REGULAR GEOMETRY TOWARDS EFFECTIVE VISITORS WAYFINDING: A CASE STUDY OF KLCC VICINITY

HOSSEIN SAFARI

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Architecture)

Faculty of Built Environment
Universiti Teknologi Malaysia

JANUARY 2016

To my lovely wife, Fataneh Fakouri Moridani. Without her love, patience, encouragement, and support unreservedly given , it would have been impossible to complete this research.

I also remain deeply indebted to my beloved mother Zahra Abhari Khoshdel, my beloved father Yaghoub Safari Syahgourabi, and to my children Farjad and Farsad.

I dedicate this work to them and express my thanks to them for their love, patience and support unreservedly given.

To my brother, Reza Safari, thank you for encouragement as well as support and wishes.

May Allah S.W.T. be pleased with “OUR” effort.

ACKNOWLEDGCMENT

BismillahirRahmanirRahiim. Assalamualaikum wmt wbt

Thanks be to Allah, the Most Benevolent and the Most Merciful, and Who made the pursuit of knowledge obligatory upon all His Believers. It was only in the pursuit of His pleasure that this work was undertaken. It is my hope that this work may contribute an iota of advancement to mankind in order to understand His knowledge.

I am gratefully indebted to my Supervisor, Dr. Sharifah Salwa Binti Syed Mahdzar. Her encouragement, dedication and expert guidance in formulating the issues and research approach towards the completion of this thesis, especially when the goings becomes very tough, were beneficial and inspirational.

A huge debt is owed to many people in the local authorities who gave their time unsparingly and for giving me access to materials and information vital to this research.

Finally, I thank and praise Allah S.W.T. again and again for turning this thesis into reality.

ABSTRACT

In developed cities, large office buildings occupy the city centre thereby destroying the legibility of these areas. These areas confront with a lack of visibility and difficult cognitive map. As a regular spatial configuration, Squares have had an effect on the characteristics of urban space such as intelligibility, synergy and accessibility. The goal of this study is to identify the importance of geometry of space on legibility, cognitive map of visitors and wayfinding. Kuala Lumpur City Centre (KLCC) was chosen as a case study because of its historical and cultural significance. Importance should be placed on its preservation for the future especially for tourists. A model of KLCC has been developed within the square that combines streets and KLCC area. It has been used as proof of the concept for a Space Syntax model network analysis using axial analysis and observations. Meanwhile, this study investigates the views of visitors including 86 respondents using surveys and interviews. Results show that there is a negative correlation between cognitive map and urban stress. Furthermore, all quantitative and qualitative data suggest viable cognitive map due to applying regular geometry may strongly improve legibility. The results show that there was a moderate positive correlation between legibility and regular geometry in general. On the other hand, existing geometry had a negligible effect on legibility. The role of the square suggestion is more immediate in high integration in the vicinity of KLCC. Moreover, the square can provide context for PETRONAS Twin Tower as landmark and symbolic building. Square as regular geometry is a good way to increase viable cognitive map. It affects the legibility of urban space where wayfinding will more strongly confirm that visitors display sociability and accessibility interaction. An implication for architects, tourism managers and urban designers is that square as a regular geometry associated with landmarks increases legibility. As a result, viable cognitive map by regular geometry is associated with easy wayfinding which decreases stress.

ABSTRAK

Di bandar- bandar yang telah membangun, bangunan-bangunan besar yang berada di pusat bandar telah menyukarkan kebolehbacaan kawasan ini. Kawasan ini berhadapan dengan kekurangan penglihatan dan peta kognitif yang sukar. Sebagai konfigurasi ruang biasa, dataran mempunyai kesan ke atas ciri-ciri ruang bandar seperti kejelasan, sinergi dan kemudahan. Matlamat kajian ini adalah untuk mengenal pasti kepentingan geometri ruang pada kebolehbacaan, kognitif peta pengunjung dan wayfinding. Pusat Bandar Kuala Lumpur (KLCC) telah dipilih sebagai kajian kes kerana kepentingan sejarah dan budaya. Kepentingan harus diletakkan pada pemuliharaannya yang sangat penting untuk generasi akan datang terutamanya bagi para pelancong. Model KLCC telah dibangunkan dalam dataran yang menggabungkan jalan-jalan dan kawasan KLCC. Ia telah digunakan sebagai bukti konsep untuk menganalisis rangkaian model Space Syntax menggunakan analisis paksi dan pemerhatian. Sementara itu, kajian ini menyiasat pandangan pengunjung termasuk 86 responden menggunakan kaji selidik dan temu bual. Hasil kajian menunjukkan bahawa terdapat hubungan yang negatif di antara peta kognitif dan tekanan bandar. Tambahan pula, semua data kuantitatif dan kualitatif mencadangkan peta kognitif berdaya maju kerana menggunakan geometri tetap boleh meningkatkan kebolehbacaan. Hasil kajian menunjukkan bahawa terdapat korelasi yang sederhana antara kebolehbacaan dan geometri tetap secara umum. Sebaliknya, geometri yang sedia ada mempunyai kesan yang boleh diabaikan pada kebolehbacaan. Peranan cadangan dataran mempercepatkan integrasi yang tinggi di sekitar KLCC. Selain itu, dataran boleh menyediakan konteks untuk Menara Berkembar PETRONAS sebagai mercu tanda dan bangunan simbolik. Dataran adalah salah satu cara yang bagus sebagai geometri tetap untuk meningkatkan kebolehan peta kognitif. Ia memberi kesan kepada kebolehbacaan ruang bandar di mana petunjuk arah atau bacaan lebih kuat mengesahkan bahawa pengunjung menunjukkan sikap suka bergaul dan saling berinteraksi. Implikasi bagi pengurus pelancongan, pereka bandar dan arkitek adalah dataran itu sebagai geometri biasa dikaitkan dengan mercu tanda meningkatkan kebolehbacaan. Hasilnya, kebolehan peta kognitif oleh geometri biasa dikaitkan dengan petunjuk arah yang mudah serta mengurangkan tekanan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

MDBC	-	Malaysian Dutch Business Council
KLCC	-	Kuala Lumpur City Centre
SPSS	-	Statistical Package for the Social Sciences
UNWTO	-	World Tourism Organization
H	-	Hypotheses
CVK	-	Configuration of Vicinity of KLCC
RG	-	Regular Geometry
IG	-	Irregular Geometry
EF	-	Effective Wayfinding
RQ	-	Research Question
Fr	-	Frequency
Fr(M)	-	Frequency of more than three weeks
Fr(F)	-	Frequency of fewer than three weeks
Fr(T)	-	Frequency of total
Ref	-	Reference

LIST OF SYMBOLS

N	-	number of nodes in the space syntax graph
K	-	the shortest depth from i to k
Mdepth	-	Mean depth map
R	-	Integration
Rn	-	Global scale integration (Radius=10KM in this study)
R2	-	Local scale integration (Radius=2KM)
R3	-	Local scale integration (Radius=3KM)
N	-	Number
M	-	Mean
SD	-	Standard Deviation
p(p-value)	-	Significance level
F(F-test)	-	Statistical test in which the test statistic has an F- distribution under the null hypothesis
ANOVA	-	Analysis of variance
%	-	Percentage
T-Test	-	A method of statistical inference using data from a scientific study
R^2	-	Coefficient of determination

LIST OF APENDICES

LIST OF GLOSSARY

Accessibility	-	In Space Syntax, accessibility is defined by integration which is determined as nearness centrality from origin to destination.
Axial map analysis	-	Axial map analysis explains the behaviour of people into a pattern of urban spaces. This method illustrates social urban space analysis and treatment of people together by computer simulation
Cognitive map	-	Cognitive map is an internal representation of what visitors have perceived from the environment
Connectivity	-	Connectivity means the number of streets that are connected to a Specific Street.
Depth	-	Depth is stated as the number of steps to reach all other nodes from node i in the space syntax graph.
Geometry	-	Geometry is a framework that allows elements to be organized and arranged into a pattern. It also shows the relationship between elements.
Integration	-	Integration shows how many turns have to be made from an origin to reach all other destination in the city, using shortest routes.
Intelligibility	-	Intelligibility is the degree of perception of the environment that is directly related to legibility.
Legibility	-	The legibility of a route is the ease with which a route can become known or how easily people can understand it.
Space syntax	-	Space syntax is a method for reading urban spaces which is an association between physical structure and social structure.
Synergy	-	Correlation between local integration and global integration is called synergy.
Wayfinding	-	Wayfinding is a dynamic behaviour that is the act of travelling from origin to destination by decision making, using cognitive map

CHAPTER 1

INTRODUCTION

1.1 Introduction

Wayfinding follows psychological patterns using perception (Emo et al., 2012). External information of urban space such as environmental configuration may affect wayfinding decision making (Conroy, 2001). Evidence has shown that impaired wayfinding effect on visitors includes disorientation. Disorientation involves the egocentric spatial sphere, representation of heading, lack of landmark and viable cognitive function agnosia (Bottoni et al., 1990; Suzuki et al., 1998; Aguirre and D'Esposito, 1999; Asselena *et al.*, 2005). Visitors rely on certain wayfinding which might be a stressful experience when people are in an unfamiliar environment (Hölscher et al., 2006).

City centres have traditionally attractions for both international and local visitors. Urban areas provide a series of tourism and travel related attractions that are varied in nature but highly focused in location. City centres offer exceptional chance for visitors whose main purpose is meeting other people or institutions .Their purpose of visit might be different for business or leisure or personal (Vandermey, 1984) .Because of high potential of visitors for connecting people, mixed cultures and experiences with place and consumption, it must create an exciting and excellent exploration for visitors without stress (Edwards, Griffin et al., 2008).

Beside the importance of morphology in urban design and architecture (Gospodini, 2001) the wayfinding and accessibility for visitors in city are significant

factors. Tóth and Dávid (2010) called the accessibility as a key element for visitors in city. In other hand, the studies related to accessible urban tourism (Darcy and Dickson, 2009; Tóth and Dávid, 2010; Hano, 2011; Więckowski, Michniak et al., 2014) have focused mostly on transportation accessibility and accessibility for disabled , elderly and children in cities from touristic perspective. Wayfinding is another key element for visitors of urban areas.

Wayfinding is purposeful movement to a specific destination (Golledge, 1999). Humans use two strategies in wayfinding: Euclidian geometry as direction and distance estimates associated with cognitive map (Golledge, 1999, Kitchin and Freundschuh, 2000) and use landmark strategy (Burgess, 2006). Xia, Arrowsmith et al. (2008) Highlights that visitors apply different methods for wayfinding and urban managers should offer complementary materials to help them in wayfinding.

In search for an appropriate urban theory to help urban regeneration for assisting the visitors in urban areas, we may consider different theories of urban researchers in 21th century. The desired theory for this purpose should have significant role in urban design and regeneration.

The variables used in this study are physical properties and characteristics of vicinity of KLCC (e.g. geometry, integration, connectivity, choice, intelligibility and synergy) and psychological properties (legibility, cognitive map and urban stress).

1.2 Background of the Study

Wayfinding had been a concern for all people, from nomadic to sedentary. Our ancient ancestors found his/her route based on signs and symptoms such as trees, rocks and other visual elements, and represented thematically in his/her mind. Wayfinding as a complex psychological process has been debated in different scientific disciplines (Afrooz, 2009; Najafpour, 2012).

Early wayfinding research (Mallot and Basten, 2009; Wiener et al., 2009; Vilar et al., 2013) focused on general characteristics and role of landmarks (Caduff and Timpf, 2008; Zakzanis et al., 2009). Other wayfinding-related research includes studies based on age (Head and Isomc, 2010; Newcombe et al., 2010), gender (Mueller et al., 2008; Chen et al., 2009; Piccardi et al., 2011) of wayfinder, variety of materials, colour (Spence et al., 2006), or on interior space such as airports, shopping malls, galleries (Lam et al., 2003). Despite these works, the literature is almost silent on unfamiliar urban space and their relationship with the spatial behaviour of tourists as visitors (Edwards and Griffin, 2013).

Much research has focused on the role of stress on the cognitive map (Pruessner et al., 2010; Allen et al.,2013; Schwabe and Wolf, 2013;). In wayfinding, cognitive map have been studied in geometry and stress (Lee et al., 2012; Mohsenina and Sevtsukb, 2013; Schwabe and Wolf, 2013). Although researcher's focus on cognitive map (Weisman, 1981; Ga¨ rling et al., 1986) and wayfinding (O'Neil, 1991a; O'Neil, 1991b) has increased lately, a review of space-syntax method(Karimi, 2012) for reading urban spaces, based on wayfinding literature, reveals relatively little theoretical work in the area. In other hand, geometry was only used in experiments on rats to determine the impact of geometry on wayfinding (Yaski and Eilam, 2007; Yaskia et al., 2011; Yaski et al., 2012). The current study attempts how wayfinding influences by geometry and how it affects urban stress.

1.3 Statement of the Problems

Evidence has shown that legibility, cognitive map and Geometry as effective elements of urban space affect wayfinding but there is little investigation about these elements of urban space simultaneously on wayfinding.

Due to the complex nature of cities, visitor behaviour in urban space within cities is not well understood (Edwards and Griffin, 2013). Past research on the cognitive mapping has concentrated on animals and young children. The literature is almost silent on urban spaces and their relationship with visitors. Consequently, we

have an incomplete picture of how to improve cognitive mapping of visitors in urban spaces and as a result reduce their stress.

