THE UNIVERSITY OF QUEENSLAND
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# Rethinking Planning for Urban Parks: Accessibility, Use and Behaviour

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# Abstract

Public parks and green spaces are important health promoting facilities for urban dwellers, which can bring about improved health outcomes, diminished racial tensions and reduced public stress. Access to urban parks and green spaces is purported to be associated with the development of social capital, increased community wellbeing and inclusive neighbourhoods. It is within this context that recent decades have witnessed increasing efforts in measuring and modelling park accessibility in cities. Previous studies, however, found significant inconsistency between subjectively (perceived) and objectively (geographic) measured accessibility, indicating the need to examine existing conceptualisation of park accessibility, especially at the individual perceptual level.

The accessibility concept has been developed as a multi-dimensional construct that requires a more adequate understanding about its influential factors and dimensions. Existing measures of accessibility have been limited to the concept's physical and temporal dimensions, leaving other relevant factors such as social conditions and personal constraints, including perceptions, largely unexplored. This research argues for the relevance of socio-personal factors to realistically assess accessibility to urban public parks. There is also a need to clarify how accessibility influences an individual's decision-making process that ultimately leads to human behaviour of park use or non-use, as psychological study of behavioural intentions to use parks has rarely been investigated. Following a correlational research design and cross-sectional validation approach, this research was proposed to fill these knowledge gaps.

The research involved both processes of model development and model validation. Two models were proposed in this study: an expanded theory of planned behavioural (TPB) model and an integrated model of park accessibility. The first model aims to identify the role of park accessibility in influencing individual behavioural intentions towards park use and non-use. The model was developed based on the theory of planned behaviour, with three additional variables included (i.e., perceived park accessibility, geographic proximity, and past use) to compare their relative importance in influencing park use intentions. The second model was proposed based on the critical literature review of the accessibility concept. The model consists of five dimensions, including both physical and socio-personal variables that were identified as being associated with urban park access and use.

Both models were empirically tested using questionnaire survey data collected from two cities of different socio-cultural settings: Brisbane (Australia) and Zhongshan (China). Within each city, sampling was carefully designed to represent residents of different socioeconomic backgrounds with an aim of modelling the differences between population groups. Data were analysed quantitatively using statistical methods and spatial analytical techniques. Key findings from this study include:

- Empirical findings from this study consistently support the multidimensional nature of the accessibility construct, with results from different case studies confirming that both physical and non-physical factors significantly influence perceived access to urban parks.
- The expanded TPB model with perceived accessibility provides the best model fit and highest explanatory power, while also enhancing the prediction of park use intentions.
- Perceived access is more important than geographic proximity in predicting urban park use, with physical and locational features (e.g. proximity and travel time) the most important predictors in influencing perceived access to parks.
- Less important, but statistically significant, socio-personal dimensions of accessibility are more sensitive to the larger social and cultural context of urban settings, with cultural groups using the parks, shared activities, and safety highlighted as more important non-physical variables to predict perceived access to parks in both city settings.
- Lower income groups have significantly lower perceived access to parks than higher income respondents living in the same cities.

From an urban planning perspective, this study highlights the importance of moving beyond the realm of conventional planning with physical standards to embrace the important findings of social analysis. The provision of parks is a necessary but insufficient condition to actually increase park use, especially in lower SES communities. Communities with lower SES and people with less mobility are population segments that should receive special attentions to ensure a more efficient and equitable urban service delivery. Therefore, it is important for planners and policy makers to enhance the evidence base whilst mindful of community diversity to provide optimal social outcomes. Possible policy interventions highlighted by this study include but are not limited to: ensuring public parks are reasonably proximate to residential locations; providing quality footpath amenities such as shade and lighting to create a walkable urban landscape; and providing opportunities to develop and sustain an inclusive community culture.

In sum, this study was able to address the research gaps by providing insights into individual decision-making towards urban park use. The models were empirically modified and validated in two different cultural settings, thus providing practical tools for urban planners and base frameworks that can be applied to other urban services in future studies.

# Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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# Publications during candidature

### *Peer-reviewed articles*

I. Wang, D., Brown, G. Liu, Y. and Mateo-Babiano, I. (2015). A comparison of perceived and geographic access to predict urban park use, Cities (42), 85-96, http://dx.doi.org/10.1016/j.cities.2014.10.003

II. Wang, D., Brown, G. and Liu, Y. (2015). The physical and non-physical factors that influence perceived access to urban parks. *Landscape and Urban Planning* (133), 53-66, 10.1016/j.landurbplan.2014.09.007

III. Wang, D., Brown, G. Zhong, G, Liu, Y. and Mateo-Babiano, I. (in press). Factors influencing perceived access to urban parks: A comparative study of Brisbane (Australia) and Zhongshan (China). *Habitat International*

IV. Wang, D., Mateo-Babiano, I. and Brown, G. (2013). Rethinking accessibility in planning of urban open space using an integrative theoretical framework. In: Kristian Ruming, Bill Randolph and Nicole Gurran, *State of Australian Cities Conference 2013*: Refereed Proceedings, (1-11).

V. Wang, D., Brown, G. and Mateo-Babiano, I. (2013). Beyond proximity: an integrated model of accessibility for public parks. *Asian Journal of Social Sciences & Humanities*, 2(3): 486-498.

### *Conference presentations*

- Wang, D. (2013). How accessibility contributes urban park use, in *PhD Symposium, SOAC 2013: 6th State of Australian Cities Conference*, 24-25 November, 2013, Sydney, NSW, Australia.
- Wang, D. (2013). Rethinking accessibility in planning of urban open space using an integrative theoretical framework, in *6th State of Australian Cities Conference*, 26-29 November, 2013, Sydney, NSW, Australia.
- Wang, D. (2014). How accessibility contributes to urban park use? An cross-cultural empirical study, in 1st *Queensland PhD Colloquium*, 28 February, 2014, Brisbane, QLD, Australia.

# Publications included in this thesis

This thesis consists of four published articles and one article that is currently in press (see *Publications during Candidature*). Articles I to III are included as the three major analytical chapters (Chapter 5-7) in this thesis. In these three chapters, the text has been retained to be consistent with their original form in publication where the plural first-person pronoun 'we' was used to refer to my work as the primary author. Articles IV and V are incorporated as Chapters 2 and 3, with the text revised and rearranged to make coherent arguments in this thesis.

### *Chapter 1*

This chapter was solely written by the candidate with editorial assistance from Iderlina Mateo-Babiano and Yan Liu.

