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

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To my dear son, Rayan
ACKNOWLEDGEMENT

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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

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td></td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td></td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td></td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td></td>
<td>v</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td></td>
<td>vi</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td></td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td></td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td></td>
<td>xv</td>
</tr>
<tr>
<td>ABBREVIATIONS</td>
<td></td>
<td>xvii</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td></td>
<td>xix</td>
</tr>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Research Background</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>Research Problem</td>
<td>2</td>
</tr>
<tr>
<td>1.4</td>
<td>The Research Aim</td>
<td>5</td>
</tr>
<tr>
<td>1.5</td>
<td>Research Objectives</td>
<td>6</td>
</tr>
<tr>
<td>1.6</td>
<td>The Study Area and Research Methodology</td>
<td>8</td>
</tr>
<tr>
<td>1.7</td>
<td>The Scope and the Limitations of the Research</td>
<td>9</td>
</tr>
<tr>
<td>1.8</td>
<td>Significance of the Study</td>
<td>10</td>
</tr>
<tr>
<td>1.9</td>
<td>Structure of the Thesis</td>
<td>10</td>
</tr>
</tbody>
</table>
2 LITERATURE REVIEW

2.1 Walking Behavior and the Role of Environmental Factors

2.1.1 Introduction

2.1.2 The Contribution of Trip’s Purposes to the Walking Behavior

2.1.3 Walking to Reach a Destination

2.1.4 Effects of the Built Environment on Walking and Path Choice Criteria

2.1.5 Commuters and Walking for Transport in CBD

2.1.6 Summary

2.2 Wayfinding and the Path Choice ofPedestrians

2.2.1 Human Wayfinding, Path Choice and the Role of Spatial Representation

2.2.2 Taxonomy of Wayfinding and the Role of the Familiarity

2.2.3 Legibility and Wayfinding Performance

2.2.4 Summary

2.3 Behavioral Models on the Path Choice and Walking of Pedestrians

2.3.1 The Behavioral Models of Pedestrians’ Walking and their Path Choice

2.3.2 Summary and the Argument

2.4 Factors Affecting the Path Choice of Pedestrians and Commuters

2.4.1 Summary and the Argument

2.5 The Perceived Time and Cognitive Distance

2.5.1 Introduction

2.5.2 Hypotheses and Empirical Findings on the Cognitive Distance and the Perceived Time

2.5.3 Summary

2.6 The Perceived Complexity of the Commuters

2.6.1 Definition of the Complexity and its Related Factors in Different Studies
2.6.2 Complexity and Aesthetic in the Urban Design

2.6.3 Complexity of the Pathways and Path Choice Criteria of Commuters

2.6.4 Definition of the Perceived Complexity for Commuters

2.6.5 The Perceived Complexity and the Estimated Distance as well as Time

2.6.6 Perceived Complexity and Comfort as One of the Path Choice Criteria of Commuters

2.6.7 The Perceived Complexity and Aesthetic Experience in Relation to the Path Choice of Commuters

2.6.8 The Perceived Complexity and the Related Physical Factors

2.6.9 Summary

2.7 The Perceived Legibility of Commuters

2.7.1 Definition of Legibility and its Related Factors

2.7.2 Legibility and Walkability of Pathways in the Urban Environments

2.7.3 Legibility and Wayfinding in the Pathways

2.7.4 Legibility and Aesthetic Experiences in the Urban Design

2.7.5 Definition of the Perceived Legibility for Commuters

2.7.6 The perceived Legibility and the Estimated Distance as well as Time

The Perceived Legibility and Aesthetic Experience in Relation to the Path Choice of Commuters

2.7.8 The Perceived Legibility and the Related Physical Factors

2.7.9 Summary

2.8 Conclusion

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Research Framework
3.2 The Central Business District of Kuala Lumpur and its Characteristics