Geometry can create a variety of unseen forms. Regular geometry is effective in human navigation (Lee et al., 2012). Irregular geometry in today's urban space, especially developed cities and cosmopolitan areas has a negative influence on viable cognitive map. On the other hand, wayfinding is difficult to confront.

Golledge (1999) stated that cognitive mapping has a very important role in wayfinding. Cognitive mapping is fundamental to wayfinding. He also stated that it is the internal representation of the environment and the perception of them. A study on cognitive mapping is how information gathered from the environment and perception are used to make decisions when approaching destinations in daily life (Hong, 2007). Wayfinding is based on completing the internal representation of relationship between spaces as cognitive map (Allen,1999). Cognitive map affect our daily life for wayfinding. Human navigation involves reaching destinations with increased perception (Hölscher et al., 2011). Unfamiliar environment and lack of human scale in a development city are affected by negative cognitive map.

Legibility is a kind of comfort that includes identifiable paths (Lynch, 1960). A legible city is defined as an area which it has landmarks or routes as part of the configuration of urban space that are known easily understood and can be grouped easily in all patterns (Lynch, 1960).

The physical structure of built environment can shape legibility of urban space and human behaviour. Regular and coherent physical configuration of urban space affects the ease with which routes can be recognized in all environments but irregular structures result in difficult perception (Yaski et al., 2012). Regular geometry of urban space can make routes legible. However, an irregular urban space with an impressive dominant landmark can be legible (Yaski et al., 2012).

Increasing numbers of visitors are exposed to the irregular geometry of urban space where the increasing number of skyscrapers is destroying landmarks (Etienne

et al., 1998; Etienne, 2003). On the other hand, regular geometric design may differ from the urban design used in the development of a city (Lee et al., 2012).

Lack of proper wayfinding in unfamiliar space, and beyond the human scale of developed city, creates stress for visitors. Stress can be beneficial in the short term for humans but it is harmful and can cause serious illness if the body does not have a chance to rest (Atkinson et al., 1996). Research has shown that stress, irritation and fatigue are very closely related (Kaplan, 1990; Dinan, 1996; Klingberg. and Larson, 2001; Grahn and Stigsdotter, 2003).

Grahn and Stigsdotter in 2003 observed that in modern society stress and stress-related diseases are a common ailment of all people. In the twentieth century, architects began to include consideration of public health standards in their designs. Western planners in towns and cities also began to consider plans that reduced stress in individuals (Grahn and Stigsdotter, 2003). Research has shown that the human body involuntarily responded to natural elements and health effects but artefacts of elements such as residential or commercial towers and streets, especially with today's streets that are designed for cars solely, do not have a positive impact on human health (Ulrich, 1984, 1993, 1999).

1.4 Aim of Study

The goal of this study is to identify the importance of the geometry of urban space on legibility and to discover how it effects the cognitive map of visitors in the vicinity of Kuala Lumpur City Centre, enabling visitors to overcome the difficulty of urban stress due to wayfinding. For this aim, a twofold purpose is defined:

i. The study investigates the attitudes of visitors to Kuala Lumpur City Centre (KLCC) using an Explanatory Design method. This study attempted to determine the views of these visitors towards the geometry, legibility, cognitive map and urban stress of KLCC.

ii. The study evaluates and compares of wayfinding behaviour by observation and simulation; that is, the effects of square suggestion on factors such as accessibility and sociability because the existing space of KLCC Park on cognitive map and wayfinding varies within and across configuration of space.

1.5 Objectives of the Study

More specifically, this study aimed to achieve the following specific research objectives:

i. To investigate the relationship between cognitive map, legibility and geometry

ii. To identify effects of regular geometry on cognitive map and urban stress

iii. To compare the relationship between spatial syntactical variables and accessibility of streets in existing and square suggestion model

1.6 Research Questions

i. What is the relationship between legibility, cognitive map and geometry?

ii. What is the implication of regular geometry on cognitive map and urban stress?

iii. What is the effect of square as regular geometry on effective wayfinding?

1.7 Hypotheses of study

Regular geometry and unity of design affect the legibility of urban space helping to form a viable cognitive map. Moreover, wayfinding for locals and visitors in the city will be easy thus reducing the stress of visitors in an unfamiliar space. This will be illustrated in terms of the framework.

- Regular geometric and coherent design affects legibility of urban space. (Figure 1.1)

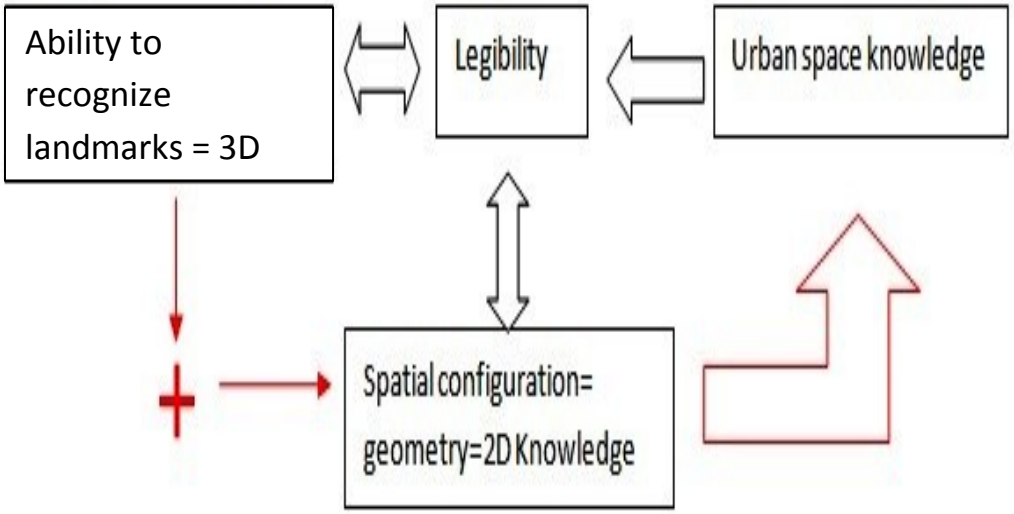

Figure1. 1 : Framework of relationship between legibility and configuration knowledge

- There is a positive relationship between regular geometry and viable cognitive map for visitors. (Figure 1.2)

- Regular geometry can reduce the stress of visitors in an unfamiliar space by ease of wayfinding. (Figure 1.2)

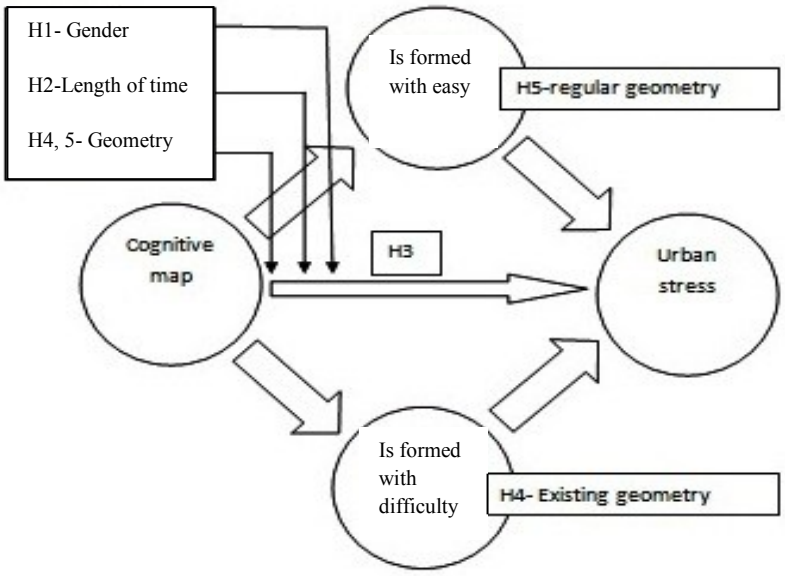

Figure1. 2 : Framework of relationship between cognitive map, geometry and stress

- Regular geometry may help to configure urban space for ease of wayfinding. (Figure 1.3)

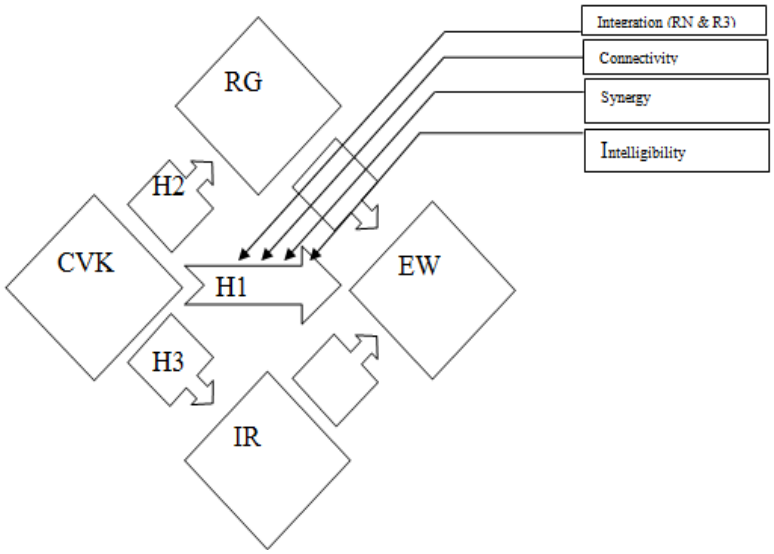

Figure1. 3: Framework of relationship between configuration of urban space and effective wayfinding

CVK: Configuration of vicinity of KLCC; RG: Regular Geometry; IG: Irregular Geometry; EF: Effective Wayfinding

1.8 Operational Framework of Study

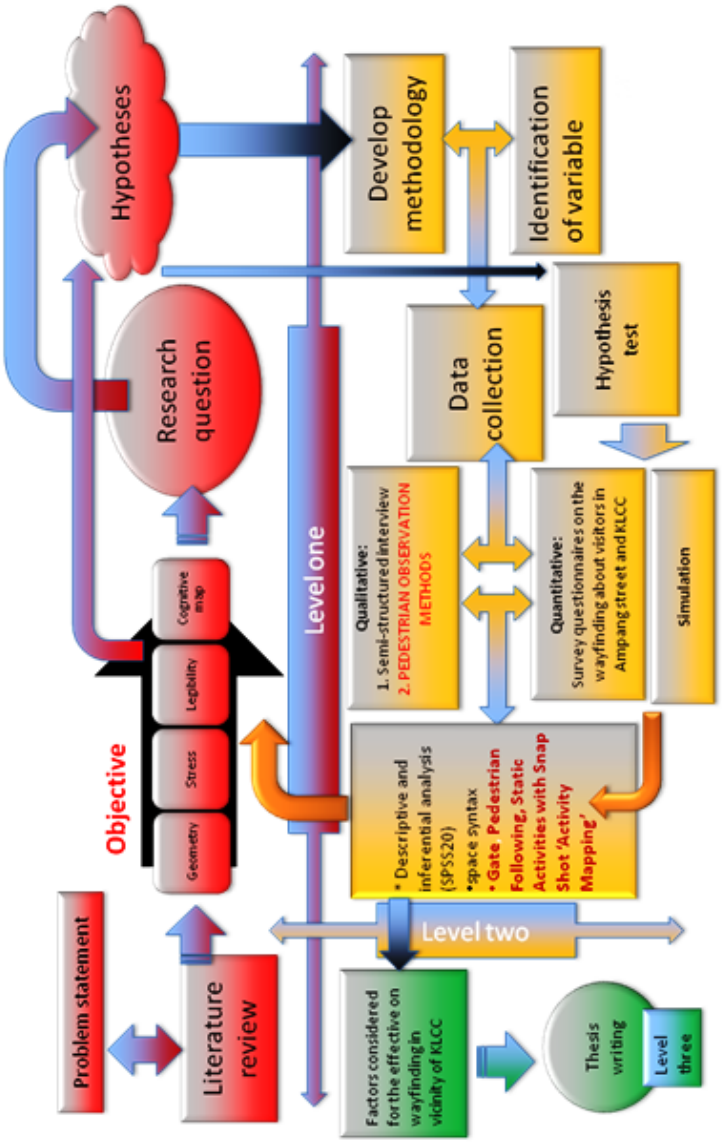

Figure 1. 4 : Operational framework of study

The diagram above illustrates the process of research undertaken.(Figure 1.4)

1.9 Significance of the Study

For different reasons, everyone has experienced disorientation and lack of recognition of environment and has felt the sensation of being lost, which is a stressful experience.

With the purpose of diversifying the economy and making it less reliant on exports, the Malaysia government has tried various plans and policies to stimulate the tourism industry (Munan, 2002). In 2014, tourist arrivals in Malaysia amounted to 27,437,315 people (Malaysia, 2015) a growth of 6.7% in comparison to 2013. Despite the economic crisis in 1998, tourist arrivals in Malaysia have been increasing consistently. Based on the same source, between 2007 and 2013, the number of arrivals has increased from 20.97 million to 25.72 million. According to United Nations World Tourism Organization (UNWTO) Malaysia has been listed as the 10th most visited country in 2012 (UNWTO, 2012).

