PERCEIVED COMPLEXITY AND PERCEIVED LEGIBILITY ON CHOICE OF PATHWAY BY URBAN PEDESTRIANS

MOHAMMAD PAYDAR

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To my dear son, Rayan

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ABSTRACT

The effects of environmental factors on walking behavior are explored based on the purpose of the walking trip. Since everybody walks for daily transportation, studying the walking behavior of those who walk for transport would contribute to maintain the minimum rate of physical activity. Commuters are the major group of pedestrians who walk for their daily transportation along the pathways of central business district (CBD). In Kuala Lumpur's CBD, an average of 120,000 commuters passes through it daily. It provides the commuters several alternative pathways between metro stations and workplaces. Despite the significance of shorter time and distance as path choice criteria of commuters, while presence of multiple pathways with almost the same length, perceived time and perceived distance as well as certain environmental factors would play the key role in path choice of commuters. In this regard, this study investigates on perceived complexity (PC) and perceived legibility (PL) as path choice criteria of commuters. This study was conducted in nine zones of CBD of Kuala Lumpur. These nine zones were the results of zone selection process which was designed to select the appropriate zones of study. Two survey questionnaires and an observational analysis were used to elicit data on the PC and PL. During the survey questionnaire, the commuters were followed and their traversed walkways were recorded. Fifty four commuters were determined for the first survey and 324 commuters were selected for the second survey questionnaire. Data was analyzed using SPSS Version 16 and the tests including multiple regression, Pearson correlation, and t-Test were run. The lowest PC and the highest PL showed moderate importance regarding the path choice of commuters as compared with the other examined path choice criteria. It was also found that these two perceptual factors via a significant correlation with perceived time, rate of pleasant and rate of comfort contribute to the path choice of the commuters. Furthermore, the physical factors that are presence of people, conflict with motor vehicles and presence of buildings specified by their height and facade are taken into account as related to PC and PL of the commuters. This research concludes that the urban design factors that are improving the safety of commuters from the motor vehicles, increasing the number of buildings, specified by their height and facade, and heightening the buildings located near the metro stations contribute to improve the path choice and the walking rate of commuters in the pathways of the CBD of Kuala Lumpur.

ABSTRAK

Kesan-kesan alam sekitar terhadap perangai berjalan telah diteroki berdasarkan tujuan perjalanan. Memandangkan semua orang berjalan setiap hari, tingkah laku golongan ini perlu dibelajari untuk mengekalkan kadar aktiviti fizikal pada tahap yang minimum. Penumpang-penumpang kenderaan adalah kumpulan utama pejalan kaki harian di daerah perniagaan pusat (CBD). Dalam CBD Kuala Lumpur, sebanyak 120,000 orang penumpang secara puratanya melalui kawasan tersebut setiap hari. Kawasan ini menyediakan beberapa laluan alternatif kepada para penumpangnya di antara stesen metro dan tempat-tempat bekerja. Di samping kepentingan kriteria masa dan jarak yang lebih singkat, kehadiran pelbagai laluan yang lebih kurang sama, jangkaan masa dan jangkaan jarak serat faktor-faktor persekitaran yang lain juga memainkan peranan yang penting dalam pemilihan laluan perjalanan. Dalam hal ini, kajian ini telah menyiasat jangkaan kerumitan (PC) dan jangkaan kebolehbacaan (PL) sebagai kriteria pilihan laluan perjalanan. Kajian ini telah dijalankan di sembilan zon CBD Kuala Lumpur yang telah dipilih melalui satu proses khas untuk memilih kawasan-kawasan yang sesuai. Dua jenis kajian soal selidik serta satu jenis analisi pemerhatian telah digunakan untuk mendapatkan data PC dan PL. Semasa kajian soal selidik, para pejalan kaki telah diekori untuk merekodkan laluan perjalanan mereka. Sebanyak 54 orang penumpang telah ditentukan dalam kajian pertama dan 324 penumpang telah dipilih untuk kajian kedua. Data yang dikumpul ini telah dianalisikan menggunakan perisian SPSS versi 16, dan ujian-ujian yang telah dijalankan termasuk regresi berganda, korelasi Pearson, dan t-Test. PC terendah dan PL yang paling tinggi menunjukkan kepentingan sederhana untuk pilihan laluan perjalanan berbanding dengan kriteria pilihan perjalanan yang lain. Kedua-dua faktor ini juga didapati mempunyai hubungan yang signifikan dengan jangkaan masa, kadar keselesaan dan kadar kesenangan dalam mempengaruhi pilihan laluan perjalanan. Tambahan pula, faktor-faktor fizikal yang lain seperti kehadiran orang, konflik dengan kenderaan motor dan kehadiran bangunan mengikut ketinggian dan fasad mereka juga telah diambil kira sebagai faktor-faktor yang berkaitan dengan PC dan PL. Kesimpulannya, faktor-faktor reka bentuk bandar yang boleh meningkatkan keselamatan penumpang daripada kenderaan bermotor, peningkatan bilangan bangunan mengikut ketinggian dan fasad mereka, dan peningkatan ketinggian bangunan-bangunan yang sedia ada serta berhampiran dengan stesen metro boleh meningkatkan peluang laluan tertentu untuk dipilih oleh penumpang-penumpang di CBD Kuala Lumpur.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