### *Chapter 2 and 3*

*Wang, D., Brown, G. and Mateo-Babiano, I. (2013) "Beyond Proximity: an integrated model of accessibility for public parks", Asian Journal of Social Sciences and Humanities 2(3):486-498;* and *Wang, D., Mateo-Babiano, I. and Brown, G. (2013) "Rethinking accessibility in planning of urban park using an integrative theoretical framework", Peer-reviewed Proceedings of the State of Australian Cities Conference, Sydney, Australia, 2013.*

These chapters were redeveloped from the above two publications, solely written by the candidate. The idea and analytical frameworks were originally conceived by the candidate (85%) with guidance and advice from Greg Brown (10%) and Iderlina Mateo-Babiano (5%). The candidate conducted the literature review (100%) and wrote the manuscripts (80%), with editorial assistance from Greg Brown and Iderlina Mateo-Babiano. The candidate also received comments on previous drafts of the paper from anonymous reviewers.

### *Chapter 4*

This chapter was solely written by the candidate with editorial assistance from Iderlina Mateo-Babiano and Yan Liu.

***Chapter 5***

*Wang, D., Brown, G. Liu, Y. and Mateo-Babiano, I. (2015). A comparison of perceived and geographic access to predict urban park use, Cities (42), 85-96,* http://dx.doi.org/10.1016/j.cities.2014.10.003

This chapter comprises the above journal article, published in *Cities*. The study was designed by the candidate (85%) with advice from Greg Brown (15%). The literature review and data collection were solely conducted by the candidate (100%). The candidate carried out the data analyses (85%) with advice from Greg Brown (10%) and Yan Liu (5%). Paper manuscript was written by the candidate (85%) with editorial assistance from all authors (15%). The paper was revised based on comments from two anonymous reviewers.

***Chapter 6***

*Wang, D., Brown, G. and Liu, Y. (2015). The physical and non-physical factors that influence perceived access to urban parks. Landscape and Urban Planning (133), 53-66,* 10.1016/j.landurbplan.2014.09.007

This chapter comprises the above journal article, published in *Landscape and Urban Planning*. The study was designed by the candidate (80%) with advice from Greg Brown (20%). The literature review and data collection were solely conducted by the candidate (100%). The candidate carried out the data analyses (80%) with advice from Greg Brown (15%) and Yan Liu (5%). Paper manuscript was written by the candidate (80%) with editorial assistance from all authors (20%). The paper was revised based on comments from three anonymous reviewers and one journal editor.

***Chapter 7***

*Wang, D., Brown, G. Zhong, G, Liu, Y. and Mateo-Babiano, I. (in press). Factors influencing perceived access to urban parks: A comparative study of Brisbane (Australia) and Zhongshan (China). Habitat International*

This chapter comprises the above journal article, submitted to *Habitat International*. The study was designed by the candidate (80%) with advice from Greg Brown (20%). The literature review was solely conducted by the candidate (100%). The candidate was supported by Guopin Zhong in the data collection in China. Data analyses were carried out by the candidate (90%) with advice from Greg Brown (5%) and Yan Liu (5%). Paper manuscript was written by the candidate (90%) with editorial assistance from all authors (10%). The paper was revised based on comments from anonymous reviewers.

### *Chapter 8*

This chapter was solely written by the candidate with editorial assistance from Iderlina Mateo-Babiano and Yan Liu.

## *Contributions by others to the thesis*

No contributions by others besides those listed in the above section.

## *Statement of parts of the thesis submitted to qualify for the award of another degree*

None

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## *Keywords*

urban parks, accessibility, use intention, park use, the theory of planned behaviour, China, Australia, comparative study, green space access, planning

## *Australian and New Zealand Standard Research Classifications (ANZSRC)*

ANZSRC code: 120507, Urban Analysis and Development, 60%
ANZSRC code: 160402, Recreation, Leisure and Tourism Geography, 20%
ANZSRC code: 160403, Social and Cultural Geography, 20%

## *Fields of Research (FoR) Classification*

FoR code: 1205, Urban and Regional Planning, 50%
FoR code: 1604, Human Geography, 50%

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# List of Abbreviations

| | |
|---|---|
| *ABS* | Australian Bureau of Statistics |
| *ATT* | Attitude |
| *AVE* | Average variance extracted |
| *CBD* | Central business district |
| *CFA* | Confirmatory factor analysis |
| *CFI* | Comparative fit index |
| *CR* | Composite reliability |
| *GA* | Geographic accessibility |
| *GIS* | Geographic Information System |
| *IRSAD* | Index of Relative Socio-economic Advantage and Disadvantage |
| *LGA* | Local government area |
| *LUPTAI* | Land Use & Public Transport Accessibility Index |
| *NFI* | Normed Fit Index |
| *PA* | Perceived accessibility |
| *PBC* | Perceived behavioural control |
| *PRD* | Pearl River Delta |
| *PU* | Past use |
| *RMSEA* | The Index of Root Mean Square Error of Approximation |
| *SEIFA* | Socio-Economic Indexes for Areas |
| *SEM* | Structural equation modelling |
| *SES* | Socioeconomic status |
| *SN* | Subjective norm |
| *TPB* | the theory of planned behaviour |
| *TRA* | the theory of reasoned action |
| *UI* | Use intention |
| *VMR* | Variance-means ratio |

# CHAPTER 1. INTRODUCTION

## 1.1 Access to urban public services and facilities

A modern city is a service dependent environment (Lineberry and Welch, 1974). Urban public services and facilities, such as parks and open spaces, water supply and sewerage, paved streets and educational facilities, are vital to the day-to-day life and wellbeing of city dwellers. Teitz (1968) noted that modern urban life is inextricably bound up with public services and facilities. Because urban public facilities such as parks and green spaces are spatially separated from their users and are typically in fixed locations, accessibility becomes an important and critical indicator in addressing distributional equity amongst groups (Bisht et al., 2010). Defined as "*the ease with which people can reach desired services and facilities*" (Gregory et al., 2009), accessibility provides important information on whether population segments are being advantaged or disadvantaged, and which groups enjoy public service benefits and why. While public facility distribution is widely regarded as a process of redistributing wealth among citizens, this practical importance makes access to public facilities a key issue to be articulated in achieving more liveable and equitable cities, especially in a period of increasing pressures from urban growth and land use conflicts.

Unplanned expansion of urban areas in recent decades has significantly affected people's way of life (Wu, 2006), particularly in their ability to access public facilities. Planning principles have now shifted towards more sustainable developments, wherein the previous trust of functionally separated, modernised zoning urban form has now moved to inclusive development and compact city (Alexander, 2009). The concept of accessibility has been highlighted in these new planning principles (Rose and Stonor, 2009) to combat challenges such as the conflicts between urban growth and environmental conservation. Planning for accessibility advocates that urban planning should take proper account of the needs of inhabitants from the perspective of people who live in the area (Rose and Stonor, 2009), giving accessibility an increasingly important role in informing the decision-makings in urban public service delivery and achieving a more sustainable future for our cities.

And thus, a complete understanding about the concept of accessibility and its influential factors is vital if planners aim to achieve an effective public facility delivery through improving accessibility level of urban facilities. An equitable public service distribution requires that there is no systematic difference in access to facilities amongst population sub-groups (Neutens et al., 2010). However, the understanding about this concept is incomplete, especially at the individual perceptual level (Næss, 2006; Pirie, 1979).