Tang and Tan (2013, 2015) have examined the relation between tourism and economic growth and stability in Malaysia. Tang and Tan (2015) argued that the role of tourism for economic growth of Malaysia is a catalyst and policies to encourage inbound tourism can effectively stimulate economic growth.

Kuala Lumpur Structure Plan 2020 (KLSP, 2004) claimed that the capital city, Kuala Lumpur has a unique tropical character and has a developed service sector and infrastructure with a wide range of tourist attractions. In this plan the vision for Kuala Lumpur is consistent with the national vision which is: Kuala Lumpur - A World-Class City. The second of five goals of this plan is “Goal 2: To create an efficient and equitable city structure” which is related to city configuration and city regeneration.

According to the evidence presented, a large amount of people today for various social, cultural, economic reasons are travelling to new places. It is clear

that city managers should pay close attention to visitors, including items that need to be addressed, such as wayfinding and stress. This study will discuss urban stress due to unfamiliar space and how it can be reduced.

Personal characteristics have been studied extensively, but physical characteristics and especially the relationships between personal and physical were rarely studied in psychological and urban areas (Cubukcu, 2003; Afrooz, 2009). Moreover, most studies focus on one variable but wayfinding involves many variables, such as landmarks, route pattern and architectural features, working simultaneously (Cubukcu, 2003). This study explores the simultaneous effect of personal and physical characteristics on wayfinding performance in vicinity of KLCC and focuses more on the physical characteristics. It addresses the relationship between wayfinding, legibility, cognitive map, geometry and stress.

One of the principles of wayfinding is the achievement of appropriate health standard goals (Cubukcu, 2003). It is surely very important in unfamiliar environments for visitors (Afrooz, 2009). People are rarely familiar with the environment when they are exploring a new destination. At this time disorientation has an effect on human life. Disorientation produces frustration, irritation, anxiety, and stress (Carpman and Grant, 2002).

This study is a practice in unfamiliar environment and finally gives a practical view of wayfinding and the impact of configuration of urban space on wayfinding in unfamiliar environment.

1.10 Scope of the Study

It is a fact that everyone experiences a new city or a new space. When new places include irregular geometry space it can be confusing. Visitors have no viable cognitive map and wayfinding to confront the problem. Sometimes visitors get lost and as a result they may become stressed.

Short term stress can be helpful but long term is harmful (Maslach, 2001). Questions to be asked include: Why do we feel stress in new spaces? How can we reduce the stress? This study was developed to answer these questions.

This study focused on the difficulties of pedestrian wayfinding in the vicinity of KLCC. The observations were made during the day. Night-time wayfinding was not studied. The differences of perception between genders were also not examined. Visitors who travelled by car or public transportation were excluded from this study as was navigation by computer, robot or any other independent or mechanical means.

1.11 Thesis Structure

This dissertation is comprised of seven chapters. Chapter 1 explains the overview of subject area. Chapter 2,3 and 4 explains the conceptual framework and background of the study. Chapter 5 describes the research method used. Chapter 6 explains and discusses the findings and results. Finally, in Chapter 7 the conclusion of the study is described followed by bibliography and five appendices. The following explains the action plan of each chapter.

Chapter 1: This chapter discusses the background of study and research gap. It details the objectives of the study coupled with the research questions and hypotheses to be addressed. It discusses scope, the study area, research design, and overall thesis structure, and prepared research basis for a literature review in chapter 2, 3 and 4.

Chapter 2, 3 and 4: It reviews and defines literature in the research area of concern related to each objective. In these chapters, the studies on effective elements of pedestrian wayfinding are reviewed forming the basis for the study conceptual framework such as geometry, stress, legibility, cognitive map as well as landmark and square. These chapters develop a systemic research concept

framework towards reliable research outcome that justify the need for this study and give a clear focus for the methodology to be applied in chapter 5 of the study.

Chapter 5: It presents research methodology in this study. It also defines how to collect data which is divided into four major types including survey questionnaire, interview, observation, and axial map as a behavioural mapping in order to examine the research objectives. It is followed by the types of analysis used in this research including descriptive analysis, inferential analysis and finally normality and reliability analysis as a confirmatory factor analysis and justifies the methodology in relation to the literature and research analysis framework used in chapter 6.

Chapter 6: It encompasses the findings of the research together with discussion. The findings are the factors which influence geometry in effective elements of wayfinding such as legibility, cognitive map and stress. Then, the findings are discussed in different aspects including "value of geometry to legibility and cognitive map", "impact of regular geometry on cognitive map and urban stress", "analyzing and comparing hypothetical model and existing space by space syntax", and "syntactical analysis on accessible and sociable with square as a regular geometry".

Chapter 7: It concludes the research findings in chapter 6, harvests researcher evidence in the reviewed literature in chapter 2, 3 and 4; and comprehensively arrived at formidable conclusions that intensely justify the study goal. It involves research implications with recommendations for goals of this study and further research in the related field.

REFERENCES

Aangeenbrug, R. T. (1991). A Critique of GIS. *Geographical Information System: Principles and Applications, 1*, 101-107.

Afrooz, A. E. (2009). *Assessing Wayfinding of Users in Unfamiliar Larg-scale Urban Places.* Master of Urban Design, Universiti Teknologi Malaysia, Skudai. UTM database. (FAB30000010817)

Aguirre, K. G., and D'Esposito, M. (1999). Topographical Disorientation: a Synthesis and Taxonomy. *Brain, 122*, 1613–1628.

Ahmadi, V., Irfan, A., Farkisch, H., and Surat, M. (2012). Morphological STUDY of Urban Hierarchy in Boshrooeh City of IRAN. *International Journal of Architectural Research 6*(3), 56-71.

Al-bvzjany, A. M. i. M. (1991). *Iranian Geometry - Books Trade*. Tehran: Soroush.

Alexander, C. (1968). *Notes on the Synthesis*. Cambridge, MA: Harvard University Press.

Alexander, C. (1987). *A New Theory of Urban Design*. New York: Oxford University Press.

Allen, A., Kennedy, P., Cryan, J., Dinan, T., and Clarke, G. (2013). Biological and Psychological Markers of Stress in Humans: Focus on the Trier Social Stress Test. *Neuroscience and Biobehavioral Reviews, In press*.

Allen, G. (1999a). Cognitive Abilities in the Service of Wayfinding: A Functional Approach. *The Professional Geographer, 51*(4), 555–561.

Allen, G. (1999b). *Spatial Abilities, Cognitive map, and Wayfinding: Based for Individual Differencees in Spatial Cognition and Behavior*. Baltimore, MD: The Johns Hopkins University press.

Allen, G. (2000). Principles and Practices for Communicating Route Knowledge. *Applied Cognitive Psychology, 14*, 333–359.

Alstott, J. (2007). *Security, Information, and Memory Determine Locomotor Exploration in Rattus Norvegicus.* Bloomington, Indiana.

Alvarez, P., Zola-Morgan, S., and Squire, L. R. (1995). Damage Limited to the Hippocampal Region Produces Long-lasting Memory Impairment in Monkeys. *Journal of Neuroscience, 15*(5 Pt 2), 3796–3807.

Amaratunga, D., Sarshar, M., and Baldry, D. (2002). Process Improvement in Facilities Management: the SPICE Approach. *Business Process Management Journal, 8*(4), 318-337.

Appleton, R. B. (1922). *Nte Elements of Greekphilosophyfrom Ntales to Aristotle*. London: Methuen.

Ardalan, N., and Bakhtiar, L. (1999). *Unity Sense* (S. Hamid, Trans.). Isfahan: Iran: Publishing Soil.

Arthur, P., and Pasini, R. (1992). *Wayfinding: People, Signs, and Architecture*. New York: McGraw-Hill Book Company.

Asselena, M. V., Kesselsa, R. P. C., Kappelleb, L. J., Neggersa, S. F. W., Frijnsb, C. J. M., and Postmaa, A. (2005). Neural Correlates of Human Wayfinding in Stroke Patients. *Brain research, 1067*, 2 2 9 – 2 3 8.

Astur, R., Ortiz, M., and Sutherland, R. (1998). A Characterization of Performance by Men and Women in a Virtual Morris Water Task: A Large and Reliable Sex Difference. *Behavioural Brain Research, 93*(1-2), 185-190.

Atkinson, R., Atkinson, R., Smith, E., Bem, D., and Nolen-Hoeksema, S. (1996). *Hilgard's Introduction to Psychology*. Fort Worth: Harcourt Brace College publishers.

Atkinson, R., and et al. (1996). *Hilgard's Introduction to Psychology*: Fort Worth: Harcourt Brace College Publishers.

Avni, R., and Eilam, D. (2008). On the Border: Perimeter Patrolling as a Proposed Transitional Exploration Phase from Piloting to Orienting in a Diurnal Rodent, the Fat Sand Rat (Psammomy Obesus). *Anim Cogn, 11*, 311–318.

Baker, G., H. (1992). Design Strategies in Architecture. *New York: Van Nostrad Reinhold pub*, 8.

Barrash, J. (1994). Age-related Decline in Route Learning Ability. *Dev Neuropsychol, 10*, 189–201.

Barton, J., and Pretty, J. (2010). What Is the Best Dose of Nature and Green Exercise for Improving Mental Health? Amulti-study Analysis. *Environmental Science and Technology, 44*(10), 3947–3955.

Batty, M., and Longley, P. (1994). *Fractal Cities: A Geometry of Form and Function, 1st edn*. New York: Academic Press.

Beatley, T. (2000). *Green Urbanism*. Washington, DC: Island Press.

Begega, A., Cienfuegos, S., Rubio, S., Santin, J. L., Miranda, R., and Arias, J. L. (2001). Effects of Ageing on Allocentric and Egocentric Spatial Strategies in the Wistar Rat. *Behavioural Processes, 53*(1-2), 75-85.

Belir, O., and Onder, D. E. (2013). *Accessibility in Public Spaces: Spatial Legibility for Visually Impaired People*. Paper Presented at the Ninth International Space Syntax Symposium, Seoul.

Bell, P. A., Greene, T. C., Fisher, J. D., and Baum, A. (2001). *Environmental Psychology (5th ed.)*. Orlando , FL: Harcpurt College Publishers.

Ben-Joseph, S. (1997). *Streets and the Shaping of Towns and Cities*.

Bentz, D., Michael, T., Wilhelm, F. H., Hartmann, F. R., Kunz, S., von R., and de Quervain, D. J. F. (2013). Influence of Stress on Fear Memory Processes in an Aversive Differential Conditioning Paradigm in Humans. *Psychoneuroendocrinology*(0). doi: http://dx.doi.org/10.1016/j.psyneuen.2012.12.018

Berg, M. (1998). The politics of Technology: on Bringing Social Theory into Technological Design. *Science, Technology, and Human Values, 23*(4), 456-490.

Blakey, R. (1850). *History of the Philosophy of Mind*. London: Longman, Brown, Green and Longmans.

Bohbot, V. D., Gupta, M., Banner, H., and Dahmani, L. (2011). Caudate Nucleus-Dependent Response Strategies in a Virtual Navigation Task are Associated with Lower Basal Cortisol and Impaired Episodic Memory. *Neurobiology of Learning and Memory, 96*(2), 173-180. doi: http://dx.doi.org/10.1016/j.nlm.2011.04.007

Bohbot, V. D., Iaria, G., and Petrides, M. (2004). Hippocampal Function and Spatial Memory: Evidence from Functional Neuroimaging in Healthy Participants and Performance of Patients with Medial Temporal Lobe Resections. *Neuropsychology, 18*(3), 418–425.

Bottoni, G., Cappa, S., Geminiani, G., and Sterzi, R. (1990). Topographic Disorientation: a Case Report. *Neuropsychologia, 28*, 309–312.

Brand, R. H. (2002). *Architecture of Islam* (A. Shirazi, Trans.). Tehran: rozaneh.

Brandon, K. (2008). Behavior. *36*(6), 839-867. Retrieved from http://www.kellybrandondesign.com

Brown, J. D. (1996). Testing in Language Programs. Upper Saddle River, NJ: Prentice Hall Regents. *Modern and Interactive Approach to Learning Engineering Mathematics, British Journal of Educational Technology, 32*(2), 195-207.

Bruce, P., and Herman, J. (1983). Spatial Knowledge of Young and Elderly Adults: Scene Recognition from Familiar and Novel Perspectives. *Exp Aging Res, 9*, 169–173.

Burgess, N. (2006). Spatial Memory: How Egocentric and Allocentric Combine. *Trends Cogn. Sci, 10*(12), 551–557.

Burgess, N., and Maguire, E. A. (2002). The Human Hippocampus and Spatial and Episodic Memory. *Neuron, 35*, 625–641.

Burkhart, T., Michon, J. L., and Nasr, S. H. (2009). *Art of Islam, Language and Meaning (Library of Perennial Philosophy Sacred Art in Tradition)*: World Wisdom.

Buzsa´ ki, G. (2010). Neural Syntax: Cell Assemblies, Synapsembles, and Readers. *Neuron, 68*, 362–385.

Caduff, D., and Timpf, S. (2008). On the Assessment of Landmark Salience for Human Navigation. *Cognitive Processing, 9*, 249–267.

Campos, M. B. A. (2000). *Urban Public Spaces: A Study of the Relation between Spatial Configuration and Use Patterns.* Ph.D, UCL, London.