PC	-	Perceived complexity
PL	-	Perceived legibility
CBD	-	Central Business District

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

This research examines two perceptual factors of perceived complexity and perceived legibility in relation with the path choice of commuters in the Central Business District (CBD) of Kuala Lumpur in Malaysia. This chapter presents the overall structure of the research as well as the research background. This is followed by the research problem and the aims and objectives of this study. Furthermore, the overview of the study area and methodology adopted to examine the objectives of this research are presented in this chapter. In addition, the scope and the limitations of the research as well as the significance of the study are discussed.

1.2 Research Background

The effects of environmental factors on walking behavior should be explored based on the purpose of the walking trip; whether walking for transport or walking for recreation. Since everybody walks in his/her daily transport, studying the walking behavior of those who walk for transport would contribute to maintain the minimum rate of physical activity of residents. In this regard, commuters are the major group of people who walk for transport especially along the pathways of CBD. Considering the city centre or Central Business District of Kuala Lumpur, the

averages of 120,000 commuters pass through daily (Draft Structure Plan Kuala Lumpur 2020, 2003). Accordingly, investigating on the environmental factors which accelerates the walking rates of commuters especially among the pathways of Central Business District is highlighted in this research. According to Guo (2009), using path choice of pedestrians is the appropriate methods to explore the effects of environmental factors on walking behavior of commuters if the context presents the multiple walkable pathways among different urban points. There are usually several pathways on the way of commuters between stations and workplaces which can be selected by them to reach their destinations in CBD. Therefore, this research focuses on path choice criteria of commuters between stations and workplaces in order to explore the effects of environmental factors on path choice as well as walking behavior of commuters in CBD of Kuala Lumpur.

1.3 Research Problem

According to Hill (1982), the shorter distance is the main important factor while the number of the turns is the second significant factor in the path choice of commuters. Pedestrians mostly tend to choose the shortest route; however, they are seldom aware that they are minimizing the distances and time as a first strategy in their route choice (Senevarante and Morall, 1985; Guy, 1987, Kitazawa and Batty, 2004; Golledge, 1995; Hill, 1982; Ovstedal and Ryeng, 2002; and Agrawal et al., 2008).

However, minimizing the distance or the duration of a trip is not necessarily the only factor that affects the pedestrians' choice of itinerary (Foltete and Piombini, 2010). The distance or time between an origin and a destination, the number of obstacles or interactions with other pedestrians along the route, the directness of the route -i.e. the number of directional changes-, the level-of-service provided by the roadway and traffic environment -including the expected number of interactions with other pedestrians-, and the overall attractiveness of the environment are considered as the additional certain factors (Hoogendoorn and Bovy, 2004; Chiolek, 1978; and Gipps, 1986). There are also similar important factors in route choice behavior

including the habit, the number of crossings, pollution and the noise level, safety and shelter from poor weather conditions, and stimulation of the environment and pleasantness (Bovy and Stern, 1990). In addition, Seveviratne and Morrall (1985) found that the presence of the shops, crossings, least crowded, most weather protection, most personal security in terms of crime, traffic noise and safety from the motor vehicles contributes to the path choice. However, they argued that shorter time and distance are definitely the most important path choice criteria of the pedestrians. It is concluded that shortest time and distance are the most important path choice criteria of pedestrians and all the other path choice criteria are counted as the secondary path choice criteria (Agrawal et al., 2008, Senevarante and Morall, 1985; and Golledge, 1995).