There is a lack of information about the impacts of accessibility on public facility use decisions (e.g., urban park use) (Kruger et al., 2007). How do accessibility dimensions and variables contribute to people's decision to use parks? Does self-reported park accessibility equate with, or closely associate with, park access measured by physical proximity? While accessibility has been developed as a multi-dimensional construct, its measurement is limited to the physical and temporal dimensions, leaving other relevant factors such as social conditions and personal constraints, including perceptions, largely unexplored.

It is critical to understand for whom accessibility is being defined. A city is sustainable only if it can meet the needs of its people (Chiesura, 2004). Public needs and personal preference contribute to the two determinants of equity in public service delivery (Jones and Kaufman, 1974; Lineberry, 1974). Similarly, Weber (2006) posited that personal preference has a direct influence on individuals' perception of access to urban facilities. Therefore, sustainability indicators such as park accessibility are valuable only if they are able to address people's preference and perceptions. If the indicator of accessibility is used to address distributional problems, it should have the potential to represent people's needs and preferences. The above discussion underpins the importance of examining the concept of accessibility at an individual perceptual level, the need to provide insights into the concept's influential factors and how they influence individuals' decisions to use or not to use urban facilities.

## 1.2 Research context: urban public parks and green spaces

Access to urban parks and green spaces is increasingly acknowledged to contribute to community wellbeing, develop social capital and enhance quality of urban life (Chiesura, 2004; Harrison et al., 1988). Previous studies found that the presence of open spaces (especially neighbourhood parks) can combat many urban ills, relieve public stress and help build welcoming and inclusive neighbourhoods (Bedimo-Rung et al., 2005; Byrne and Sipe, 2010; Byrne and Wolch, 2009; Wolch et al., 2014).

In urban management, park accessibility is therefore adopted as an important indicator to measure urban livelihood and quality of life (Byrne et al., 2009). For example, the National

Recreation and Park Association (NRPA) in the U.S. argued that the provision of parks and green spaces is more critical than ever as they provide possibilities to combat many social problems such as racial tensions and violence (Stacey, 2009). Recent years have witnessed many innovative strategies implemented in cities around the world to increase the supply of parks in urban areas (Wolch et al., 2014).

In the academic field, the benefits that parks offer to urban communities have also made park access and use an important research theme. Some researchers examined park access as a social equity problem, recognising it as an important environment justice issue. For example, previous research found that there is a worldwide problem of inequitable distribution of parks within cities, with low-income communities and people of colour often subject to poor access to green space, and degraded facilities (Byrne et al., 2009; Wolch et al., 2014). The issue was examined from the perspective of spatial distributional equity in many geographic studies (Hung et al., 2005; Talen and Anselin, 1998), compared to others who focused more on social inclusion and justice (Byrne and Wolch, 2009; Byrne et al., 2009). Park access may also be investigated from an individual perspective, such as individual barriers to physical activity and active lifestyle. For example, Roche et al (2009) found that higher perceptions of park availability are significantly associated with higher levels of physical activities; or, from the perspective of urban development, previous studies suggested that park-related policies significantly influence the form of urban settlement, highlighting the important impact of park planning on urban forms (Elson, 1986; Longley et al., 1992).

As human society is increasingly becoming urbanised and congested, park provision is of strategic importance to improve the quality of urban life (Harrison et al., 1988; Wolch et al., 2014). With their significant role in an urban environment and typical features as public facilities being taken into consideration, this study adopted local neighbourhood parks as its research context. Reviews of existing literature indicate an incomplete understanding about park accessibility and its role in influencing park visits. Although the relationship between access to urban parks (e.g. distance, park availability) and park use has been recognised, little has been done to investigate the importance of accessibility dimensions (physical or socio-personal) in contributing to people's perception of park accessibility. Further, psychological study of behavioural intentions to use urban parks has rarely been investigated. And thus, not much is known about the role of park accessibility (perceived or physically measured) as an influential component on intentions to use parks, nor has it been examined together with other behavioural determinants (e.g., subjective norms and attitude) to explain park use behaviour. The above discussions indicate a need to investigate what park accessibility means to potential park users and how this self or social construction of accessibility affects people's perception of park accessibility, and ultimately their use or non-use decisions.

## 1.3 Problem statement

Urban open spaces, such as public parks and green spaces are important health promoting facilities, with an increasingly critical role in contributing to the sustainable future of our cities. Reviews of planning literature indicate that conventional urban open space planning largely relies on objective indices such as area and number of parks per capita to measure people's access to parks and green spaces. However, this approach overlooks the complexity of the accessibility concept and people's decision-making processes. Accessibility to urban parks serves as a key indicator for quality of urban life, and as such is used to guide park allocations within urban areas, because it is taken as a potential predictor to promote facility utilisation. Therefore, it is important to develop an adequate understanding of influential factors relating to park accessibility, and their role in people's decision-making processes, if park planners aim to respond to the diversity of recreational demands for different population groups.

In order to achieve such understanding, a set of questions needs to be answered, including: do variables from socio-psychological dimensions impose significant impact on people's perception of park accessibility? Does an objective measure provide reliable representation for perceived accessibility to urban parks? Is there any relationship between geographic accessibility and perceived accessibility? How much park use behaviour can be explained by perceptual accessibility and geographic accessibility?

## 1.4 Study rationale and significance

Regarded as an essential indicator in contemporary planning practice, accessibility has been widely identified by urban planners as a key issue to address problems in public service distributions (Ferreira and Batey, 2007). Existing accessibility research indicates a wide range of applications in studies related to the provision of public services. For example, studies have examined the relationship between access to public facilities and spatial distribution of social disadvantaged groups (Farrington and Farrington, 2004); the problem of social equity and social exclusion resulting from public facility accessibility (Hung et al., 2005; Preston and

Rajé, 2007; Talen and Anselin, 1998); the influence of accessibility on location choice (Næss, 2006; Önal and Yanprechaset, 2006; Zondag and Pieters, 2005); and modelling public transit accessibility and transport-related social exclusion (Preston and Rajé, 2007).

Positive benefits of health-promoting resources such as parks and green spaces have received growing recognition in recent studies for their potential to impact upon causative behaviour (Humpel et al, 2002). It is within this context that recent decades have witnessed great advances in measuring and modelling accessibility for urban parks. However, a review of the planning literature indicates that conventional urban open space planning largely relies on objective indices such as area and number of parks per capita to measure people's access to parks and green spaces, overlooking the complexity of the accessibility concept and people's decision-making processes. In addition, an increasing number of studies have recognised the significant impact that the methods by which accessibility is defined and measured may impose upon the outcome of empirical studies (e.g. directions and levels of associations) (Murray et al., 2003; Neutens et al., 2010; Oh and Jeong, 2007; Talen and Anselin, 1998; Weber, 2006). While an adequate understanding about the accessibility concept and its influential factors is vital if public service providers aim to combat inequalities and disparities within areas, the existing knowledge about park accessibility is incomplete (Kruger et al., 2007), especially at the individual perceptual level.