Cangoz, B. (2005). Gecmisten Gunumuze Bellegi Aciklamaya Yonelik Yaklasimlara Kisa Bir Bakis. *Hacettepe Universitesi Edebiyat Fakultesi Dergisi, 22*(1), 51-62.

Carbon, C., and Hesslinger, V. M. (2013). Attitudes and Cognitive Distances: On the Non-unitary and Flexible Nature of Cognitive maps. *Advances in Cognitive Psychology, 9*(3), 121-129. doi: 10.2478/v10053-008-0140-y

Carpman, J. R., and Grant, M. A. (2002). *Wayfinding: A Broad View*. New York: John Wiley and Sons.

Chatterton, P., and Hollands, R. (2002). Theorising Urban Playscapes: Producing, Regulating and Consuming Youthful Nightlife City Spaces. *Urban Studies, 39*, 95–116.

Chebat, J.-C., Gelinas-Chebat, C., and Therrien, K. (2005). Lost in a Mall, the Effects of Gender, Familiarity with the Shopping Mall and the Shopping Values on Shoppers' Wayfinding Processes. *Journal of Business Research, 58*, 1590-1598.

Chen, C. H., Chang, W. C., and Chang, W. T. (2009). Gender Differences in Relation to Wayfinding Strategies, Navigational Support Design, and Wayfinding Task Difficulty. *Journal of Environmental Psychology, 29*(2), 220-226.

Cheng, K. (1986). A Purely Geometric Module in the Rat's Spatial Representation. *Cognition, 23*, 149–178.

Cheng, K. (2008). Whither Geometry? Troubles of the Geometric Module. *Trends Cogn Science, 12*, 355–361.

Cheng, K., and Gallistel, C. R. (1984). *Testing the Geometric Power of an Animal's Spatial Representation*. Erlbaum: Hillsdale, NJ.

Cheng, K., and Gallistel, C. R. (2005). Shape Parameters Explain Data from Spatial Transformations: Comment on Pearce et al. (2004) and Tommasi and Polli (2004) *Journal of Experimental Psychology: Animal Behavior Processes, 31*(2), 254–259.

Chesterton. (1997). *Pedestrian Market Research Services Ltd. Managing Urban Spaces in Town Centres*. London: The Stationery Office.

Chitsazian, A. (2007). Symbolism and Its Effect on the Carpet. *Goljaam, 4*(Society of Iranian carpets), 37-40.

Chitsazian, A. (2010). Recognizing the Campus in Symbolic Architecture and Carpet Platform of Iran. *Goljaam, 12*(Journal of Pavement Research Society), 99-122.

Clark, H. H. (1996). *Using Language*. Cambridge, UK: Cambridge University Press.

Clearfield, M. W. (2004). The Role of Crawling and Walking Experience in Infant Spatial Memory. *Journal of Experimental Child Psychology, 89*, 214–241.

Collins, C. C., Collins, G. R., and Sitte, C. (2006). *Camillo Sitte: The Birth of Modern City Planning: With a Translation of the 1889 Austrian Edition of His City Planning According to Artistic Principles*. New York: Dover Publications.

Collins, K. M. T., Onwuegbuzie, A. J., and Jiao, Q. J. (2006). Prevalence of Mixed-Methods Sampling Designs in Social Science Research. *Evaluation & Research in Education, 19*(2), 83-101.

Coluccia, E., and Louse, G. (2004). Gender Differences in Spatial Orientation: A Review. *Journal of Environmental Psychology, 24*(3), 329-340.

Conrad, C., Galea, L., Kuroda, Y., and McEwen, B. (1996). Chronic Stress Impairs Rat Spatial Memory on the Y maze, and This Effect is Blocked by Tianeptine Pretreatment. *Behavioral Neuroscience, 110*(6), 1321–1334.

Conroy-Dalton, R. (2003). The Secret Is to Follow Your Nose. Route Path Selection and Angularity. *Environment and Behavioral 35*(1), 107–131.

Conroy, R. (2001). Spatial Navigation in Immersive Virtual Environments. *Faculty of Built Environment. University of London, London*, 249.

Conzen, M. R. G., and Conzen, M. P. (2004). *Thinking About Urban Form: Papers on Urban Morphology*. Oxford; New York: Peter Lang.

Cooper, R., Schindler, S., and Hill. (2006). *Marketing Research*. New York: McGraw.

Cornell, E., Sorenson, A., and Mio, T. (2003). Human Sense of Direction and Wayfinding. *Annals of the Association of American Geographers, 93*(2), 399–425.

Cottrell, N. D., and Barton, B. K. (2012). The Impact of Artificial Vehicle Sounds for Pedestrians on Driver Stress. *Ergonomics, 55*(12), 1476-1486. doi: 10.1080/00140139.2012.724452

Crampton, J. (1992). A Cognitive Analysis of Wayfinding Expertise. *Cartographica, 29*(3/4), 46–65.

Creswell, J. W., Plano Clark, V. L., Gutmann, M., and Hanson, W. (2003). Advanced Mixed Methods Research Designs. In A. Tashakkori and C. Teddlie (Eds.), *Handbook of Mixed Methods in Social and Behavioral Research* (pp. 209–240). Thousand Oaks, CA: Sage.

Crewe, K., and Forsyth, A. (2011). Compactness and Connection in Environmental Design: Insights from Ecoburbs and Ecocities for Design with Nature. *Environment and Planning B: Planning and Design, 38*(2), 267-288.

Critchlow, K. (1976). *Islamic Patterns: An Analytical and Cosmological Approach*. London, UK,: Schocken Books,Thames and Hudson.

Critchlow, K. (1987). *Order in Space: A Design Source Book.* . USA: Thames and Hudson.

Cubukcu, E. (2003). *Investigating Wayfinding Using Virtual Environment.* Ph.D, The Ohio State University.

Cubukcu, E., and Nasar, J. (2005). Relation of Physical Form to Spatial Knowledge in Largescale Virtual Environments. *Environment and Behaviour, 37*(3), 397–317.

Cutini, V. (2003). *Lines and Squares: Towards a Configurational Approach to the Morphology of Open Spaces.* Paper Presented at the 4th International Space Syntax Symposium, London.

Dabbour, L. M. (2012). Geometric Proportions: The Underlying Structure of Design Process for Islamic Geometric Patterns. *Frontiers of Architectural Research, 1*(4), 380-391. doi: http://dx.doi.org/10.1016/j.foar.2012.08.005

Dalke, H., Little, J., Niemann, E., Camg¨oz, N., Steadman, G., and Hill, S. (2005). Colour and Lighting in Hospital Design. *Optics and Laser Technology, 38*, 343–365.

Dalton, N. (2003). *Fractional Configurational Analysis and a Solution to the Manhattan Problem.* Paper Presented at the 3rd International Symposium on Space Syntax, Georgia, Institute of Technology, Atlanta.

Dalton, R. C., and Bafna, S. (2003). *The Syntactical Image of the City: A Reciprocal Definition of Spatial Elements and Spatial Syntaxes.* Paper Presented at the 4th International Space Syntax Symposium London.

Dalton, R. C., H'olscher, C., and Turner, A. (2012). Understanding Space: the Nascent Synthesis of Cognition and the Syntax of Spatial Morphologies. *Environment and Planning B: Planning and Design, 39*(1), 7-11.

Darken R. P., and Sibert, J. L. (1996). *Wayfinding Strategies and Behaviors in Large Virtual Worlds.* Paper Presented at the CHI '96 Proceedings of the SIGCHI Conference on Human Factors in Computing Syste New York, NY, USA.

Darcy, S. and T. J. Dickson (2009). A whole-of-life approach to tourism: The case for accessible tourism experiences. *Journal of Hospitality and Tourism Management* 16(01): 32-44.

de Vries, S. (2010). *Nearby Nature and Humanhealth: Looking at the Mechanisms and Their Implications*. Abingdon, UK: Routledge.

Dehaene, S., Izard, V., Pica, P., and Spelke, E. S. (2006). Core Knowledge of Geometry in an Amazonian Indigene Group. *Science, 311*, 381–384.

Denis, M., Pazzaglia, F., Cornoldi, C., and Bertolo, L. (1999). Spatial Discourse and Navigation: An Analysis of Route Directions in the City of Venice. *Applied Cognitive Psychology, 13*(2), 145–174.

Devlin, A. S. (2001). *Mind and Maze: Spatial Cognition and Environmental Behavior*: Greenwood Press.

Dinan, T. (1996). *Fran stress till depression*: SERIP.

Downs, R. M., and Stea, D. (1973). *Image and Environment: Cognitive Mapping and Spatial Behavior*. Chicago: Aldine Publishing Co.

Driscoll, I., and Sutherland, R. J. (2005). The Aging Hippocampus: Navigating between Rat and Human Experiments. *Reviews in the Neurosciences, 16*(2), 87-121.

Dupret, D., O'Neill, J., and Csicsvari, J. (2013). Dynamic Reconfiguration of Hippocampal Interneuron Circuits During Spatial Learning. *Neuron*, in press. doi: http://dx.doi.org/10.1016/j.neuron.2013.01.033

Dupret, D., O'Neill, J., Pleydell-Bouverie, B., and Csicsvari, J. (2010). The Reorganization and Reactivation of Hippocampal Maps Predict Spatial Memory Performance. *Nat. Neurosci., 13*, 995–1002.

Dussutour, A., Deneubourg, J., and Fourcassié, V. (2005). Amplifcation of Individual Preferences in a Social Context: The Case of Wall-following in ants. *Proc R Soc B Biol, 272*, 705–714.

Edwards, D., et al. (2008). Urban tourism research: developing an agenda. *Annals of Tourism Research* 35(4): 1032-1052.

Edwards, D., and Griffin, T. (2013). Understanding Tourists' Spatial Behaviour: GPS Tracking as an Aid to Sustainable Destination Management. *Journal of Sustainable Tourism Management*, 1-16. doi: 10.1080/09669582.2013.776063

Eichenbaum, H., and Cohen, N. J. (2001). *From Conditioning to Conscious Recollection*. New York: Oxford University Press.

Emo, B. (2013). *Seeing the Axial Line: Evidence from Wayfinding Experiments.* Paper Presented at the The Ninth International Space Syntax Symposium, Seoul: Sejong University.

Emo, B., Hölscher, C., Wiener, J. M., and Dalton, R. C. (2012). *Wayfinding and Spatial Configuration: Evidence from Street Corners.* Paper Presented at the Proceedings of the 8th Space Syntax Symposium, Pontifícia Universidad.

Esfahani, R. (1953). *Almfrdat fi Gharib al-quran*. Tehran: nasr maktab Mortazavi.

Etienne, A. (2003). *How Does Path Integration Interact with Olfaction, Vision, and the Representation of Space?* Oxford, England: Oxford University Press.

Etienne, A., Berlie, J., Georgakopoulos, J., and Maurer, M. (1998). *Role of Dead Reckoning in Navigation*. Oxford: Oxford University Press.

Eysenck, M. W. (1990). *Blackwell Dictionary of Cognitive Psychology*. Cambridge, MA: Basil Blackwell.

Faria, A. P. N., and Krafta, R. (2003). *Representing Urban Cognitive Structure Through Spatial Differentiation*. Paper Presented at the 4th International Space Syntax Symposium, London.

Farshidnick, F., et al. (2010). An Alter Product Semiotics: Masjed Architecture Is Reflected in the Carpet. *Goljaam, 14*(the Journal of Pavement Research Society), 9-27.

Feist, G., and Rosenberg, E. (2009). *Psychology: Making Connections*. New York: McGraw-Hill.

Fewings, R. (2001). Wayfinding and Airport Terminal Design. *Journal of Navigation, 54*(2).

Foo, P., Harrison, M., Duchon, A., Harren, W. H., and Tarr, M. J. (2004). Humans Follow Landmarks over Path Integration. *Journal of Vision, 4*(8).

Foo, P., Warren, W. H., Duchon, A., and Tarr, M. J. (2005). Do Humans Integrate Routes into a Cognitive map? Map- Versus Landmark-based Navigation of Novel Shortcuts. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31*, 195–215.

Francis, M. L. (1984). Mapping Downtown Activity. *Journal of Architectural and Planning Research, 1*, 21-35.

French, J. S. (1983). *Urban Space – A Brief History of the City Square*. Iowa: Kendall Hunt Publishing.

Ga¨ rling, T., Bo¨ o¨ k, A., and Lindberg, E. (1986). Spatial Orientation and Wayfinding in the Designed Environment. *Journal of Architectural Planning Research, 3*, 55–64.

Gallistel, C. R. (1990). *The Organization of Learning*. Cambridge, M.A.: MIT Press.

Geddes, P., and Library. (2008). *Civics: As Applied Sociology*. Teddington: Echo.

Gehl, J., and Gemzoe, L. (2001). *New City Spaces. Copenhagen*. Denmark: The Danish Architectural Press.

Ghehi, H. B. (2010a). *The Geometry of Imagination and Beauty* Tehran: Shadrang.

Ghehi, H. B. (2010b). *Spiritual Principles of Islamic Art and Architecture*. Tehran: Soreh Mehr.

Giddings, B. (1996). Towards the Urban Restoration of Newcastle Upon Tyne. *URBAN DESIGN International, 1*(3), 265–281.