In urban context, especially with the grid patterns, the alternative presented pathways to pedestrians between the origin and the destination would usually have almost the same length (Agrawal et al., 2008). The reason is that there are usually several situations in which certain parallel pathways connect one location to another. Therefore, there are many situations in which several pathways with almost the same length can be selected by pedestrians to reach their destination in the urban setting. None of the studies on path choice of pedestrians has focused on such situations in an urban setting. Same length of the pathways between the origin and the destination implies on the same dedicated time and distance among all of the alternative pathways. In this situation the question arises is that what path choice criteria other than shorter time and distance are used by commuters while there are some selectable alternative pathways with almost the same dedicated time and distance?

Regarding the possible alternatives, two scenarios are defined (Figure 1.1). In the first scenario, the quickest pathway considering the shortest time and distance is the most important path choice criteria of commuters. The studies on perceived time and distance argued that in this situation, commuters judge the quickest pathway on the basis of their perception of time and distance instead of real time and distance dedicated to different alternative pathway between the origin and the destination (Golledge and Stimson, 1997; Brimberg, 1992; Thompson, 1963; Garling and Loukopoulos, 2007; and Jansen-Osmann and Wiedenbauer, 2004). Therefore, in this scenario perceived time and distance should be taken into account as path choice

criteria of commuters instead of real time and distance. According to the studies on perceived time and distance, there are several physical features i.e. number of turns, number of intersections and visibility of destinations which contribute to perceived time and perceived distance along the pathways. The storage-size hypothesis provides a theoretical basis for the relationship between physical factors along the pathways and perceived time and distance. It suggests that when the surroundings contain too much information, this overload leads to size distortions in the human's perceptions. And consequently this contributes to perceive the time and distance of the pathway much more than the real time and distance for normal walking from the origin to the destination. Thus, complex pathways with more environmental features require a greater effort to walk and more mental capacity to process their presented information comparing to less complex walking routes and the perceived time and distance of the more complex pathway would be much more than those with the more simple structure.

In the second scenario, the other alternative factors are regarded as more important path choice criteria of commuters in comparison with the shorter time and distance. Accordingly, these path choice criteria are more important for the path choice of commuters comparing to the perceived time and distance of the alternative pathways.

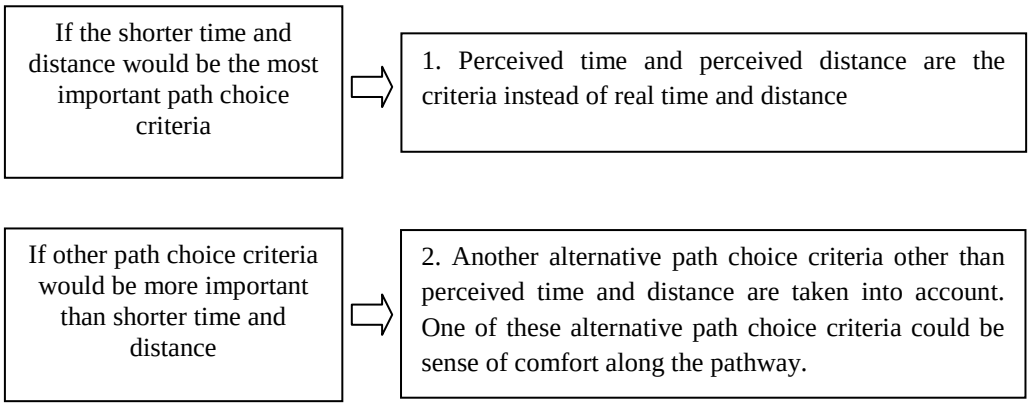

Figure 1.1: The presented scenarios in the case of the availability of alternative pathways with almost the same length for commuters