3.3 The Zone Selection Process in CBD of Kuala Lumpur

3.3.1 The First Step, Selection of Zones on the Basis of the Map

3.3.1.1 Phase 1: Using Typology of Heritage Zones as the Basis of Zone Selection

3.3.1.2 Phase 2: Selection of Stations

3.3.1.3 Phase 3: Selection of Workplaces around the Selected Stations

3.3.1.4 Phase 4: Checking the Selected Zones in Terms of Meeting Certain Primitive Criteria

3.3.2 The Second Step (Field Observational Step)

3.4 The First Objective, Hypotheses, the Adopted Methodology and the Designed Process of Examination

3.5 The Second Objective, the Adopted Methodology and the Designed Process of Examination

3.6 The Third Objective, the Adopted Methodology and the Designed Process of Examination

3.7 The Fourth Objective, Hypotheses, the Adopted Methodology and the Designed Process of Examination

3.7.1 The First Step

3.7.2 The Second Step

3.8 Reliability and Validity of the First and the Second Survey Questionnaires

3.9 Summary

4 RESULTS AND DISCUSSION

4.1 Results of Reliability and Validity of the First and the Second Survey Questionnaire

The Importance of the Lowest PC and the Highest PL among the Other Probable Path Choice Criteria of Commuters

4.2.1 The first Step
4.2.2  The Second Step  113
4.3  The physical factors related to PC and PL  121
  4.3.1  The Physical factors related to the PC of Commuters  122
  4.3.2  The Physical Factors Related to the PL of Commuters  126
4.4  Measuring PC and PL on the Basis of Their Related Physical Factors  136
  4.4.1  The First Step  138
  4.4.2  The Second Step  140
  4.4.3  The Third Step on PC  144
  4.4.4  The Third Step on PL  148
4.5  Examine the Indirect Contribution of Lowest PC and Highest PL to Path Choice of the Commuters  152
  4.5.1  The First Step  152
  4.5.2  The Second Step on PC  155
  4.5.3  The Second Step on PL  157
4.6  An Additional Analysis  160
4.7  Summary  164

5  CONCLUSION  165
  5.1  Summary and Conclusion  165
  5.2  Implication of the Research  172
  5.3  Recommendations for Further Research  173

REFERENCES  175
Appendices A-C  193-203
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>The Initial selected LRT and Monorail Stations</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>The selected workplaces and respected zones as the result of phase 3, in secondary heritage zone</td>
<td>79</td>
</tr>
<tr>
<td>3.2</td>
<td>The selected workplaces and respected zones as the result of phase 3, in tertiary heritage zone</td>
<td>79</td>
</tr>
<tr>
<td>3.3</td>
<td>The zones located in the secondary heritage zone which should be excluded from further considerations as the results of phase four</td>
<td>81</td>
</tr>
<tr>
<td>3.4</td>
<td>The zones located in the tertiary heritage zone which should be excluded from further considerations as the results of phase four</td>
<td>81</td>
</tr>
<tr>
<td>3.5</td>
<td>Zones included located in the secondary heritage zone</td>
<td>82</td>
</tr>
<tr>
<td>3.6</td>
<td>Zones included located in the tertiary heritage zone</td>
<td>82</td>
</tr>
<tr>
<td>3.7</td>
<td>Final zones of study located in secondary heritage zone</td>
<td>83</td>
</tr>
<tr>
<td>3.8</td>
<td>Final zones of study located in tertiary heritage zone</td>
<td>84</td>
</tr>
<tr>
<td>3.9</td>
<td>Table for Determining Sample Size from a Given Population</td>
<td>89</td>
</tr>
<tr>
<td>3.10</td>
<td>The definitions of the PC as well as the PL in the first survey due to the experts</td>
<td>110</td>
</tr>
<tr>
<td>4.1</td>
<td>The results of validity test of the questions included the definitions of the PC as well as the PL in the first survey due to the experts</td>
<td>110</td>
</tr>
<tr>
<td>4.2</td>
<td>The results of validity test of the questions for measuring the perceptual factors of this research</td>
<td>111</td>
</tr>
<tr>
<td>4.3</td>
<td>The results of first Survey regarding the preliminary evaluation of path choice criteria (first step)</td>
<td>112</td>
</tr>
</tbody>
</table>
4.5 The importance of factors for path choice of commuters while coming back from workplace to the station in evening trips