Giddings, B., Charlton, J., and Horne, M. (2011). Public Squares in European City Centres. *URBAN DESIGN International, 16*(3), 202–212.

Giddings, B., Hopwood, B., Mellor, M., and O'Brien, G. (2005). *Back to the City: A Route for Urban Sustainability*. Oxford: Architectural Press.

Giedion, S. (1962). *Space, Time, Architecture*. Cambridge: Harvard University Press.

Giuliani, R. (2001). *Universal Design New York*. New York: Mayor Publication.

Goel, V. (1995). *Sketches of Thought*. Cambridge, Mass: MIT Press.

Golany, G. (1995). *Ethics and URBAN DESIGN: Culture, Form, and Environment*. New York: John Wiley and Sons.

Goldschmidt, G., and Badke-Schaub, P. (2010). *The Design-psychology*. Sydney, Australia: DAB Documents.

Golledge, R. (1999). *Human Cognitive Maps and Wayfinding*. Baltimore: Johns Hopkins University Press.

Golledge, R., and Gärling, T. (2004). *Cognitive Maps and Urban Travel, in Handbook of Transport Geography and Spatial Systems*. Amsterdam: Elevesier.

Gospodini, A. (2001). Urban design, urban space morphology, urban tourism: an emerging new paradigm concerning their relationship. *European Planning Studies* 9(7): 925-934.

Gould, P., and White, R. (1986). *Mental Maps*. Boston: Allen and Unwin.

Gould, T., Dao, D., and Kovacsics, C. (2009). *The Open Field Test*: Humana Press.

Graham, P., Fauria, K., and Collett, T. (2003). The Influence of Beacon-Aiming on the Routes of Wood Ants. *J Exp Biol, 206*, 535.

Grahn, P., Ivarsson, C. T., Stigsdotter, I. K., and Bengtsson, I. (2010). *Innovative Approaches in Researching Landscape and Health, Open Space: People Space 2*. Abingdon, UK: Routledge.

Grahn, P., and Stigsdotter, U. A. (2003). Landscape Planning and Stress. *Urban Forestry and Urban Greening, 2*, 1-18.

Gray, W. D., Sims, C. R., Fu, W.-T., and Schoelles, M. J. (2006). The Soft Constraints Hypothesis: A Rational Analysis Approach to Resource Allocation for Interactive Behavior. *Psychological Review, 113*(3), 461–482.

Grön, G., Wunderlich, A. P., Spitzer, M., Tomczak, R., and Riepe, M. W. (2000). Brain Activation During Human Navigation: Gender-Different Neural Networks as Substrate of Performance. *Nature Neuroscience, 3*(4), 404–408.

Habel, C. (1988). *Prozedurale Aspekte der Wegplanung und Wegbeschreibung [Procedural aspects of route planning and route description]*. Paper Presented at the Sprache in Mensch und Computer, Opladen: Westdt.

Haciomeroglu, M., Laycock, R. G., and Day, A. M. (2007). *Distributing Pedestrians in a Virtual Environment*. Paper presented at the International Conference on Cyberworlds, Norwich, UK, School of Computing Sciences, University of East Anglia.

Hannes, E., Kusumastuti, D., Espinosa, M. L., Janssens, D., Vanhoof, K., and Wets, G. (2012). Mental Maps and Travel Behaviour: Meanings and Models. *Journal of Geographical Systems, 14*, 143-165. doi: 10.1007/s10109-010-0144-2 V

Hano, K. (2011). Accessible Tourism: Concepts and Issues. *Tourism Planning & Development* 8(4): 467-468.

Hanson, J. (1989). Order and Structure in Urban Design: The Plans for the Rebuilding of London after the Great Fire of 1666. *Ekistics, 334/335(Jan/Feb, Mar/Apr)*, 22–42.

Hartig, T., Book, A., Garvill, J., Olsson, T., and Garling, T. (1996). Environmental Influences on Psychological Restoration. *Scandinavian Journal of psychology, 4*(37), 378-393.

Hartley, T., Maguire, E. A., Spiers, H. J., and Burgess, N. (2003). The Well-worn Route and the Path Less Traveled: Distinct Neural Bases of Route Following and Wayfinding in Humans. *Neuron, 37*(5), 877–888.

Hartley, T., Trinkler, I., and Burgess, N. (2004). Geometric Determinants of Human Spatial Memory. *Cognition, 94*, 39–75.

Hashim, M. S., and Said, I. (2013). Effectiveness of Wayfinding Towards Spatial Space and Human Behavior in Theme Park. *Procedia - Social and Behavioral Sciences, 85*, 282 – 295.

Head, D., and Isomc, M. (2010). Age Effects on Wayfinding and Route Learning Skills. *Behavioural Brain Research, 209* 49–58.

Hecht, L. (1988). Mysterium Microcosmicum: the Geometric Basis for the Periodicity of the Elements. *21st Century Science*, 18.

Heft, H. (1996). *The Ecological Approach to Navigation. A Gibsonian Perspective*. Dordrect, Netherlands: Kluwer Academic.

Heinrichs, M., Baumgartner, T., Kirschbaum, C., and Ehlert, U. (2003). Social Support and Oxytocin Interact to Suppress Cortisol and Subjective Responses to Psychosocial Stress *Biological Psychiatry, 54*(12), 1389–1398.

Hejazi, M. (2005). Geometry in nature and Persian architecture. *Building and Environment, 40*(10), 1413-1427. doi: http://dx.doi.org/10.1016/j.buildenv.2004.11.007

Hellqvist, E. (1999). *Svensk Etymologisk Ordbok, Forsta Bandet*. Lund: Gleerups.

Hermer, L., and Spelke, E. (1994). A Geometric Process for Spatial Reorientation in Young Children. *Nature, 370*, 57–59.

Herzog, T., Black, A., Fountaine, K., and Knotts, D. (1997). Reflection and Attentional Recovery as Distinctive Benefits of Restorative Environments. *Environment Psychology*(17), 165-170.

Hill, M. R. (1984). *Walking, Crossing Streets, and Choosing Pedestrian Routes: A Survey of Recent Insights from the Social/ Behavioral Science*. USA: University of Nebraska Studies.

Hillier, B. (1984). *Mansion House Square Inquiry: Proof of Evidence*. Bartelett School of Architectural and planning, University College London: Unit for Architectural Studies.

Hillier, B. (1989). The Architecture of the Urban Object. *Ekistics 56*(334/335), 5–21.

Hillier, B. (1996). *Space Is the Machine: A Configurational Theory of Architecture*. Cambridge, MA: Cambridge University Press.

Hillier, B. (2003). *The Architectures of Seeing and Going: or, Are Cities Shaped by Bodies or Minds? and Is There a Syntax of Spatial Cognition?* Paper Presented at the 4th International Space Syntax Symposium, London.

Hillier, B. (2008). Space and Spatiality: What the Built Environment Needs from Social Theory. *Building Research & Information, 36*(3), 36216–36230.

Hillier, B., Burdett, R., Peponis, J., and Penn, A. (1987). Creating Life: or, does Architecture Determine Anything? *Architecture and Behaviour, 3*(3), 233-250.

Hillier, B., and Hanson, J. (1984). *The Social Logic of Space, Reprint*. Cambridge, UK: Cambridge University Press.

Hillier, B., and Hanson, J. (1998). Space Syntax as a Research Programme. *Urban Morphology, 2*(2), 108–110.

Hillier, B., Hanson, J., Peponis, J., Hudson, J., and Burdett, R. (1983). Space Syntax: A Different Urban Perspective. *Architectural Journal, 30(November)*, 47–63.

Hillier, B., and Iida, S. (2005). *Network and Psychological Effects in Urban Movement;Spatial Information Theory, Lecture Notes in Computer Science*. Berlin/Heidelberg: Springer.

Hillier, B., and Penn, A. (1996). Cities as Movement Economies. *URBAN DESIGN International, 1*(1), 49–60.

Hillier, B., Penn, A., Hanson, J., Grajewski, T., and Xu, J. (1992). Natural Movement: Configuration and Attraction in Urban Pedestrian Movement. *Environment and Planning B: Planning and Design, 19*.

Hillier, B., Penn, A., Hanson, J., Grajewski, T., and Xu, J. (1993). Natural Movement: Or Configuration and Attraction in Urban Pedestrian Movement. *Environment and Planning B: Planning and Design, 20*, 2029–2066.

Hillier, B., and Shu, S. (2000). *Crime and Urban Layout: The Need for Evidence; Key Issues in Crime Prevention and Community Safety*. London: Institute of Public Policy Research.

Hishamuddin, M., S.,. (2005). *Panduan Mudah Analisis Data Menggunakan SPSS Windows*. Skudai, Johor: UTM.

Hockey, G. R., Nickel, P., Roberts, A. C., and Roberts, M. H. (2009). Sensitivity of Candidate Markers of Psychophysiological Strain to Cyclical Changes in Manual Control Load During Simulated Process Control. *Applied Ergonomics*(40), 1011–1018.

Hoffmann, G. (1983). The Search Behavior of the Desert Isopod Hemilepistus Reaumuri as Compared with a Systematic Search. *Behav Ecol Sociobiol, 13*, 93–106.

Hölscher, C., Dalton, R., and Turner, A. (2007). *Space Syntax and Spatial Cognition*. SFB/TR 8 Monographs.

Hölscher, C., Meilinger, T., Vrachliotis, G., Brösamle, M., and Knauff, M. (2005). Finding theWay Inside: Linking Architectural Design Analysis and Cognitive Processes. 1-23.

Hölscher, C., Meilinger, T., Vrachliotis, G., Brösamle, M., and Knauff, M. (2006). Up the Down Staircase: Wayfinding Strategies and Multi-level Buildings. *Journal of Environmental Psychology, 26*(4), 284–299.

Hölscher, C., Tenbrink, T., and Wiener, J. M. (2011). Would You Follow Your Own Route Description? Cognitive Strategies in Urban Route Planning. *Cognition, 121*(2), 228-247. doi: http://dx.doi.org/10.1016/j.cognition.2011.06.005

Hong, I. (2007). *Communal Ontology for Navigation Support in Urban Region: Getting Directions from Familiar Landmarks.* Ph.D Thesis, The state University of new York, New York, Buffalo.

Hupbach, A., and Nadel, L. (2005). Reorientation in a Rhombic Environment: No Evidence for an Encapsulated Geometric Module. *Cognitive Development 20*, 279–302.

Iaria, G., Petrides, M., Dagher, A., Pike, B., and Bohbot, V. D. (2003). Cognitive Strategies Dependent on the Hippocampus and Caudate Nucleus in Human Navigation: Variability and Change with Practice. *Journal of Neuroscience, 23*(13), 5945–5952.

Ingold, T. (2000). *Perception of the Environment: Essays in Livelihood, Dwelling and Skill* (1st ed. ed.). New York, NY: Routledge.

Ishikawa, T., and Montello, D. R. (2006). Spatial Knowledge Acquisition from Direct Experience in the Environment: Individual Differences in the Development of Metric Knowledge and the Integration of Separately Learned Places. *Cognitive Psychology, 52*(2), 93–129. doi: http://dx.doi.org/ 10.1016/j.cogpsych.2005.08.003

Izard, V., Pica, P., Spelke, E. S., and Dehaene, S. (2011). Flexible Intuitions of Euclidean Geometry in an Amazonian Indigene Group. *Proceedings of the National Academy of Sciences, 108*, 9782–9787.

Jacobs, A. B. (1993). *Great Streets*. Cambridge, Massachusetts: MIT Press.

Jacobs, W. J., Laurance, H. E., and Thomas, K. G. F. (1997). Place Learning in Virtual Space I: Acquisition, Overshadowing, and Transfer. *Learning and Motivation, 28*(4), 521-541.

Jansen-Osmann, P. (2002). Using Desktop Virtual Environments to Investigate the Role of Landmarks. *Computers in Human Behavior, 18*(4), 427-436.

Jansen-Osmann, P., and Fuchs, P. (2006). Wayfinding Behavior and Spatial Knowledge of Adults and Children in a Virtual Environment: The Role of Landmarks. *Experimental Psychology, 53*, 171–181.

Jeanson, R., Blanco, S., Fournier, R., Deneubourg, J., Fourcassie, V., and Theraulaz, G. A. (2003). Model of Animal Movements in a Bounded Space. *J Theor Biol, 225*, 443–451.

Jeffrey, C. (2007). *Wayfinding Brands: Clear a Path Through the Clutter*. London: Brand Strategy.

Jiang, B., and Claramunt, B. (2002). Integration of Space Syntax into gis: New Perspectives for Urban Morphology. *Transactions in GIS, 6*(3), 295–309.

Johnson, J. (2009). *Embracing Complexity in Design*. London: Routledge.

kamal, F. J. (2008). Research on Visual Background Light in Painting. *Garden Journal, 8*, 26-30.

Kaplan, R., and Kaplan, S. (1989). *The Experience of Nature*. Cambridge: Cambridge University press.

Kaplan, S. (1990). Parks for the Future: A Psychological Perspective. *Alnarp: Stad and Land*(85), 4-22.

kaplan, S., and Talbot, J. (1983). Psychological Benefits of a Wilderness Experience. *Human Behavior and the Environment, 6*, 163-203.

