thead>
<tr>
<th>Extremely</th>
<th>Very</th>
<th>Fairly</th>
<th>Neither</th>
<th>Fairly</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Pleasant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Unpleasant)</td>
</tr>
<tr>
<td>(Dislike)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Like)</td>
</tr>
<tr>
<td>(Beautiful)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Ugly)</td>
</tr>
<tr>
<td>(Undesirable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Desirable)</td>
</tr>
</tbody>
</table>

Now, please answer the following questions, each one about one particular aspect of the space:

**প্রশ্ন ২: এই বাণিজ্যের চারপাশে বাড়ির মাধ্যমে আলোকের মূল্যমান কি?**

Q2. How do you feel about the surroundings created by the outside edges of buildings of this urban space?

<table>
<thead>
<tr>
<th>Extremely</th>
<th>Very</th>
<th>Neither</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Pleasant)</td>
<td></td>
<td></td>
<td></td>
<td>(Unpleasant)</td>
</tr>
<tr>
<td>(Dislike)</td>
<td></td>
<td></td>
<td>(Like)</td>
<td></td>
</tr>
<tr>
<td>(Beautiful)</td>
<td></td>
<td></td>
<td>(Ugly)</td>
<td></td>
</tr>
<tr>
<td>(Undesirable)</td>
<td></td>
<td></td>
<td>(Desirable)</td>
<td></td>
</tr>
</tbody>
</table>

**প্রশ্ন ৩: এই বাণিজ্যের উচ্চতা সম্পর্কে আপনার অনুভূতি কি?**

Q3. How do you feel about the height of the surrounding buildings?

<table>
<thead>
<tr>
<th>Extremely</th>
<th>Very</th>
<th>Neither</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Pleasant)</td>
<td></td>
<td></td>
<td></td>
<td>(Unpleasant)</td>
</tr>
<tr>
<td>(Dislike)</td>
<td></td>
<td></td>
<td>(Like)</td>
<td></td>
</tr>
<tr>
<td>(Beautiful)</td>
<td></td>
<td></td>
<td>(Ugly)</td>
<td></td>
</tr>
<tr>
<td>(Undesirable)</td>
<td></td>
<td></td>
<td>(Desirable)</td>
<td></td>
</tr>
</tbody>
</table>
The Evaluative Image of Designed Open Spaces: Bangladesh

Q4. How do you feel about the **water features** in this urban space? (N/A □ )

<table>
<thead>
<tr>
<th>Extremely</th>
<th>Very</th>
<th>Neither</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dislike</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beautiful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undesirable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q5. How do you feel about the **vegetation** in this urban space? (N/A □ )

<table>
<thead>
<tr>
<th>Extremely</th>
<th>Very</th>
<th>Neither</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dislike</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beautiful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undesirable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q6. How do you feel about the **monuments and sculptures** in this urban space? (N/A □ )

<table>
<thead>
<tr>
<th>Extremely</th>
<th>Very</th>
<th>Neither</th>
<th>Very</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dislike</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beautiful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undesirable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“সমাজ্য সামাজিক ব্যবহার” (SOCIAL USE)

Second, please tell us some things about why you come here and what types of things you might do in the space:

Q7. How often do you come to this urban space?

<table>
<thead>
<tr>
<th>Very Infrequently</th>
<th>Very Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (1)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>3 (3)</td>
<td>4 (4)</td>
</tr>
<tr>
<td>5 (5)</td>
<td></td>
</tr>
</tbody>
</table>
Q. 8. *When* and at *what time* do you usually visit this urban space?