This research considers the perceived complexity (PC) and the perceived legibility (PL) as the potential alternative factors of commuters' path choice instead

of shorter time and distance. These two perceptual variables are defined in relation with commuters' movement. The PC of the path is defined in terms of the degree to which the visual and configurational elements of the pathways would increase the level of difficulty on commuter's movement (Paydar and Ismail, 2012). For the commuters who have a high familiarity with the pathways, PL of the path is defined in terms of the degree to which the pathway provides the strongest sense of direction toward the destination. Based on the definition of these perceptual factors, the PC is regarded as the negative factor for the path choice of commuters. And in contrast with the PC, the PL comes up as a positive factor. Therefore, it is expected to identify the contribution of the lowest PC as well as the highest PL to the path choice of commuters in CBD of Kuala Lumpur.

These two perceptual factors are highlighted in this research based on their theoretical and empirical relationships with both of the possible before-mentioned scenarios. There are the theoretical relationships between the PC as well as the PL with perceived time and distance. There are also relationships between these factors and certain path choice criteria of commuters such as most comfort and most pleasant pathways. The assumed relationships between these two factors and perceived time and distance as well as certain important path choice criteria of commuters are discussed in Chapter 2. Figure 1.2 shows the sequence of the study areas in accordance with the statement of the problem which leads to define the aim of this study.

1.4 The Research Aim

This study investigates on the relationship between the perceived complexity as well as the perceived legibility and the path choice of commuters in the situation that alternative pathways with almost the same length are available in the Central Business District. Since the PC is considered as a negative factor for the path choice and the PL as a positive factor, the lowest PC and the highest PL are examined on the path choice criteria of commuters.