Karimi, K. (2012). A Configurational Approach to Analytical Urban Design: Space Syntax Methodology. *Urban Design International, 17*(4), 297-318. doi: 10.1057/udi.2012.19

Kaymaz, I. (2013). Urban Landscapes and Identity. doi: http://dx.doi.org/10.5772/55754

Kelly, D., and Bischof, W. (2008). Orienting in Virtual Environments: How Are Surface Features and Environmental Geometry Weighted in an Orientation Task? *Cognition, 109*, 89–104.

Kelly, J., McNamara, T., Bodenheimer, B., Carr, H., and Rieser, J. (2008). The Shape of Human Navigation: How Environmental Geometry Is Used in Maintenance of Spatial Orientation. *Cognition, 109*, 281–286.

Kelly, J. W., and et al. (2009). Individual Differences in Using Geometric and Featural Cues to Maintain Spatial Orientation: Cue Quantity and Cue Ambiguity Are More Important Than Cue Type. *Psychon. Bull. Rev., 16*, 176–181.

Keys, D. (2000). *Catastrophe: An Investigation into the Origins of the Modern World*. London: Arrow.

Kinsbourne, M., and Wood, F. (1975). *Short-term Memory and the Amnesic Syndrome*. New York: Academic Press.

Kitchin, R., and Freundschuh, S. (2000). *Cognitive mapping*. London: Routledge.

Kitchin, R. M. (1994). Cognitive maps: What Are They and Why Study Them. *Journal of Environmental Psychology, 14*, 1-19. doi: 10.1016/S0272-4944(05)80194-X

Kleen, J., Sitomer, M., Killeen, P., and Conrad, C. (2006). Chronic Stress Impairs Spatial Memory and Motivation for Reward Without Disrupting Motor Ability and Motivation to Explore. *Behavioral Neuroscience, 120*(4), 842–851.

Klingberg., and Larson, S. (2001). Stressutlosta Utmattningsreaktion er Och Utbrandhet (Stress-triggered Reactions of Fatigue and Burnout) *Stressutlosta Utmattningsreaktion er Och Utbrandhet (Stress-triggered Reactions of Fatigue and Burnout)*. Stockholm: Liber.

Klippel, A., Tappe, H., Kulik, L., and Lee, P. U. (2005). Wayfinding Choremes – A Language for Modeling Conceptual Route Knowledge. *Journal of Visual Languages and Computing, 16*(4), 311–329.

KLSP (2004). Kuala Lumpur Structure Plan 2020.

Kohn, M. (2004). *Brave New Neighbourhoods, the Privatisation of Public Space*. New York: Routledge.

Koseoglu, E., and Onder, D. E. (2011). Subjective and Objective Dimensions of Spatial Legibility. *Procedia - Social and Behavioral Sciences, 30*(0), 1191-1195. doi: http://dx.doi.org/10.1016/j.sbspro.2011.10.231

Koseoglu, E., and Onder, D. E. (2011). Subjective and Objective Dimensions of Spatial Legibility. *Procedia - Social and Behavioral Sciences, 30*, 1191 – 1195. doi: 10.1016/j.sbspro.2011.10.231

Krier, R. (1979). *Urban Space*. New York: Rizzoli Publications.

Kuipers, B. (1978). Modeling Spatial Knowledge. *Cognitive Science, 2*, 129–153.

Kuipers, B. (1996). *A Hierarchy of Qualitative Representations for Space.* Paper Presented at the Tenth International Workshop on Qualitive Reasoning about Physcial Systems, QR-96, Menlo Park CA, AAAI Press.

Kuipers, B., Tecuci, D. G., and Stankiewicz, B. J. (2003). *Environment and Behaviour, 35*, 81-106.

kuller, R., and Lindsten, C. (1992). Health and Behavior of Children in Classrooms with and Without Windows. *Environmental Psychology, 12*, 33-52.

Kuller, R., and Wetterberg, L. (1996). The Subterranean Work Environment: Impact on Well-being and Health. *Environment International*(22), 33-52.

Lam, W. H. K., Tam, M.-L., Wong, S. C., and Wirasinghe, S. C. (2003). Wayfinding in the Passenger Terminal of Hong Kong International Airport. *Journal of Air Transport Management, 9*(2), 73–81.

Landau, B., Gleitman, H., and Spelke, E. (1981). Spatial Knowledge and Geometric Representation in a Child Blind from Birth. *Science, 213*, 1275–1278.

Law, S., Chiaradia, A., and Schwander, C. (2012). *Towards a Multi Modal Space Syntax Analysis. Acase Study of the London Street and Underground Network*. Paper presented at the Eighth International Space Syntax Symposium, Santiago de Chile.

Lawton, C. A. (1994). Gender Differences in Way-finding Strategies: Relationship to Spatial Ability and Spatial Anxiety. *Sex Roles 30*, 765–779.

Lawton, C. A. (1996). Strategies for Indoor Wayfinding: The Role of Orientation. *Journal of Environmental Psychology, 16*(2), 137–145.

Learmonth, A. E., Newcombe, N. S., and Huttenlocher, J. (2001). Toddlers' Use of Metric Information and Landmarks to Reorient. *Journal of Experimental Child Psychology, 80*, 225–244.

Lee, S., Shusterman, S., and Spelke, E. (2006). Reorientation and Landmark-guided Search by Young Children: Evidence for Two Systems. *Psychological Science, 17*, 577–582.

Lee, S., Sovrano, V., and Spelke, E. (2012). Navigation as a Source of Geometric Knowledge: Young Children's Use of Length, Angle, Distance, and Direction in a Reorientation Task. *Cognition, 123*(1), 144-161. doi: http://dx.doi.org/10.1016/j.cognition.2011.12.015

Lee, S., and Spelke, E. (2008). Children's Use of Geometry for Reorientation. *Developmental Science, 11*, 743–749.

Lee, S., and Spelke, E. (2010). Modular Geometric Mechanisms for Navigation in Disoriented Children. *Cognitive Psychology, 61*, 152–176.

Lee, S., and Spelke, E. (2011). Young Children Reorient by Computing Layout Geometry, Not by Matching Images of the Environment. *Psychological Bulletin and Review, 18*, 192–198.

Lee, S., Spelke, E., and Vallortigara, G. (2010). *Spontaneous Reorientation Behavior in Chicks: Evidence for Evolutionary Continuity Across Distantly Related Species. Poster Presented at The Rovereto Workshop on Cognition and Evolution*. Italy: Rovereto.

Leiser, D., and Zilbershatz, A. (1989). The Traveller: A Computational Model of Spatial Network Learning. *Environment and Behavior, 21*(4), 435–463.

Leutgeb, S., Leutgeb, J. K., Barnes, C. A., Moser, E. I., McNaughton, B. L., and Moser, M. B. (2005). Independent Codes for Spatial and Episodic Memory in Hippocampal Neuronal Ensembles. *Science, 309*, 619–623.

Lew, A. (2011). Looking Beyond the Boundaries: Time to Put Landmarks Back on the Cognitive map? *Psychol Bull, 137*, 484–507.

Lim, J., Wu, W., Wang, J., Detre, J. A., Dinges, D. F., and Rao, H. (2010). Imaging Brain Fatigue from Sustained Mental Workload: An ASL Perfusion Study of the Time-on-task Effect. *Neuroimage*(49), 3426–3435.

Lin, C. T., Huang, T. Y., Lin, W. J., Chang, S. Y., Lin, Y. H., Ko, L. W., and Chang, E. C. (2012). Gender Differences in Wayfinding in Virtual Environments with Global or Local landmarks. *Journal of Environmental Psychology 32* 89-96.

Long, Y. (2007). *The Relationships Between Objective and Subjective Evaluations of the Urban Environment: Space Syntax, Cognitive maps, and Urban Legibility. (Unpublished Doctoral Dissertation)*. North Carolina State University, Raleigh, North Carolina.

Loomis, J., Kent, P., Strange, L., Fausch, K., and Covich, A. (2000). Measuring the Total Economic Value of Restoring Ecosystem Services in An Impaired River Basin: Results from a Contingent Valuation Survey. *Ecological Economics, 33*, 103–117.

Loomis, J., Klatzky, R., Golledge, R., and Philbeck, J. (1999). *Human Navigation by Path Integration*. Baltimore: Johns Hopkins.

Lovelace, K. L., Hegarty, M., and Montello, D. R. (1999). *Elements of Good Route Directions in Familiar and Unfamiliar Environments*. Berlin, Heidelberg: Springer.

Elderly Subjects: Relationship to Cortisol Reactivity. J. Clin. *Endocrinol. Metab*(82), 2070–2075.

Lynch, K. (1960). *The Image of the City*. Cambridge: MIT Press.

MacInnis, D. J., and Price, L. L. (1987). The Role of Imagery in Information Processing: Review and Extensions. *Journal of Consumer Research, 13*, 473-491.

Magliano, J. P., and Cohen, R., et al. (1995). The Impact of a Wayfinder's Goal on Learning a New Environment: Different Types of Spatial Knowledge As Goals. *Journal of Environmental Psychology, 15*, 65-75.

Maguire, E. A., Burgess, N., Donnett, J. G., Frackowiak, R. S., Frith, C. D., and O'Keefe, J. (1998). Knowing where and getting there: A human navigation network. *Science, 280*(5365), 921–924.

Maguire, E. A., Frith, C. D., Burgess, N., Donnett, J. G., and O'Keefe, J. (1998). Knowing Where Things Are: Parahippocampal Involvement in Encoding Object Locations in Virtual Large-scale Space. *Journal of Cognitive Neuroscience, 10*(1), 61-76.

Major, M. D. (1997-98). *MSc Built Environment: Advanced Architectural studies*. London: The Bartlett School of Graduate Studies, University College London.

Malaysia, T. (2015). Tourist arrivals and receipts to Malaysia. Retrieved 4 Jun 2015, 2015, from tourism.gov.my.

Mallot, H. A., and Basten, K. (2009). Embodied Spatial Cognition: Biological and Artificial Systems. *Image and Vision Computing, 27*(11), 1658–1670. doi: http://dx.doi.org/10.1016/j.imavis.2008.09.001

Marcus, L., Westin, S., and Liebst, L. S. (2013). *Network Buzz: Conception and Geometry of Network in Geography, Architecture and Sociology.* Paper Presented at the Ninth International Space Syntax Symposium, Seoul.

Marshall, S. (2005). *Streets and patterns*. Oxon: Spon Press.

Martin, S. J., and Morris, R. G. (2002). New Life in An Old Idea: the Synaptic Plasticity and Memory Hypothesis Revisited. *Hippocampus, 12*, 609–636.

Mattson, K. (1999). Reclaiming and Remaking Public Space: Towards an Architecture for American Democracy. *National Civic Renewal, 88*(2), 133–144.

McDonald, R. J., and White, N. M. (1993). A Triple Dissociation of Memory Systems: Hippocampus, Amygdala, and Dorsal Striatum. *Behavioral Neuroscience, 107*(1), 3–22.

McDonald, R. J., and White, N. M. (1994). Parallel Information Processing in the Water Maze: Evidence for Independent Memory Systems Involving Dorsal Striatum and Hippocampus. *Behavioral and Neural Biology, 61*(3), 260–270.

McDonald, T. P., and Pellegrino, J. W. (1993). Psychological Perspectives on Spatial Cognition. In T. G. a. R. G. Golledge (Ed.), *Behavior and Environment: Psychological and Geographical Approaches*: Elsevier Science Publishers B.V.

McEwen, B. (2001). Plasticity of the Hippocampus: Adaptation to Chronic Stress and Allostatic Load. *Ann N Y . Acad Sci, 933*, 265-277. doi: PMID:12000027; http://dx.doi.org/10.1111/j.1749-6632.2001.tb05830.x

McEwen, B., Eiland, L., Hunter, R., and Miller, M. (2012). Stress and Anxiety: Structural Plasticity and Epigenetic Regulation As a Consequence of Stress. *Neuropharmacology, 62*, 3-12. doi: PMID:21807003; http://dx.doi.org/10.1016/j.neuropharm.2011.07.014

McEwen, B., and Gianaros, P. (2011). Stress- and Allostasisinduced Brain Plasticity. *Annu Rev Med, 62*, 431-445. doi: PMID:20707675; http://dx.doi.org/10.1146/annurev-med-052209-100430

McEwen, B., and Sapolsky, R. (1995). Stress and Cognitive Function. *Current Opinion in Neurobiology 5*(2), 205–216.

McKittrick, C., Magariños, A., Blanchard, D., Blanchard, R., McEwen, B., and Sakai, R. (2000). Chronic Social Stress Reduces Dendritic Arbors in CA3 of

Hippocampus and Ddecreases Binding to Serotonin Transporter Sites. *Synapse, 36*(2), 85–94.

Meilinger, T. (2008). *The Network of Reference Frames Theory: A Synthesis of Graphs and Cognitive maps*. Berlin: Springer.

Meilinger, T., Frankenstein, J., and Bülthoff, H. H. (2013). Learning to Navigate: Experience Versus Maps. *Cognition, 129* 24–30.

Miles, M. B., and Huberman, A. M. (1994). *An Expanded Sourcebook Qualitative Data Analysis*. London, UK: Sage Publications.

Milner, B. (2005). The Medial Temporal-lobe Amnesic Syndrome. *Psychiatric Clinics of North America, 28*(3), 599–611.