<table>
<thead>
<tr>
<th>(When)</th>
<th>(Time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ সপ্তাহের মাঝে (Weekdays)</td>
<td>□ সকাল (Morning)</td>
</tr>
<tr>
<td>□ সাপ্তাহিক বন্ধের দিন (Weekend)</td>
<td>□ দুপুর (Afternoon)</td>
</tr>
<tr>
<td>□ সরকারী বন্ধের দিন (Public holidays)</td>
<td>□ বিকাল (Evening)</td>
</tr>
<tr>
<td>□ অন্যান্য (Others)</td>
<td>□ অন্যান্য (Others)</td>
</tr>
</tbody>
</table>

Q. 9. *How* do you usually come to this urban space?

<table>
<thead>
<tr>
<th>(By)</th>
<th>(Others)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ চোখের হেতু (By walk)</td>
<td>□ অন্যান্য (Others)</td>
</tr>
<tr>
<td>□ রিকশা চেরা (By rickshaw)</td>
<td>□ অন্যান্য (Others)</td>
</tr>
<tr>
<td>□ বাস (By bus)</td>
<td>□ অন্যান্য (Others)</td>
</tr>
<tr>
<td>□ গাড়ী (By car)</td>
<td>□ অন্যান্য (Others)</td>
</tr>
</tbody>
</table>

Q. 10. When you visit this urban space, with *whom* do you come to enjoy?

<table>
<thead>
<tr>
<th>(With)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ একা (Alone)</td>
</tr>
<tr>
<td>□ পরিবার (Family)</td>
</tr>
<tr>
<td>□ বন্ধু বন্ধু (Friends)</td>
</tr>
<tr>
<td>□ সহকারী (Colleague)</td>
</tr>
<tr>
<td>□ অন্যান্য (Others)</td>
</tr>
</tbody>
</table>

Q11. *How important* are these factors to you when visiting this place?

<table>
<thead>
<tr>
<th>(Factor)</th>
<th>(Less important)</th>
<th>(Very important)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Due to the central location of Dhaka city)</td>
<td>১(১)</td>
<td>৫(৫)</td>
</tr>
<tr>
<td>(Very close to your house/work place/locality)</td>
<td>১(১)</td>
<td>৫(৫)</td>
</tr>
<tr>
<td>(Easily accessible and connected with surrounding roads)</td>
<td>১(১)</td>
<td>৫(৫)</td>
</tr>
<tr>
<td>(Aesthetic and visual qualities of the space)</td>
<td>১(১)</td>
<td>৫(৫)</td>
</tr>
</tbody>
</table>
Q12. In what ways do you frequently use this space?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Less important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Walking around</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Enjoying nature/ Sitting on the grass</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Sitting on the grass</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Walking: Exploring architecture</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Sitting: Sitting on the benches and seats</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Having coffee/drinks/food</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Watching people</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Chating with friends</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Exploring architecture</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Watching people</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Watching people</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Relaxing: Watching people</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

*Sticky RESPONDENT*

**Finally, please tell me a few things about yourself:**

Q13. What is your gender? □ Male □ Female

Q14. What is your age? (please tick one)

- □ 18-24 years (18-24 years)
- □ 25-34 years (25-34 years)
- □ 35-44 years (35-44 years)
- □ 45-54 years (45-54 years)
- □ 55 years and above

Q15. What is your highest level of education? (please tick one)

- □ Below S.S.C
- □ S.S.C
- □ H.S.C
- □ Diploma
- □ Bachelor Degree
- □ Masters Degree
- □ PhD
Q16. Which of the following **best characterises** the type of education or training you have? (tick one)

- [ ] Business discipline (like accounting, business, management, etc.)
- [ ] Scientific or technical discipline (like engineering, sciences, psychology, etc.)
- [ ] Creative discipline (like visual arts, performing arts, architecture, etc.)
- [ ] Humanities discipline (like history, literature, journalism, etc.)

Q17. What **best describes** your current occupation and types of work? (please choose one)

- [ ] Retail and commercial (banker, accountant, sales/service, manager, etc.)
- [ ] Technological and scientific (engineer, doctor, scientist, etc.)
- [ ] Designing and creative fields (architect, artist, graphic designer, photographer, etc.)
- [ ] Social work and humanities (historian, teacher, psychologist, social worker, etc.)
- [ ] Skilled worker and others (please specify) _______________________________

Thank you very much for taking part in this survey. Your contribution is greatly appreciated.
Appendix G: Participant consent form used in the Main Study

PARTICIPANT CONSENT FORM

I, ............................................................................ [PRINT NAME], give consent to my participation in this research project.

Title: The Evaluative Image of Urban Open Spaces: The Relationship between Built Environment, Aesthetic Response and Social Use of Designed Urban Open Spaces in Dhaka, Bangladesh

In giving my consent, I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher.