Developing an accurate conceptual definition and measurement for accessibility is crucial for public resource allocation (Bisht et al., 2010). The extensive documentation of the inconsistency between subjectively measured accessibility (perceived accessibility) and objectively measured accessibility (geographic accessibility) confirms the multidimensional nature of the accessibility concept (Ball et al., 2008; Hoehner et al., 2005; Jones et al., 2009; McCormack et al., 2008; Scott et al., 2007), but also further highlights the need to investigate the accessibility concept from a perspective of potential urban facility users. Analysis in this study indicates that the accessibility concept has been developed into a multidimensional construct that encompasses both spatial and socio-psychological dimensions. However, its measurement has been limited to the physical and temporal dimensions, leaving other relevant factors such as social conditions and personal constraints, including perceptions, largely unexplored. In contrast to the well-developed objective accessibility measurement using spatial techniques, knowledge on the socio-psychological dimensions of accessibility is lacking. Objective measures provide good representation for variables in the spatial dimension of accessibility, but, are they authentic measures for perceived accessibility? This study sought to fill these theoretical and applied knowledge gaps.

This study contributes to the academic field by providing 1) an integrated multivariate model of park accessibility and cross-cultural model validations using primary survey data; 2) an empirical study investigating relationships between geographic accessibility and perceived accessibility and how they interactively influence people's decision to use parks; 3) empirical supports to the significance of physical and social-personal variables in affecting perceived access to parks; and 4) comparisons of models between communities of different socioeconomic backgrounds.

## 1.5 Aim and objectives

This study aims to develop an integrated accessibility model in an urban park context to facilitate accessibility research at an individual perceptual level and to test the influence of geographic and perceived accessibility on self-reported park use intention.

The aim has been addressed by four specific objectives as follows:

*Objective 1: Develop an integrated conceptual framework for urban park use.*

*Objective 2: Examine the impact of perceived accessibility and geographic accessibility on people's attitudes and behavioural intentions to visit parks.*

*Objective 3: Determine the factors that influence perceived accessibility for communities of contrasting socioeconomic status.*

*Objective 4: Validate the proposed park accessibility model across different socio-cultural settings.*

## 1.6 Research approach

A correlational research design was adopted to achieve the research aims and objectives outlined above. The research process in this study involved both model development and model validation, with a focus on quantifying the relationships between variables. First, two individual conceptual models were constructed: an expanded theory of planned behaviour

(TPB) model and an integrated park accessibility model. Grounded in the existing theory of planned behaviour, an expanded TPB model was proposed to investigate the impact of accessibility (both subjectively and objectively measured) on intentions to visit neighbourhood parks. The second model represents park accessibility as a multidimensional construct, describing both physical and non-physical factors that are likely to influence individual perception of park access. The proposed models were then empirically tested and validated using primary data collected from neighbourhood-level surveys.

The first survey was conducted in Brisbane, the state capital city of Queensland, Australia, providing the primary dataset for model testings in this study. Two suburbs in Brisbane were selected as survey areas following purposive sampling design procedures. One suburb was selected from the higher end of the socioeconomic status (SES) scale and the other from the lower end. Cross-cultural model validation was conducted using primary survey data collected from Zhongshan, a regional city located in the south of Pearl River Delta in Guangdong Province, P.R. China. The same survey questions were asked in both cities. Other data used in this study include the 2012 Brisbane local government area (LGA) park and green space spatial dataset, road network datasets, park classification tables and census data from the two cities.

The primary survey instrument was developed in English, and then translated into Chinese. Psychometric scaling method was used to operationalise the variables in the two proposed models. Survey data were analysed using a variety of methods, including bivariate analysis and multiple regression using IBM SPSS 20, spatial analysis in Esri ArcGIS 10.2 and structural equation modelling using Amos 20.

## 1.7 Thesis structure

This thesis is organised into eight chapters. The first chapter is the introduction. This is followed by the critical review of literature culminating with the theoretical framework and conceptual models of this research. Chapter 4 describes the research design and methodology, including data needs, sampling design and analytical methods. Chapters 5 to 7 are the three core analytical chapters that address major research objectives, followed by one summary chapter that presents a synthesis of findings, reflections and future research priorities. Figure 1-1 presents a flow chart describing the structure of the chapters and how they are linked with the four research objectives.

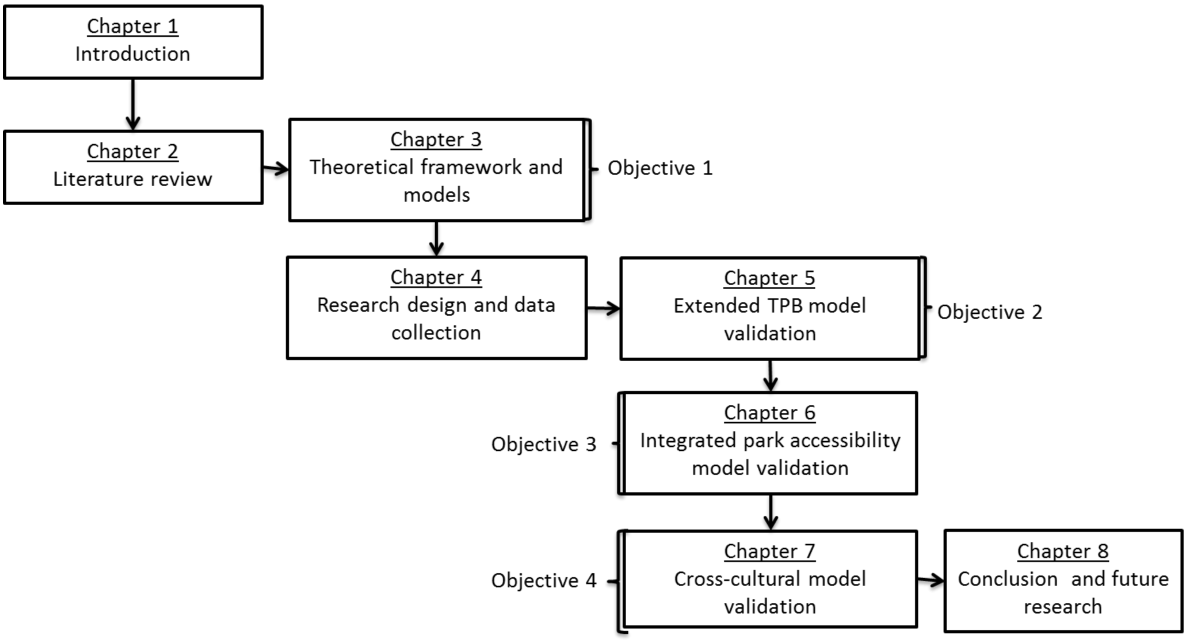


Figure 1-1 Chapter structure flow chart

The focus of each chapter is described below:

Chapter 2 includes a review of literature relevant to this research. It begins with a conceptual review of accessibility and examines various ways it is being measured in the literature. The chapter then focuses on current park planning approaches to address accessibility issues and theories to explore human behaviour. Through a critical literature review, this chapter identifies research gaps and argues for the need for an integrated approach to examine park accessibility concept and its relationship with park use.