Minton, A. (2006). *What Kind of World Are We Building? The Privatisation of Public Space*. London: RICS.

Mizumori, S., Yeshenko, O., Gill, K., and Davis, D. (2004). Parallel Processing Across Neural Systems: Implications for a Multiple Memory System Hypothesis. *Neurobiology of Learning and Memory, 82*(3), 278–298.

Moffat, S., Elkins, W., and Resnick, S. (2006). Age Differences in the Neural Systems Supporting Human Allocentric Spatial Navigation. *Neurobiology of Aging, 27*(7), 965-972.

Moffat, S., Hampson, E., and Hantzipantelis, M. (1998). Navigation in a Virtual Maze: Sex Differences and Correlates with Psychometric Measures in Spatial Ability in Humans. *Evolution and Human Behaviour, 19*, 73–87.

Moffat, S., Kennedy, K., Rodrigue, K., and Raz, N. (2007). Extrahippocampal Contributions to Age Differences in Spatial Navigation. *Cereb Cortex, 17*, 1274–1282.

Moffat, S., and Resnick, S. (2002). Effects of Age on Virtual Environment Place Navigation and Allocentric Cognitive Mapping. *Behavioral Neuroscience, 116*(5), 851-859.

Moffat, S., Zonderman, A., and Resnick, S. (2001). Age Differences in Spatial Memory in a Virtual Environment Navigation Task. *Neurobiology of Aging, 22*(5), 787-796.

Mohebbi, H. R., and Ashouri, M. T. Symbol Processing in the Historical Carpet. 50-51.

Mohsenina, M., and Sevtsukb, A. (2013). The Impact OF Street Properties on Cnognitive Maps. *Journal of Architecture and Urbanism, 37*(4), 301–309.

Montello, D. (2001). *Spatial cognition.* Paper Presented at the International Encyclopedia of the Social & Behavioral Sciences.

Moser, E. I., Kropff, E., and Moser, M. B. (2008). Place Cells, Grid Cells, and the Brain's Spatial Representation System. *Annu. Rev. Neurosci, 31*, 69–89.

Motahari, A. (2006). Religious Art in Bourkhart Opinion. *Fantasy Quarterly, 16*, 141-145.

Moughtin, C., Cuesta, R., Sarris, C., and Signoretta, P. (1999). *Urban Design: Method and Technique*. London: Architectural Press.

Mueller, S. C., Jackson, C. P. T., and Skelton, R. W. (2008). Sex differences in a virtual water maze: An Eye Tracking and Pupillometry Study. *Behavioural Brain Research, 193*(2), 209-215.

Munan, H. (2002). Malaysia, New York: Benchmark Books.

Muller, R. (1996). A Quarter of a Century of Place Cells. *Neuron, 17*, 813–822.

Murakoshi, S., and Kawai, M. (2000). Use of Knowledge and Heuristics for Wayfinding in an Artificial Environment. *Environment and Behavior, 32*(6), 756–774.

Najafi, M., and Shariff, M. K. M. (2011). The Concept of a Place and Sense of Place in Architectural Studies. *International Journal of Human and Social Sciences, 6*(3), 187-193.

Najafpour, H. (2012). *Formal Method for Landmark Saliency Measurement Based on Social Network Analysis.* Master of Urban Design, Universiti Teknologi Malaysia, Skudai. (FAB30000012320)

Nardini, M., Thomas, R. L., Knowland, V. C. P., Braddick, O. J., and Atkinson, J. (2009). A Viewpoint-independent Process for Spatial Reorientation. *Cognition, 112*, 241–248.

Nasar, J. L. (1983). Environmental Factors, Perceived Distance and Spatial Behavior. *Environment and Planning B: Planning and Design, 10*, 275-281.

Newcombe, N. S., Ratliff, K. R., Shallcross, W. L., and Twyman, A. D. (2010). Young Children's Use of Features to Reorient is More Than Just Associative: Further Evidence Against a Modular View of Spatial Processing. *Developmental Science, 13*, 213–220.

Nystrom, C., and Nystrom, O. (1995). *Stress and Crisis Inventory SCI-93. A process-Oriented Personality Exploration Starting from a Crisis-theoretical Fram of Reference.* . Swedish, Stockholm.

O'Keefe, J., and Dostrovsky, J. (1971). The Hippocampus As a Spatial Map. Preliminary Evidence from Unit Activity in the Freely-moving Rat. *Brain Research, 34*, 171-175.

O'Keefe, J., and Nadel, L. (1978). *The Hippocampus As a Cognitive Map*. Oxford: Clarendon.

O'Keefe, J., and Nadel, L. (1979). Precis of O'Keefe and Nadel's the Topohippocampus As a Cognitive Map. *Behav. Brain Sci, 2*, 487–533.

O'Neill, M. (1991). Evaluation of a Conceptual Model of Architectural Legibility. *Environment and Behavior, 23*(3), 259 - 284.

O'Neill, M. J. (1991a). Effects of Signage and Floorplan Configuration on Wayfinding Accuracy. *Environment and Behavior, 23*(5), 553–574.

O'Neill, M. J. (1991b). Evaluation of a Conceptual Model of Architectural Legibility. *Environment and Behavior, 23*(3), 259.

Ocakçı, M., and Türk Aydın, T. (Eds.). (2012). İstanbul: Ninova.

Oei, N. Y., and et al. (2007). Glucocorticoids Decrease Hippocampal and Prefrontal Activation During Declarative Memory Retrieval in Young Men. *Brain Imaging Behav*(1), 31–41.

Önder, D. E., and Gigi, Y. (2010). Reading Urban Spaces by the Space-Syntax Method: A Proposal for the South Haliç Region. *Cities 27*, 260–271.

Packard, M. G., Hirsh, R., and White, N. M. (1989). Differential Effects of Fornix and Caudate Nucleus Lesions on Two Radial Maze Tasks: Evidence for Multiple Memory Systems. *Journal of Neuroscience, 9*(5), 1465–1472.

Packard, M. G., and McGaugh, J. L. (1996). Inactivation of Hippocampus or Caudate Nucleus with Lidocaine Differentially Affects Expression of Place and Response Learning. *Neurobiology of Learning and Memory, 65*(1), 65–72.

Passini, R. (1981). Wayfinding: A Conceptual Framework. *Urban Ecology, 5*, 17-31.

Passini, R. (1984). *Wayfinding in Architecture*. New York: Van Nostrand Reinhold.

Passini, R., and Shiels, G. (1987). *Wayfinding in Public Buildings: A Design Guideline* (Vol. AES/SAG 1–4). Ottawa: Documentation Centre, PublicWorks Canada.

Payne, A. (1995). *Advances in Relationship Marketing*. London: Kogan Page.

Penn, A. (2003). Space Syntax and Spatial Cognition: Or, Why the Axial Line? *Environment and Behavior, 35*, 30-65.

Penn, A. (2008). *Architectural Research.Advanced Research Methods in the Built Environment and Behavior*. Oxford: Wiley-Blackwell.

Penn, A., Hillier, B., Banister, D., and Xu, J. (1998). Configurational Modelling of Urban Movement Networks. *Environment and Planning B: Planning and Design, 25*(1), 59–84.

Penn, A., and Turner, A. (2004). Movement-generated Land-use Agglomeration: Simulation Experiments on the Drivers of Fine-scale Land-use Patterning. *URBAN DESIGN International, 9*(2), 81–96.

Piccardi, L., Bianchinib, F., Iasevoli, L., Giannonec, G., and Guarigliab, C. (2011). Sex Differences in a Landmark Environmental Re-orientation Task Only During the Learning Phase. *Neuroscience Letters, 503*, 181– 185.

Pollett, D., and Haskell, P. (1979). *Sign Systems for Libraries: Solving the Wayfinding Problem* (Vol. 2). New York: Idea Publications.

Pottmann, H. (2013). Architectural Geometry and Fabrication-Aware Design. *Nexus Network Journal*. doi: 10.1007/s00004-013-0149-5

Poucet, B. (1993). Spatial Cognitive Maps in Animals: New Hypotheses on Their Structure and Neural Mechanisms. *Psychological Review, 100*, 163–182.

Pratt, S., Brooks, S., and Franks, N. (2001). The Use of Edges in Visual Navigation by the Ant Leptothorax albipennis. *Ethol Sociobiol, 107*, 1125–1136.

Pruessner, J. C., Dedovic, K., Pruessner, M., Lord, C., Buss, C., and Collins, L. (2010). Stress Regulation in the Central Nervous System: Evidence from Structural and Functional Neuroimaging Studies in Human Populations – 2008 Curt Richter Award Winner. *Psychoneuroendocrinology, 35*(1), 179–191.

Pugalis, L. (2009). Achieving Place Quality. *URBAN DESIGN, 109*, 14–15.

Qvarsell, R. (1996). *Vardens Idehistoria*. Stockholm: Carlsson.

Qvarsell, R., and Torell, U. (2001). Humanistisk Halsoforskning: Ett Vaxande Forskningsfalt. *Humanistisk Halsoforskning*, 9-22.

Rapp, B. (1999). *Culture in Health Care Vis-a-vis Health Care As Culture*. Stockholm: Stockholms Lans Museum.

Rasmussen, S. E. (1986). *Experiencing Architecture*. Cambridge: The MIT press.

Ratti, C. (2004). Space Syntax: Some Inconsistencies. *Environment and Planning B: Planning and Design, 31*, 487 - 499.

Raubal, M. (2001). *Agent-based Simulation of Human Wayfinding: A Perceptual Model for Unfamiliar Buildings.* Vienna University of Technology.

Raubal, M., and Winter, S. (2002). *Enriching Wayfinding Instructions With Local Landmarks*. Paper Presented at the Geographic Information Science - Second International Conference, GIScience 2002, Boulder, CO, USA.

Read, M. (2003). Use of Colour in Child Care Environments: Application of Colour for Wayfinding and Space Definition in Alabama Child Care Environments. *Early Childhood Education Journal, 30*(4), 233–239.

Reason, J. (1990). *Human Error*. Cambridge: Cambridge University Press.

Rittel, H. (1972). Systems Analysis of the 'First and Second Generations'. *Bedriftsokomen, 8*, 390–396.

Ruddle, R. A., Payne, S. J., and Jones, D. M. (1999). The Effect of Maps on Navigation and Search Strategies in Very-Larg-Scale Virtual Environments. *Journal of Experimental Psychology: Applied, 5*, 54-75.

Ryan, R. L., and Kaplan, R. (1998). *With People in Mind: Design and Management of Everyday Nature*. Washington DC: Island press.

Sacks, O. (2007). *Karisini Sapka Sanan Adam (A Man Who Mistook His Wife for a Hat)*. Istanbul: YKY.

Sandstrom, N. J., and et al. (1998). Males and Females Use Different Distal Cues in a Virtual Environment Navigation task. *Brain Res. Cogn. Brain Res, 6*, 351–360.

Sapolsky, R. (1994). The physiological Relevance of Glucocorticoid Endangerment of the Hippocampus. *Annals New York Academy of Sciences*(746), 294-304.

Sapolsky, R., Uno, H., Rebert, C., and Finch, C. (1990). Hippocampal Damage Associated with Prolonged Glucocorticoid Exposure in Primates. *Journal of Neuroscience, 10*(9), 2897–2902.

Saremi, A., and Radmrd, T. (1998). The Values of Sustainable Architecture. *Iranian Cultural Heritage Organization*, 80.

Saucier, D. M., Green, S. M., Leason, J., MacFadden, A., Bell, S., and Elias, L. J. (2002). Are Sex Differences in Navigation Caused by Sexually Dimorphic Strategies or by Differences in the Ability to Use the Strategies? *Behavioral Neuroscience, 116*, 403–410.

Schwabe, L., Oitzl, M. S., Philippsen, C., Richter, S., Bohringer, A., and Wippich, W. (2007). Stress Modulates the Use of Spatial Versus Stimulus-response Learning Strategies in Humans. *Learn Memory, 14*(1), 109–116.

Schwabe, L., and Wolf, O. T. (2013). Stress and Multiple Memory Systems: from 'Thinking' to 'Doing'. *Trends in Cognitive Sciences, 17*(2), 60-68. doi: http://dx.doi.org/10.1016/j.tics.2012.12.001

Scott, R. (1997). The Symbolic Form of Architecture. *An Investigation into Its Philosophical Foundations and a Discussion on the Development of the Perception of Architectural from by Modern Theoreticians and Symbolist Architects*(Virginia: Alexandria University), 7-8.

Scoville, W. B., and Milner, B. (1957). Loss of Recent Memory after Bilateral Hippocampal Lesions. *Journal of Neurology*(20), 11–21.

Seamon, D., and Sowers, J. (2008). Place and Placelessness, Edward Relph. Key Texts in Human Geography. *Sage*, 43-51.

Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach*. New Jersey: John Wiley and Sons.

Shayestehfar, M., and Shakarpor, S. (2010). Compared to Carpet Weaving Designs and the Mosque of Yazd Meybod. *Journal of Islamic Art, 11*, 25-43.

Shettleworth, S., and Sutton, J. (2005). Multiple Systems for Spatial Learning: Dead Reckoning and Beacon Homing in Rats. *J Exp Psychol Anim Behav Process, 31*, 125–141.