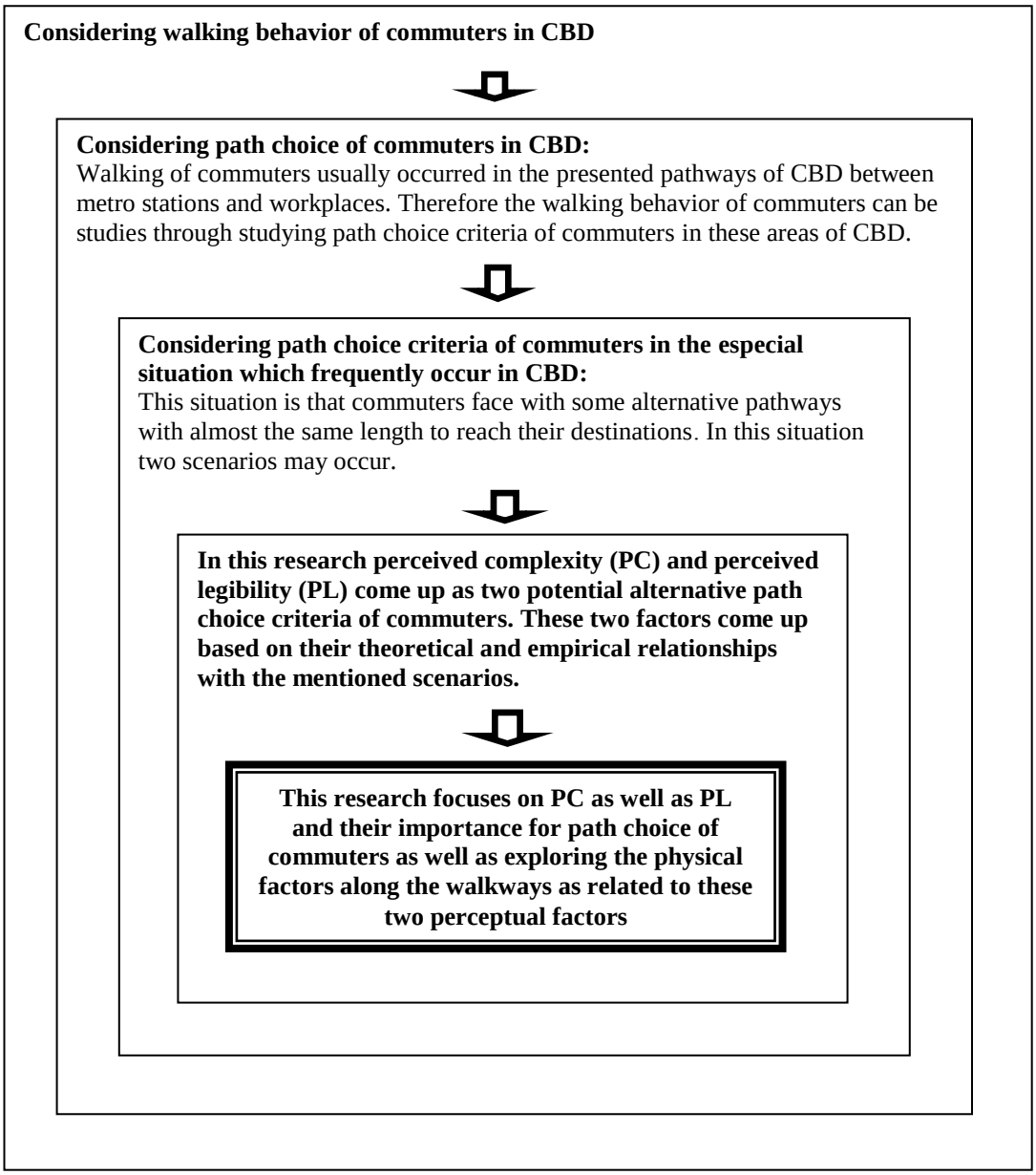

Figure 1.2: The sequence of the study areas leading to define the research aim

1.5 Research Objectives

This study comprises of four objectives. The first objective of this study is to evaluate the importance of the lowest PC as well as the highest PL for the path choice among the other probable path choice criteria of commuters. Examining this objective will lead to find out which of the above mentioned scenarios is true about the path choice criteria of commuters in this context. The second objective is to

explore the related physical factors of the PC as well as the PL. In the third objective, the PC and the PL are operationalized based on their related physical factors. In other words, the relationships between the PC and PL with their related physical factors will be examined statistically in order to measure these two perceptual factors based on their related physical factors. Finally, the fourth objective is to examine the indirect ways in which the PC and PL contribute to the path choice of commuters. And these indirect ways are through examining the correlations between the PC and PL and their assumed path choice criteria of commuters. It must be noted that the fourth objective was defined based on an assumption that these related path choice criteria to the PC and PL, are more important criteria as compared with the lowest PC and the highest PL. Otherwise, the indirect ways of contribution of the lowest PC and the highest PL to the path choice of commuters would make no sense. In short, the objectives of this study are as follow:

1. To evaluate the importance of the lowest PC and the highest PL for the path choice of commuters as compared with other related path choice criteria,

2. To explore the physical factors which contribute to the perception of complexity and legibility of the commuters,

3. To operationalize the PC and the PL on the basis of their related physical factors, and

4. To examine the indirect ways in which the lowest PC and the highest PL contribute to path choice of commuters.

The research questions of this research are as follow:

1. Do the lowest PC and the highest PL are counted as the path choice criteria of commuters?

2. What physical factors contribute to the perception of complexity of commuters along the pathways?

3. What physical factors contribute to the perception of legibility of commuters along the pathways?

4. What physical factors related to PC show the significant correlations with rate of PC in the traversed pathways of the commuters?

5. What physical factors related to PL show the significant correlations with rate of PL in the traversed pathways of the commuters?

1.6 The Study Area and Research Methodology

To implement current study it is mandatory to design the procedure in which certain representative zones between stations and major workplaces of commuters in different areas of CBD of Kuala Lumpur are selected. Selection of these zones as the representative zones of CBD are in accordance to the key question, the purpose and the objectives of this study. Zone selection process consisted of two steps of map study and observational analysis. Each zone has three main components; the metro station, the workplace of commuters and the alternative pathways between the origin and the destination points of commuters, which are usually used by commuters in that zone. Within the first step or map studies it was tried to choose the zones based on the primitive criteria which can be met on the map. Certain zones were selected as the results of the first step. Then, within the second or observational step, the selected zones were evaluated in terms of meeting certain observational criteria. On the basis of zone selection process, finally, nine zones as the representative zones of CBD were selected to be studied at this research. These none zones met all the criteria of the first and second step of zone selection process. Indeed, the data of the this study were collected within these selected zones. Two consequent survey questionnaires called first and second survey and an observational analysis were used to examine the objectives of this research. The quantitative method was used in order

to examine the first, third and forth objectives. Exploring the second objective, a mix of qualitative and quantitative methods including open ended questions and context analysis were applied.