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher or the University of Sydney now or in the future.
4. I understand that my involvement is strictly confidential and no information about me will be used in any ways that reveal my identity.

Ами абораг ааци ё эи гебебам эаамар аңшергам дармур тхаро гасаний ик ик аамар паричя аңшергам кео туху кәән аборагдәүи уымынут кыра хык нан.

5. I understand that being in this study is completely voluntary- I am not under any obligation to consent.

Ами абораг ааци ё эи гебебам аңшергам кыра жылы аамаке кәән парырсык дөйка хык нан, аңшергам аңуусты продаң бергел жылы аами бакый нан.

6. I understand that I may stop the interview at any time if I do not wish to continue and the information that I have provided will not be included in the study.

Аами абораг ааци ё кео көмө аами саккытаар дөс кыра пәри ик кийи аамар саккытыйл нан тыхаке аамаке дөйк кәән туху эи гебебам улдөйүк кыра хык нан.

7. I consent to: – Аами аңуусты продаң карыды:

i) Receiving Feedback

If you answered YES to the “Receiving Feedback Question”, please provide your details i.e. mailing address, email address on next page.

Protected: YES ☐ NO ☐

If you answered YES to the “Receiving Feedback Question”, please provide your details i.e. mailing address, email address on next page.

क) Фалалға дармур абораг карыр жылы ёрдам ☐ нан ☐

यәлди ааптый фалалға дармур жәыдә аапрый көңө, табы апқайр пүштый ааптыйл түккәна ик эң

Signed: (сәмәр) ........................................................................................................................................

Name: (нәәм) ........................................................................................................................................

Date: (ђәрый) ........................................................................................................................................

Address: (тынчан) .................................................................................................................................

Email: (әмайл) ....................................................................................................................................

Appendix G: Participant consent form used in main study
Space Inventory Rating Scale

Instructions
The images on the next pages are from urban open spaces in Dhaka, Bangladesh. Each space is represented by two panoramas and three individual images. The following scale measures the physical appearance of each space depicted by the photographs. Please rate each of the following urban open spaces by putting a tick mark on the appropriate number that best describes your opinion about the physical appearance of space. For example, if you think the height of the surrounding enclosure is ‘moderately high’; put a tick mark on ‘4’.

**Height of the surrounding enclosure** of this urban space:

<table>
<thead>
<tr>
<th>Extremely low</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Extremely high</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

As another example, if you think the amount of water features in the urban space is ‘none’; put a tick mark on ‘1’.

**Amount of water features** in this urban space:

<table>
<thead>
<tr>
<th>None at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Great amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

There are no right or wrong answers. Please look at the images first and then describe each urban open space based on the following categories.
1. **Degree of surrounding enclosure** of this urban space:
   - Completely enclosed
   - Completely open

2. **Height of the surrounding enclosure** of this urban space:
   - Extremely low
   - Extremely high

3. **Amount of water features** in this urban space:
   - None at all
   - Great amount

4. **Amount of vegetation** in and around this urban space:
   - None at all
   - Great amount

5. Size and number of **monuments or sculptures** in this urban space:
   - None at all
   - Extensive in size and/or great amount

6. Availability of **seating spaces** (in any form: including benches, low height wall) in this urban space:
   - Less available
   - More available

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**Appendix H: Space inventory rating scale used in main study**
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PARTICIPANT CONSENT FORM

I, ...............................................................................

[PRINT NAME], give consent to my participation in this research project.

Title: The Evaluative Image of Urban Open Spaces: The Relationship between Built Environment, Aesthetic Response and Social Use of Designed Urban Open Spaces in Dhaka, Bangladesh

In giving my consent, I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me.

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher or the University of Sydney now or in the future.

4. I understand that my involvement is strictly confidential and no information about me will be used in any ways that reveal my identity.

5. I understand that being in this study is completely voluntary- I am not under any obligation to consent.

6. I understand that I may stop the session at any time if I do not wish to continue and the information that I have provided will not be included in the study.

Signed: ...............................................................................

Name: ...............................................................................

Date: .............................................................................
REFERENCE LIST:


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Reference list 236