Chapter 3 argues for the need to examine the accessibility concept at the individual perceptual level and proposes the theoretical framework in this study. An integrative framework is developed to describe a psychological process wherein perceived accessibility to urban parks results from the evaluation of both physical and social psychological accessibility variables, ultimately influencing human behavioural intention to use (or not use) urban parks. Two processes were presented to further illustrate this framework: (1) an integrated model of accessibility containing both spatial and non-spatial dimensions; and (2) a behavioural model examining the role of accessibility in influencing park use intentions.

Chapter 4 describes the research design and data collection. To address research objectives, this chapter introduces the research philosophy, sampling strategies and data collection approaches, followed by survey design and implementation.

Chapter 5 investigates the role and contribution of geographic accessibility and perceptual accessibility in explaining intention to visit urban parks. The expanded TPB model is empirically tested using primary survey data collected from Brisbane suburbs. The implications for urban park management and planning are then discussed based on research findings.

Chapter 6 empirically tests and validates the proposed integrated park accessibility model using primary survey data collected from Brisbane suburbs. This chapter examines the factors that may affect people's perceived accessibility to neighbourhood parks and describes how self-reported park accessibility relates to participant characteristics such as socioeconomic status. Policy recommendations are suggested based on research findings.

Chapter 7 extends the analysis in Chapter 6 to investigate the applicability of the multivariate park accessibility model in a larger socio-cultural context of urban settings using a comparative approach with data collected from the two cities, Brisbane (Australia) and Zhongshan (China). Apart from providing a cross-cultural model validation, this chapter further compares research outcomes between the two case study cities and recommends policy interventions.

Chapter 8 draws together the outcomes from previous chapters into a synthetic discussion, answers research questions and concludes with ideas for further research priorities.

# CHAPTER 2. LITERATURE REVIEW

Chapters 2 and 3 are based on the following two peer-reviewed articles. The contents of these articles have been revised and rearranged to make coherent arguments in these chapters:

1. *Wang, D., Brown, G. and Mateo-Babiano, I. (2013) "Beyond Proximity: an integrated model of accessibility for public parks", Asian Journal of Social Sciences and Humanities 2(3):486-498; and*
2. *Wang, D., Mateo-Babiano, I. and Brown, G. (2013) "Rethinking accessibility in planning of urban park using an integrative theoretical framework", Peer-reviewed Proceedings of the State of Australian Cities Conference, Sydney, Australia, 2013.*

Chapter 2 provides background information and a critical review of literature pertaining to the major areas of this study, highlighting key theoretical and applied knowledge gaps that became the research focus in this thesis. The review is structured into six sections from Section 2.1 to Section 2.6, with findings and knowledge gaps summarised in Section 2.7.

Section 2.1 starts the review with broader urban planning aspects, addressing the shift in urban planning from modernist design to inclusive and compact development that emphasises access to urban facilities. This section provides a planning context for the need to examine accessibility issues in urban areas.

Section 2.2 presents a conceptual review of accessibility, starting from its early geometric focus to its evolution to a multi-dimensional construct. The review highlights the shift of its conceptual emphasis from spatial physical dimensions to socio-personal dimensions.

Section 2.3 reviews major accessibility measures that are used in research and planning practices. Analyses are conducted to investigate how well these measures address multiple dimensions of the accessibility concept. The impact of variation in accessibility measurement on empirical results has also been included.

Section 2.4 defines both planning and social contexts of this study. It reviews major planning models used in park planning to provide a broader planning background for this research. The factors identified by these models are reviewed and compared. This section also provides the social context of this study with a review of findings from environmental justice literature.

Section 2.5 highlights the potential of accessibility as a predictor of park use behaviour, along with other factors that may influence park use behaviour and behavioural intention. The theory of planned behaviour is reviewed and discussed for its suitability as a theoretical framework for this research.

Section 2.6 differentiates the concept of perceived accessibility from geographic accessibility. Perceived accessibility has not received sufficient academic attention, but is important in predicting changes in use behaviour.

## 2.1 The shift in planning culture

Urban change demands more inclusive and sustainable outcomes (Alexander, 2009), wherein equitable access to urban public services has been embraced as central to this change. Post-war urban developments in more developed countries were dominated by the Garden City movement (initiated by Ebenezer Howard in his book TO-MORROW: A peaceful path to real reform in 1898), and its successor the New Town development (represented by the New Town Act 1946 in the UK). The planning principles associated with these publications advocate functionally separated cities with the purpose of improving living conditions for urban poor in congested areas of industrialised cities (Alexander, 2009). However, these principles have been heavily criticised for their high social and environmental costs because they advocate car-oriented urban layouts and spatial separation of functional cores. For example, one of the important trends for post-war new town development in the UK was a modernist design that emphasised mobility via private vehicles (Alexander, 2009). Recent research showed that historic town centres have higher levels of accessibility and land values when compared with their new town counterparts (Rose and Stonor, 2009), suggesting that the planned new towns were likely fail to deliver higher attractiveness to people settling in them. Although some new towns may appear more affluent, based on economic performance, such as Cumbernauld in Scotland (Welch, 2007), they appear less desirable as a place to live.

Research indicates that access to certain urban facilities such as public parks and green spaces, affects land and property values, social activities, and even people’s attitude to quality of life (Anderson and West, 2006; Colwell, 1985; Coughlin et al., 1974; Hannon, 1994). This makes public facility accessibility a central issue in contemporary urban planning. The modern planning culture advocates inclusive urban development and compact city design (Alexander, 2009). These principles differ from modernist design by acknowledging that planning practice should actively address people’s needs and preferences (Rose and Stonor, 2009). Accordingly, measures of accessibility used by planners need to fully account for the meaning and importance of accessibility to people. This requires that accessibility research move beyond proximity-based measures to examine accessibility at the individual, perceptual level with greater emphasis on its non-spatial dimensions (i.e., social psychological factors).

## 2.2 Evolution of the accessibility concept

### *2.2.1.* Early definitions with a geometric focus

With a purely geometric origin, the study of accessibility was founded in Location Theory (Hass, 2009) and advanced by Central Place Theory (Marten and Gillespie, 1978). Location Theory seeks to identify and explain the effects of geographic space on the spatial patterns of economic activities with the key variable being physical distance (Larkin and Peters, 1983). The variable of physical distance or proximity is also the major component of the geographic definition of accessibility. An earlier definition of accessibility focused on the amount of physical distance between the provider and the service user (Marten and Gillespie, 1978). The definition was enhanced by Central Place Theory, which posits that human settlements function as central places that provide services to surrounding areas. One of the important assumptions of the theory is that consumers are only willing to travel as far as necessary to obtain their desired services (Larkin and Peters, 1983). That is, people always minimise the distance to be travelled to reach the services. And thus, early accessibility research focused on maximising the efficiency of service distribution while minimising operational costs of the system (Marten and Gillespie, 1978; Nicholls, 2001). While limited, this served as the basis for the development of an urban system performance evaluation.