Sheynikhovich, D., and Arleo, A. (2010). A Reinforcement Learning Approach to Model Interactions between Landmarks and Geometric Cues During Spatial Learning *Brain Research, 1 3 6 5*, 35 – 47.

Siegel, A. W., and White, S. H. (1975). *The Development of Spatial Representations of Large-scale Environments* (Vol. 10). New York: Academic Press.

Sitte, C. (1945). *The Art of Building Cities: City Building According to Its Artistic Fundamentals*. New York: Hyperion Press.

Sovrano, V., Bisazza, A., and Vallortigara, G. (2005). Animals Use of Landmarks and Metric Information to Reorient: Effects of the Size of the Experimental Space. *Cognitive, 97*, 121–133.

Spelke, E., Lee, S., and Izard, V. (2010). Beyond Core Knowledge: Natural Geometry. *Cogn Sci, 34*, 863–884.

Spence, I., and Feng, J. (2010). Video Games and Spatial Cognition. Review of General. *Psychology, 14*, 92–104.

Spence, I., Wong, P., Rusan, M., and Rastegar, N. (2006). How Colour Enhances Visual Memory for Natural Scenes. *Psychological Science, 17*(1), 1–6.

Spiers, H. J., and Maguire, E. A. (2008). The Dynamic Nature of Cognition During Wayfinding. *Journal of Environmental Psychology, 28*(3), 232–249.

Squire, L. R., and Zola-Morgan, S. (1991). The Medial Ttemporal Lobe Memory System. *Science, 253*(5026), 1380–1386.

Stanford, S., and wheel, T. o. f. t. r. t. (2007). The Open Field Test: Reinventing the Wheel. *J Psychopharmacol, 21*, 134–135.

Steck, S. D., and Mallot, H. A. (2000). The Role of Global and Local Landmarks in Virtual Environment Navigation. *Presence, 9*(1).

Stephenson, J. (2008). The Cultural Values Model: An Integrated Approach to Values in Landscapes. *Landscape and Urban Planning, 84*, 127-139.

Stigsdotter, U. A., and Grahn, P. (2004). A Garden at Your Doorstep May Reduce Stress Private Gardens as Restorative Environments in the City.

Suzuki, K., Yamadori, A., Hayakawa, Y., and Fujii, T. (1998). Pure Topographical Disorientation Related to Dysfunction of the Viewpoint Dependent Visual System. *Cortex, 34*, 589–599.

Syed Mahdzar, S. S. B. (2008). *Sociability Vs Accessibility Urban Street Life.* Ph.D, University College London, London.

Syed Mahdzar, S. S. B. (2013). *Streets for People: Sustaining Accessible and Sociable Streets in Pasir Gudang City Centre.* Paper Presented at the The Ninth International Space Syntax Symposium Seoul.

Tahoori, N. (2006). Officials of Paradise in the Traditional Arts. *Khyal Quarterly, 16*, 4.

Takahashi, T., Ikeda, K., Ishikawa, M., Tsukasaki, T., Nakama, D., Tanida, S., and Kameda, T. (2004). Social Stress-induced Cortisol Elevation Acutely Impairs Social Memory in Humans. *Neurosci. Lett, 363*, 125–130.

Talbot, J., and Kaplan, S. (1983). Psychological Perspective. *Stad and Land*(85), 4-22.

Tan, D. S., Czerwinski, M. P., and Robertson, G. G. (2006). Large Displays Enhance Optical Flow Cues and Narrow the Gender Gap in 3-D Virtual Navigation. *Human Factors 48*(2), 318–333.

Tang, C. F. and E. C. Tan (2013). How stable is the tourism-led growth hypothesis in Malaysia? Evidence from disaggregated tourism markets. *Tourism Management* 37: 52-57.

Tang, C. F. and E. C. Tan (2015). Does tourism effectively stimulate Malaysia's economic growth? *Tourism Management* 46: 158-163.

Tashakkori, A., and Teddlie, C. (1998). *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Thousand Oaks, CA: Sage.

Tenbrink, T., and Wiener, J. (2009). The Verbalization of Multiple Strategies in a Variant of the Traveling Salesperson Problem. *Cognitive Processing, 10*(2), 143–161.

Thompson, C. W., Roe, J., Aspinall, P., Mitchell, R., Clow, A., and Miller, D. (2012). More Green Space is Linked to Less Stress in Deprived Communities: Evidence from Salivary Cortisol Patterns. *Landscape and Urban Planning, 105*(3), 221-229. doi: 10.1016/j.landurbplan.2011.12.015

Thorndyke, P. W., and Hayes-Roth, B. (1982). Differences in Spatial Knowledge Acquired from Maps and Navigation. *Cogn. Psychol, 14*, 560–589.

Tibbalds, F. (1992). *Making People-Friendly Towns: Improving the Public Environment in Towns and Cities*. London: Longman.

Tolman, E. C. (1948). Cognitive Maps in Rats and Men. *Psychological Review, 55*, 189-208.

Tommasi, L., and Thinus-Blanc, C. (2004). Generalization in Place Learning and Geometry Knowledge in Rats. *Learn Memory, 11*, 153–161.

Tóth, G. and L. Dávid (2010). Tourism and accessibility: An integrated approach. *Applied Geography,* 30(4): 666-677.

Toraby., M. (2006). Economy. *Economic Trends, 20*(6), 42-47. doi: http://www.noormags.com

Trowbridge, C. C. (1913). On Fundamental Methods of Orientation and "Imaginary Maps.". *Science, 38*, 990.

Trullier, O., Wiener, S. I., Berthoz, A., and Meyer, J.-A. (1997). Biologically Based Artificial Navigation Systems: Review and Prospects. *Progress in Neurobiology 51*, 483–544.

Tulving, E. (1972). Episodic and Semantic Memory. In E. Tulving and W. Donaldson (Eds.), *Organization of Memory* (pp. 381–403). New York: Academic Press.

Tulving, E. (1983). *Elements of Episodic Memory*. Oxford: Clarendon Press.

Twyman, A., and Newcombe, N. (2010). Five Reasons to Doubt the Existence of a Geometric Module. *Cogn Sci, 34*, 1315–1356.

Ulrich, R. S. (1984). View Through a Window May Influence Recovery from Surgery. *Science, 244*, 420-421.

Ulrich, R. S. (1993). Biophilia, Biophobia, and Natural Landscapes. *The Biophilia Hypothesis*, 74-137.

Ulrich, R. S. (1999). Effects of Gardens on Health Outcomes: Theory and Research. *Healing Gardens: Therapeutic Benefits and Design Recommendations*, 27-86.

Ulrich, R. S. (2001). Effects of Healthcare Environmental Design on Medical Outcomes. *Design and Health*, 49-59.

UNWTO, W. T. O. (2012). The most visited countries in 2012. Retrieved 4 June 2015, 2015, from http://www2.unwto.org/.

Van den Berg, A. E., and Vlek, C. A. (1998). The Influence of Planned-Change Context on the Evaluation of Natural Landscapes. *Landscape and Urban Planning, 43*(1), 1-10.

Vandermey, A. (1984). Assessing the importance of urban tourism: conceptual and measurement issues. *Tourism Management* 5(2): 123-135.

Vargas, J. P., Portavella, M., Quintero, E., and López, J. C. (2011). Neural Basis of the Spatial Navigation Based on Geometric Cues. *Behavioural Brain Research, 225*, 367– 372.

VarghaKhadem, F., Gadian, D. G., Watkins, K. E., Connelly, A., Van Paesschen, W., and Mishkin, M. (1997). Differential Effects of Early Hippocampal Pathology on Episodic and Semanticmemory. *Science, 277*, 376–380.

Vasquez, R., Ebensperger, L., and Bozinovic F. (2002). The Infuence of Habitat on Travel Speed, Intermittent Locomotion, and Vigilance in a Diurnal Rodent. *Behav Ecol, 13*, 182–187.

Vilar, E., Rebelo, F., Noriega, P., Teles, J., and Mayhorn, C. (2013). The Influence of Environmental Features on Route Selection in an Emergency Situation. *Applied Ergonomics*, 1-10.

Voermans, N. C., Petersson, K. M., Daudey, L., Weber, B., van Spaendonck, K. P., and Kremer, H. P. H. (2004). Interaction Between the Human Hippocampus and the Caudate Nucleus During Route Recognition. *Neuron, 43*(3), 427–435.

Waller, D., and Lippa, Y. (2007). Landmarks as Beacons and Associative cues: Their Role in Route Learning. *Memory and Cognition, 35*(5), 910-924.

Walsh, R., and Cummins, R. (1976). The Open Field Test: A Critical Review. *Psychol Bull, 83*, 482–504.

Wang, R. F., Hermer, L., and Spelke, E. S. (1999). Mechanisms of Reorientation and Object Localization by Children: A Comparison with Rats. *Behavioral Neuroscience, 113*, 475–485.

Weber, R., and Landis, J. (2012). *Modelling Urban Systems,The Oxford Handbook of Urban Planning*. Oxford, UK: Oxford University Press.

Weisman, G. (1981). Evaluating Architectural Legibility. *Environment and Behavior, 13*(2), 189 - 204.

Weisman, J. (1981). Evaluating Architectural Legibility: Wayfinding in the Built Environment. *Environment and Behavior, 13*(2), 189–204.

Welter, V. M., and Whyte, I. B. (2003). *Biopolis: Patrick Geddes and the City of Life*. Cambridge, MA: MIT Press.

Weston, L., and Handy, S. (2004). *Mental Maps, in Handbook of Transport Geography and Spatial Systems*. Amsterdam: Elevesier.

Więckowski, M., et al. (2014). Road accessibility to tourist destinations of the Polish–Slovak borderland: 2010–2030 prediction and planning. *Geographia Polonica* 87(1): 5-26.

Wiener, J. M., Büchner, S., and Hölscher, C. (2009). Taxonomy of Human Wayfinding: A Knowledge-based Approach. *Spatial Cognition and Computation, 9*(2), 152–165.

Wilkniss, S., Jones, M., Korol, D., Gold, P., and Manning, C. (1997). Age-related Differences in an Ecologically Based Study of Route Learning. *Psychol Aging, 12*, 372–375.

Wills, T. J., and Cacucci, F. (2014). The Development of the Hippocampal Neural Representation of Space. *Current Opinion in Neurobiology, 24*, 111–119.

Wilson, M. A., and McNaughton, B. L. (1993). Dynamics of the Hippocampal Ensemble Code for Space. *Science, 261*, 1055–1058.

Wolbers, T., and Hegarty, M. (2010). What Determines Our Navigational Abilities? Trends Cogn. *Science, 14*, 138-146.

Wolf, O. (2009). Stress and Memory in Humans: Twelve Years of Progress? [history]. *Brain research* 1 4 2 – 1 5 4.

Wolf, O. T., Kudielka, B. M., Hellhammer, D. H., Hellhammer, J., and Kirschbaum, C. (1999). Opposing Effects of DHEA Replacement in Elderly Subjects on Declarative Memory and Attention after Exposure to a Laboratory Stressor. *Psychoneuroendocrinology*(23), 617–629.

Woolley, H., Rose, S., Carmona, M., and Freeman, J. (2004). *The Value of Public Space, How High Quality Parks and Public Spaces Create Economic, Social and Environmental Value*. London: CABE Space.

World, Health, and Organization. (1948). *Preamble to the Constitution of the World Health Organization As Adopted by the International Health Conference*. Paper Presented at the the International Health Conference, New York.

Worpole, K., and Knox, K. (2007). *The Social Value of Public Spaces*. York: Joseph Rowntree Foundation. Giddings et al.

Burgess, N. (2006). Spatial memory: How egocentric and allocentric combine. *Trends Cogn*. Sci 10(12): 551–557.

Yaski, O., and Eilam, D. (2007). The Impact of Landmark Properties in Shaping Exploration and Navigation. *Anim Cogn 10*, 415–428.

Yaski, O., Portugali, J., and Eilam, D. (2011). City Rats: From Rat Behavior to Human Spatial Cognition in Urban Environments. *Anim Cogn, 14*, 655–663.

Yaski, O., Portugali, J., and Eilam, D. (2012). Traveling in the Dark: The Legibility of a Regular and Predictable Structure of the Environment Extends Beyond Its Borders. *Behavioural Brain Research, 229*(1), 74-81. doi: http://dx.doi.org/10.1016/j.bbr.2011.12.043

Yaskia, O., Portugalib, J., and Eilama, D. (2011). Arena Geometry and Path Shape: When Rats Travel in Straight or in Circuitous paths? *Behavioural Brain Research, 225*, 449– 454. doi: 10.1016/j.bbr.2011.07.055

Yi, Y., and Jeon, H. (2003). Effects of Loyalty Programs on Value Perception, Program Loyalty and Brand Loyalty. *Journal of the Academy of Marketing Science, 31*, 229-240.

Zakzanis, K., Quintin, G., Graham, S., and Mraz, R. (2009). Age and Dementia Related Differences in Spatial Navigation within An Immersive Virtual Environment. *Med Sci Monit, 15*, 140–150.

Zhang, L., Chiradia, A., and Zhuang, Y. (2013). *In the Intelligibility Maze of Space Syntax: A Space Syntax Analysis of Toy Models, Mazes and Labyrinths.* Paper Presented at the Ninth International Space Syntax Symposium, Seoul.