4.6 The importance of factors for path choice of commuters while going to workplace from the station in morning trips

4.7 The importance of the lowest PC for path choice based on gender difference

4.8 The importance of physical factors related to the PC for path choice based on gender difference

4.9 The importance of the highest PL for path choice based on gender difference

4.10 Physical factors related to higher PC based on the number of repetitions of each factor

4.11 The physical factors related to higher PC in the second survey

4.12 Name of the buildings and their types in each zone mentioned by respondents in the first survey regarding more PL

4.13 The results of the first survey regarding the physical factors related to higher PL based on the number of repetitions of each factor

4.14 The results of second survey regarding the physical factors related to higher PL

4.15 The results of path recognition in the zones of study located at secondary heritage zone

4.16 The results of path recognition in the zones of study located at tertiary heritage zone

4.17 The mean difference of the PC among the traversed ways of commuters

4.18 The mean difference of the PL among the traversed ways of commuters

4.19 Inter-rater Reliability for Estimates of Physical Factors
Summary of Regression Equation among the PC and rates of its related physical factors

Analysis regression variance among the PC and rates of its related physical factors

Multiple Regression equation analysis among the PC and rates of its related physical factors

Multiple Regression equation analysis after eliminating the insignificant factors among the PC and rates of its related physical factors

Summary of Regression Equation among the PL and rates of its related physical factors

Analysis regression variance among the PL and rates of its related physical factors

Multiple Regression equation analysis among PL and rates of its related physical factors

Multiple Regression equation analysis after eliminating the insignificant factors among the PL and rates of its related physical factors

Pearson correlation analysis between rate of the PC and the perceived time, rates of pleasance and rates of comfort

Pearson correlation analysis between rate of the PL and perceived time, and rates of pleasance

Pearson correlation analysis between representative physical factors of the PC and the correlated perceptual factors to the PC

Pearson correlation analysis between representative physical factor of the PL and the correlated perceptual factors to the PL
LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>The presented scenarios in the case of the availability of alternative pathways with almost the same length for commuters</td>
<td>4</td>
</tr>
<tr>
<td>1.2</td>
<td>The sequence of the study areas leading to define the research aim</td>
<td>6</td>
</tr>
<tr>
<td>2.1</td>
<td>The sequence of the content in the reviewed literature</td>
<td>13</td>
</tr>
<tr>
<td>2.2</td>
<td>Summary of path choice process</td>
<td>19</td>
</tr>
<tr>
<td>2.3</td>
<td>The relationships between the familiarity derived from the frequency of navigation and knowledge components</td>
<td>22</td>
</tr>
<tr>
<td>2.4</td>
<td>The pedestrian’s behavioral model suggested by Kitazawa and Batty (2004)</td>
<td>28</td>
</tr>
<tr>
<td>2.5</td>
<td>Framework on the most affective factors on path choice of commuters based on reviewed literature</td>
<td>35</td>
</tr>
<tr>
<td>2.6</td>
<td>The presented scenarios in the case of the availability of alternative pathways with almost the same length for commuters</td>
<td>36</td>
</tr>
<tr>
<td>2.7</td>
<td>The relationships between the complexity and certain path choice criteria of commuters</td>
<td>43</td>
</tr>
<tr>
<td>2.8</td>
<td>The procedure of defining the perceived complexity</td>
<td>45</td>
</tr>
<tr>
<td>2.9</td>
<td>The relationships between the PC of commuters and the sense of comfort</td>
<td>48</td>
</tr>
<tr>
<td>2.10</td>
<td>The procedure of defining PL in this research</td>
<td>55</td>
</tr>
<tr>
<td>2.11</td>
<td>The Theoretical Framework-Expected Path Choice Criteria of Commuters Consisting of the PC and the PL, identified in this research</td>
<td>60</td>
</tr>
<tr>
<td>3.1</td>
<td>The research framework</td>
<td>65</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>3.2</td>
<td>The reasons of necessity of equalizing the length of the traversed pathways of commuters in the selected zones</td>
<td>66</td>
</tr>
<tr>
<td>3.3</td>
<td>The Methodological steps and tools used to examine the objectives of this study</td>
<td>66</td>
</tr>
<tr>
<td>3.4</td>
<td>Main Zones of Kuala Lumpur</td>
<td>68</td>
</tr>
<tr>
<td>3.5</td>
<td>The zone selection process in CBD of Kuala Lumpur</td>
<td>70</td>
</tr>
<tr>
<td>3.6</td>
<td>The Conservation (Heritage) map and its different area’s types inside the city center or CBD of Kuala Lumpur</td>
<td>72</td>
</tr>
<tr>
<td>3.7</td>
<td>Areas within the metro stations in CBD</td>
<td>73</td>
</tr>
<tr>
<td>3.8</td>
<td>Different heritage zones of conservation map inside the city center or CBD of Kuala Lumpur</td>
<td>74</td>
</tr>
<tr>
<td>3.9</td>
<td>Illustration of the process to find the workplaces around the selected stations</td>
<td>78</td>
</tr>
<tr>
<td>3.10</td>
<td>The process of examining the first objective</td>
<td>87</td>
</tr>
<tr>
<td>3.11</td>
<td>The research framework regarding the first objective</td>
<td>89</td>
</tr>
<tr>
<td>3.12</td>
<td>The Process of examining the second objective</td>
<td>91</td>
</tr>
<tr>
<td>3.13</td>
<td>The Process of examining the third objective</td>
<td>94</td>
</tr>
<tr>
<td>3.14</td>
<td>The perceptual and physical path choice criteria of commuters, as assumed related factors to the PC of commuters</td>
<td>99</td>
</tr>
<tr>
<td>3.15</td>
<td>The perceptual and physical path choice criteria of commuters, as assumed related factors to PL of commuters</td>
<td>100</td>
</tr>
<tr>
<td>3.16</td>
<td>The process of examining the fourth objective</td>
<td>101</td>
</tr>
<tr>
<td>3.17</td>
<td>The process of examining the objectives of this research based on the related research tools, adopted for consequent steps of each objective</td>
<td>104</td>
</tr>
<tr>
<td>4.1</td>
<td>The factors contributing to path choice for commuters</td>
<td>115</td>
</tr>
<tr>
<td>4.2</td>
<td>The physical factors related to more difficulty of walking movement or higher PC</td>
<td>125</td>
</tr>
<tr>
<td>4.3</td>
<td>Number of the mentioned buildings and their repetition based on their types regarding higher PL</td>
<td>128</td>
</tr>
</tbody>
</table>
4.4 The physical factors related to stronger sense of direction toward the destinations or higher PL