On the other hand, accessibility is more than just a simple measurement of physical distance between origin and destination. It was recognized that the concept should include some qualitative attributes such as the convenience or ease of overcoming distances (i.e. transport availability). For example, Penchansky and Thomas (1981) posited that client transportation resources, distance and travel cost were all important factors for understanding the relationship between location of supply and the location of clients. The concept of accessibility was defined as the ease with which a site may be reached or obtained by Gregory et al. (1986). These early definitions of accessibility identify ease and physical distance as key accessibility variables. Some contemporary studies adopt similar geographic definitions of accessibility in their empirical studies, but more studies refined the meaning of ‘ease’. For example, Preston and Raje (2007) defined accessibility as ease of reaching, in contrast to the notion of mobility which is defined as the ease of moving.

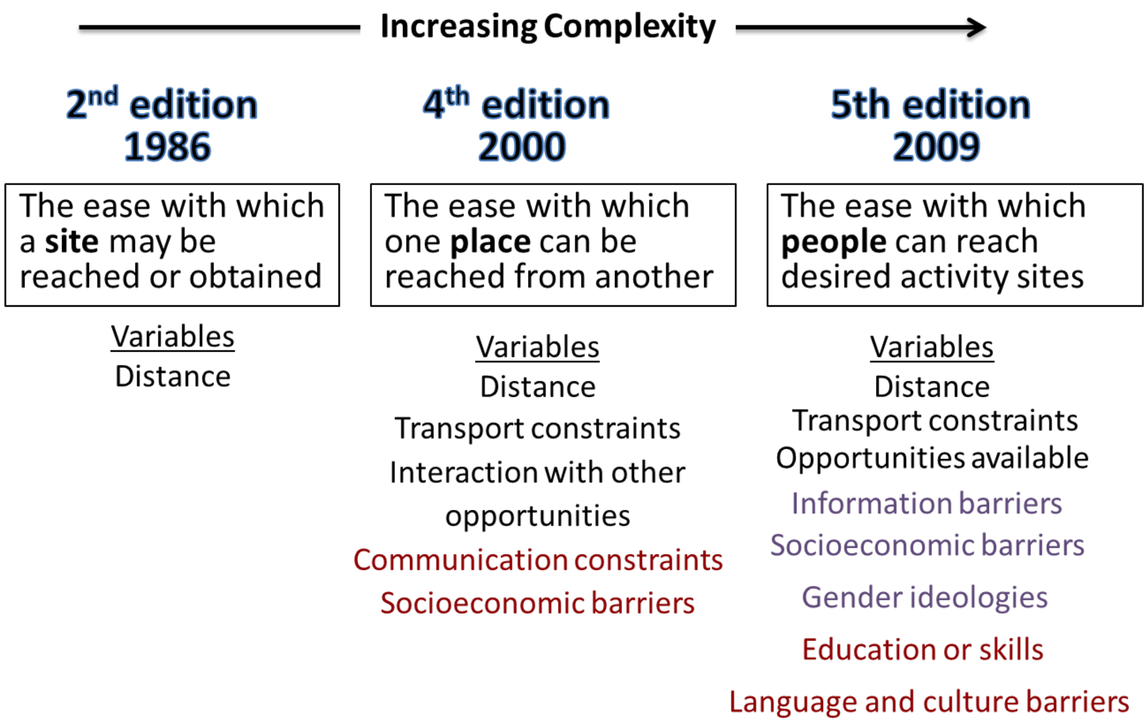
### *2.2.2.* An evolving concept

The conceptualisation and understanding of accessibility is continually evolving to respond to the changing environment, to adapt to the increasingly multi-disciplinary nature of the planning field and to satisfy the diverse needs of individuals. Likewise, there is also recognition that the development of a conceptually robust and inclusive notion of accessibility is as important as improving accessibility measurement (Pirie, 1981). The concept has been adapted to a number of fields outside the geography discipline to include not only the physical attributes but also other critical dimensions such as social needs, information availability, etc.

Aday and Andersen (1974) provided the principal study to distinguish the socio-organisational and geographic aspects of accessibility. They proposed the notion of ‘friction of space’ to be a function of travel time and physical distance to represent geographic accessibility. Socio-organisational accessibility refers to non-spatial attributes that influence people’s ability to obtain service. They argued that accessibility should be gauged by the actual use of service provided, which may be influenced by the financial, informational and psychological conditions of the individual user (Aday and Andersen, 1974). Expanding on Aday and Andersen’s definition of accessibility, Marten and Gillespie (1978) suggested that aside from the concept of friction of space, social barriers and user characteristics should be integrated with other geographic factors that affect accessibility. Pirie (1981) reckoned accessibility as a synonym of reachability and convenience, which implies that accessibility should be examined as an attribute of potential users rather than as simply a physical measure of distance between origins and destinations.

These definitions reveal the shifting conceptual focus of accessibility from the spatial dimensions to non-spatial dimensions that account for both the ability of individuals and the capacity of the activity site. Accessibility research has progressed beyond its spatial dimension (Gregory et al., 2009). In order to determine its influential factors, the complex and broader nature of the accessibility concept must be acknowledged while also requiring a comprehensive and integrated analysis. Derived from the earlier analysis, in the context of urban public facility accessibility, these influential factors may include user characteristics, social barriers, attributes of facilities, and interaction with other facilities in the system.

Figure 2-1 compares these definitions and the variables used in the three different editions of the *Dictionary of Human Geography*. In the 2nd edition published in 1986, accessibility was defined as the ease with which a site may be researched or obtained, with distance being the only addressed variable measuring accessibility (Gregory et al., 1986). This definition conforms to the geographic origin of accessibility that was discussed in the previous paragraph. However, the more recent editions of the Dictionary (4th edition in 2000 and 5th edition in 2009) recognised that accessibility is a complex and broader concept that requires increasing conceptual emphasis on non-spatial mismatch. In the fourth edition (2000), the standard definition of accessibility was read as the ease with which one place can be reached from another, which broadened the concept to include interactions with other places and services, transport and communication constraints, and other socioeconomic barriers (Gregory et al., 2000). The concept of accessibility was further broadened in the latest edition of this dictionary (5th edition published in 2009) to include more non-physical variables such as information available, language and culture barriers, education and skills. Furthermore, the standard definition of the concept was changed to the ease with which people can reach desired activity sites, such as employment and urban parks (Gregory et al., 2009), indicating that the focus of accessibility research has shifted from place to people to address the diverse needs of individuals. Gregory et al. (2009) alleged that lack of access is far more than just spatial mismatch. This asserts that non-spatial dimensions should be included to examine disparity in access to public services that serves as an important indicator of quality of urban life.