The data collection for the first survey is implemented by selecting the respondents that are commuters from the determined workplace of each zone. And the data collection within the second survey is implemented by following the commuters from the workplace of each zone toward the metro station of that zone. Then, after recording the traversed path, commuters were asked to fill up the survey questionnaire as they reach to the determined metro station of the regarded zone.

1.7 The Scope and the Limitations of the Research

This research focuses on commuters and their walking trips between the metro stations and their workplaces in CBD of Kuala Lumpur. It is due to the fact that commuters are the major group of pedestrians who usually walk between metro stations and workplaces along the pathways of CBD. There are also other groups of pedestrians in CBD who walk to reach other destinations except workplaces in CBD. The path choice criteria of these groups of pedestrians are not examined in this study.

In this study, the path traversing of commuters along the selected zones of CBD needs to be recorded between pre-determined workplaces and metro stations. However, recording the normal walking movement of commuters from the metro stations to the pre-determined workplaces was impossible. It is because of many pedestrians walking from the metro stations to reach several workplaces around the stations and it is impossible to identify the people going to a certain workplace. Thus, the path traversing of commuters were recorded from the selected workplace toward the metro station of each zone.

1.8 Significance of the Study

Since everybody walk for transport, studying the walking behavior as well as the path choice of those who walk to their destinations contributes to maintain the minimum rate of physical activity of the residents. As noted before, commuters are the major groups of pedestrians who walk to reach their destinations regularly. And the CBD -including numerous walking areas between metro stations and workplaces- is the best area to examine the path choice of pedestrians especially commuters.

There are many situations in which several pathways with almost the same length can be selected by pedestrians to reach their destination in the urban setting. These situations are highlighted as the pathways follow a grid pattern in the urban setting. None of the studies on path choice of pedestrians has focused on such situations in an urban setting. Having found the importance of perceived complexity as well as perceived legibility in relation with the path choice of commuters, introduces new alternative factors. Therefore, these perceptual factors and their representative physical factors are significant in relation with the path choice and walking behavior of pedestrians.

Perceived time and distance and their related physical and perceptual factors along the walkways play a key role in the urban design studies. On the basis of the empirical studies on perceived time and distance of pedestrians, there are several factors i.e. number of turns and visibility of destinations in relation with perceived time and distance of the pedestrians. Examining the relationships between the PC as well as the PL and perceived time of the commuters, would also lead to introduce these perceptual factors in relation with perceived time of pedestrians.

1.9 Structure of the Thesis

This chapter presented the overall structure of the research through providing a review of the scope, purpose and the objectives as well as the methodology. It also highlights the significance of the research. The thesis consists of six chapters.

Chapter 2 presents a review of literature in the research area of concern. In this chapter, the studies on walking behavior of pedestrians are reviewed. And the most important path choice criteria of commuters are extracted. Finally, the definition of the PC as well as the PL on the basis of the commuters' needs and specifications are presented. Furthermore, the theoretical and empirical relationships between the PC as well as the PL and the perceived time and distance in addition to the important path choice criteria of commuters are discussed.

Chapter 3 describes the methodology of the research and the strategies used to collect the relevant data in order to examine the research objectives. This chapter illustrates the process in which the objectives of the study are examined.

Chapter 4 presents the results and discussion. The first section of this chapter is dedicated to the results of reliability and validity tests of the first and the second survey questionnaire. The sections of this chapter are organized on the basis of the objectives of the study. And the end of each section is dedicated to discuss on the results of each objective.

Finally chapter six, the final chapter, summaries the main findings of the research. The urban design implications of the findings are also discussed in this chapter. Finally, this chapter presents the suggestions for future research into the area.

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