4.5 Evaluation of normal distribution of data regarding rate of the PC

4.6 Evaluation of normal distribution of data regarding rate of the PL

4.7 The process of categorizing the physical factors related to the PC into different related measurable physical factors

4.8 The process of categorizing the physical factors related to the PL into different related measurable physical factors

4.9 The results of the Regression analysis regarding the correlation between rate of the PC and the physical factors

4.10 The results of the Regression analysis regarding the correlation between rate of the PL and the physical factors

4.11 The results of the first step of examining the fourth objective regarding the lowest PC

4.12 The results of the first step of examining the fourth objective regarding the highest PL

4.13 The results of the first and second step of examining the fourth objective regarding the lowest PC

4.14 The results of the first and second step of examining the fourth objective regarding the highest PL

4.15 The process which shows how the question discussed in this section is raised

4.16 The significant correlations between perceptual factors related to the PC and the representative physical factors of the PC in the context

4.17 The significant correlations between perceptual factors related to the PL and the representative physical factors of the PL in the context

5.1 The Overview of the Findings
## LIST OF SYMBOLS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>Perceived complexity</td>
</tr>
<tr>
<td>PL</td>
<td>Perceived legibility</td>
</tr>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
</tbody>
</table>
LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The Reliability Tests of First and Second Survey Questionnaire</td>
<td>193</td>
</tr>
<tr>
<td>B</td>
<td>First Survey Questionnaire</td>
<td>196</td>
</tr>
<tr>
<td>C</td>
<td>Second survey questionnaire</td>
<td>199</td>
</tr>
</tbody>
</table>
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.

| If the shorter time and distance would be the most important path choice criteria | 1. Perceived time and perceived distance are the criteria instead of real time and distance |
| If other path choice criteria would be more important than shorter time and distance | 2. Another alternative path choice criteria other than perceived time and distance are taken into account. One of these alternative path choice criteria could be sense of comfort along the pathway. |

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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