(Adapted from *Gregory et al. (1986, 2000)* and *Gregory et al. (2009)*)

Figure 2-1 Increasing complexity of accessibility definitions

## 2.3 Accessibility measures

The previous section reveals the advances in the conceptual development of accessibility in recent decades. Meanwhile, great effort has been devoted to the development of measurement in order to provide better assessment of accessibility to meet the practical need of evaluation. The history of accessibility research can be typically expressed as the history of the development of particular measures (Weber, 2006). Recent years have witnessed unprecedented progress in measuring and modelling accessibility, thanks to the increased spatial analytical capabilities offered by the geographic information system (GIS) and the availability of spatial and activity data (Murray et al., 2003; Neutens et al., 2010; Oh and Jeong, 2007; Talen and Anselin, 1998; Weber, 2006).The measure used to operationalise the accessibility concept in research imposes direct impacts on evaluation outcomes (Neutens et al., 2010). This section presents a critical review of accessibility measurement through comparing variables that are addressed in different measures.

### *2.3.1.* Accessibility variables addressed in various measures

To distinguish various accessibility measures, it is important to uncover the aspects of accessibility that each measure is concerned with and the variables that it measures. This section presents an overview of major accessibility measurement models used in the literature and planning practices. Accessibility variables addressed in these measures were identified and analysed.

Major accessibility measures can be grouped into two categories: location models and space-time (ST) measures. Location models have long been used and are still the most popular method used in accessibility assessment (Kwan, 1998; Murray et al., 2003). This group of accessibility measures is developed based on Location Theory. They evaluate the impedance effect of spatial separation between origin and destination, which can either be measured by the intention to minimise average access (in terms of distance, travel time or transport cost), or to maximise opportunities within a specified travel distance or travel time. Five major location models were reviewed and analysed. They are container index, cumulative opportunity, gravity potential, minimum distance and travel cost models (Kwan, 1998; Neutens et al., 2010; Talen and Anselin, 1998). The result show that physical distance (between origin and destination) and availability of services are the prevalent variables addressed in these location measurement models.

As the most widely used accessibility measures, location models present a variety of strengths: they are practical (Pirie, 1981) and easy to implement (Neutens et al., 2010); they provide spatial simplification of accessibility problems with minimum data requirement (Kwan, 1998), etc. Nevertheless, location models are criticised for: 1) being restricted by their assumptions about origins and destinations wherein all origins are known and people will always choose the closest facility as the travel destination (Murray et al., 2003; Pirie, 1979); 2) the lack of consideration for space-time constraints and temporal variations (Kitamura et al., 2001; Murray et al., 2003; Pirie, 1979).

Space-time (ST) measures were proposed to overcome the limitations of location models. Advocators of ST measures argue that space and time are two essential components in shaping access to facilities and opportunities. Five ST measures are widely used in the literature, namely *NUM*, *NUMD, BAGG, BMAX* and *AI* (Joerin et al., 2005; Kwan, 1998; Miller, 1999; Neutens et al., 2010). An analysis was conducted for the most common variables that these models address in their measurement. The results indicates that, besides the two physical variables used in location models (i.e., distance, number of facilities), additional variables such as travel time and people's available leisure time are also taken into account.

The challenges of operationalising the accessibility concept has been acknowledged in the literature, given such a complex notion. Most advances in current accessibility measurement are still limited within its spatial-physical dimension (Bisht et al., 2010). Nevertheless, the above analyses reveal that contemporary accessibility research is starting to recognise the importance of measuring the non-physical dimensions of accessibility. For example, some ST measures have taken certain variables from socio-personal dimensions into measurement considerations (i.e., available leisure time).

### *2.3.2.* The impact of variation in accessibility measures

Academics have recognised that variation in accessibility measurement will significantly influence the outcome of empirical research (Kwan, 1998; Neutens et al., 2010; Talen and Anselin, 1998; Weber, 2003). Research has been conducted to address this significance by testing different accessibility measures with empirical data. Three landmark studies are reviewed below.

Talen and Anselin (1998) investigated how variation in accessibility measurement affected outcomes of spatial equity analysis on the distribution of playgrounds in Tulsa, Oklahoma. They compared four different geographic accessibility measures (location models) and the results revealed that analysis on spatial equity of facilities distribution is highly influenced by the selection of accessibility measures (Talen and Anselin, 1998), resulting in generating different remedial policy recommendations.

Another landmark research is conducted by Kwan (1998), who provided the foremost empirical evidence for comparative analysis between outcomes from using geographic accessibility measures and those using space-time accessibility measures (ST measures). This comparative research was based on individual travel data and land use information in Columbus, Ohio. This research finding showed a substantial distinction between results from using the two groups of accessibility measures, concurring with Talen and Anselin (1998) that different types of measures provide significantly different insights into accessibility, even in the situations where individual-level data are used and the analytical context is free from the assumption of location models about origins and destinations. The author argued that ST measures appear to be more gender and individual sensitive (Kwan, 1998). Kwan (1998) further emphasised the importance of choosing suitable measures when assessing accessibility to public services. For example, ST measures may be more sensitive to capturing interpersonal differences in terms of spatial and temporal constraints.

Neutens et al (2010) expanded Kwan (1998)'s research by incorporating more ST measures (e.g. utility-based space-time measures) in their comparative study. In addition to confirming with Kwan (1998)'s research that there is a distinction between the analysis results of assessing accessibility from using space-time measures and geographic measures, their research further found a substantial distinction between the results obtained from using different ST measures (Neutens et al., 2010). Based on these findings, the authors further pointed out that these distinctions originate from ST measures' restrictive behavioural assumptions, which make travel time and activity duration the central variables to be measured in evaluating people's ability to access service. This limits the ability to identify individual difference from other accessibility dimensions such as social-psychological dimensions. This argument suggests a need for future research to incorporate these important but unexplored dimensions into accessibility assessment.

## 2.4 Research context

### *2.4.1.* Urban parks and planning context

Urban parks refer to the type of parks that have the maximum human interference with the natural environment and the highest level of accessibility for populations, commonly found within or adjacent to urban built up areas (Maruani and Amit-Cohen, 2007). Urban parks and green spaces offer a variety of economic, environmental and social function values (Bedimo-Rung et al., 2005; Byrne and Wolch, 2009; Cohen et al., 2007; Ulrich and Addoms, 1981; Wolch et al., 2014), providing important space-filling elements in shaping the form and layout of cities (Batty and Longley, 1994; Davies et al., 2008; Longley et al., 1992). From an analytic standpoint, proximity to parks has been widely adopted as one of the key driving factors in constructing models to simulate the complex and dynamic processes of urban land use and landscape changes using spatially explicit cellular automata (CA) (Besussi et al., 1998; Haase and Schwarz, 2009; Jenerette and Wu, 2001; Stevens and Dragicevic, 2007) and agent-based model approaches (Haase and Schwarz, 2009; Loibl et al., 2007). The potential impacts of urban forms on public health outcomes has long been recognized in the literature, with more recent studies ascertaining the positive correlation between urban sprawl and the increased likelihood of obesity-related diseases (e.g., high blood pressure, diabetes, and cardiovascular disease) (Alfonzo et al., 2014; Badland et al., 2014; McCann and Ewing, 2003). The positive externality effects that parks and green spaces offer to urban communities make them important public health promoting facilities to encourage more active lifestyle in cities (Reyes et al., 2014).

With an ultimate aim of fulfilling the recreation needs of urban inhabitants, urban park planning should take into consideration the attributes of target population such as demographic features, density, values and preferences (Chiesura, 2004; Gold, 1973). However, does the current park planning adequately address the needs of such diverse population groups? In planning practice, park planners use planning models as tools to achieve specific planning objectives. Each model has an identified focus in the planning of parks in cities (Maruani and Amit-Cohen, 2007). The rest of this section examines three park planning models to identify key criteria utilised to measure access to urban parks. They are opportunistic model, space standards model and park system model.

The opportunistic model refers to land acquisitions that are considered as due to opportunities rather than systematic planning outcomes. Opportunities may arise in different instances, through land donation, demolitions, transformation of recycling sites and use of leftover space (Maruani and Amit-Cohen, 2007). A number of well-known parks have evolved based on this model (e.g., Central Park in New York City). Nevertheless, the opportunistic model is hardly considered as a systematic planning tool due to the lack of planning principles in this model, and also because opportunities are largely due to chance.

The space standards model, on the other hand, is guided by quantitative matching between park units (e.g., size and number) and population size in target areas. Its guiding principle is to provide a minimal amount of park per capita for a target population. The simplicity in operationalisation has led to the worldwide expansion of the model since being first introduced in the 19th century (Maruani and Amit-Cohen, 2007). And yet, the space standards model is now criticised for disregarding complex social and environmental systems, with this limitation addressed by the park system model that promotes a system approach towards urban park planning. The park system model holistically considers the interrelationship between parks that supports continuous movement within the system, emphasising proximity to users and the variety of user experiences in different types of urban parks, from small community gardens to large metropolitan parks.

The above review indicates that the contemporary urban park models primarily concern with questions relating to the area, type and positioning of parks. It reveals that quantitative parameters (e.g., population size, spatial location and distance) are the most common measures utilised to determine park access (see Table 2-1 for the comparative summary of the key criteria used by the three models). However, these models fail to consider other important elements from individuals' perspectives.

Table 2-1 Key variables addressed in urban park models

| *Urban Park Planning Models* | *Objectives* | *Park variables* | *Population variables* | *Random or planning* |
|---|---|---|---|---|
| **Opportunistic model** | Park provision as a result of opportunities | | | Random model |
| **Space standards model** | Park provision as units per capita of target areas | Park size Park number | Population size | Planning model |
| **Park system model** | Park provision interrelated system | Park size Park type Connectivity | Population location Distance to users | Planning model |

(Adapted from *(Maruani and Amit-Cohen, 2007)*)

Defined as the ease with which people can reach desired activity sites (Gregory et al., 2009), accessibility has been widely used as an important indicator to evaluate the extent to which planning has been able to adequately respond to populations' demands for urban parks. Given the focus on ensuring community wellbeing, urban park planning must relate to a variety of parameters that focus on users' needs (Maruani and Amit-Cohen, 2007). However, modern planning practice largely relies on quantitative planning standards to measure communities' access to urban parks. As revealed in Table 2-1, besides population size, few other population attributes have been taken into account. Little evidence has been provided to support the approach that objectively measured accessibility can adequately address the diversity of people's needs related to access to urban parks, which are largely determined by populations' demographic characteristics, values and personal preferences.

### *2.4.2.* Social context

While park planning provides a broader planning background for this research, findings from environmental justice research define the study context from a social perspective. Concerns about distributional equity of urban infrastructure have become particularly acute since the end of 20th century (Wolch et al., 2005). As urban design tends to constrain people's ability to perform their daily activities, making public spaces and urban services accessible to everyone has become a human right issue. Urban parks are important public facilities with both physical and mental health benefits that encourage active lifestyle (Coutts, 2008). A perceived lack of parks in some communities stands out as one of the highest profile environmental justice issues in cities with the continuing expansion of urban footprints and the increasing density of population. As such, access to environmental benefits provided by urban parks has emerged as an important theme in contemporary environmental justice research.

Various studies have examined the implications of park distribution for population segments with different socioeconomic or cultural backgrounds (Byrne and Wolch, 2009; Byrne et al., 2009; Tsou et al., 2005). Some research has concluded that urban parks appear inequitably distributed within cities, with communities of lower socioeconomic status (SES) and people of colour having inferior geographic access to parks as well as degraded public recreation facilities, constraining the frequency of park use (Byrne et al., 2009; Estabrooks et al., 2003; Sister et al., 2010; Wolch et al., 2005). These studies confirmed significant associations between higher poverty rates and reduced availability of green spaces. For example, in Los Angeles, low-income neighbourhoods and those dominated by ethnic minorities (e.g., African-Americans and Latinos) have significantly lower levels of access to parks (Wolch et al., 2005) and a higher risk of potential park congestion (Sister et al., 2010). People of colour and the poor are largely excluded from accessing the city's largest urban national park as the park is surrounded by predominantly white and wealthy neighbourhoods (Byrne et al., 2009). Such uneven distribution of park spaces has raised compelling environmental equity concerns about the fact that park benefits are not equally distributed amongst population subgroups.

These findings contrast with other studies reporting that the distribution of green spaces has no significant association with deprivation (Jones et al., 2009; Lindsey et al., 2001; Macintyre et al., 2008a; Nicholls, 2001). For example, in the UK, poorer neighbourhoods are not always subject to poorer access to urban resources such as parks (Macintyre et al., 2008a). In Bristol, England, people living in more deprived areas were found to be closer to urban green spaces, but used parks less frequently than people in more affluent areas (Jones et al., 2009). Similar results were reported from the U.S. where less advantaged groups (ethnic minorities and people of lower incomes) were found to have better geographic access to public parks and green trails or be more likely to live in walkable neighbourhoods (Cutts et al., 2009; Lindsey et al., 2001; Nicholls, 2001; Wendel et al., 2011). However, the advantage of physical proximity to parks and green spaces may be offset by the quality, diversity, and size of the green spaces (Wendel et al., 2011) or by socio-personal characteristics including age, income, safety, and cultural concerns (Cutts et al., 2009).

In sum, findings from environmental justice research provide the social context for this research. Nevertheless, unlike environmental justice literature that concerns large-scale (city or regional wide) distributional equity issues, this study focuses on variables that may influence park access and use and the interrelationships between these variables, with a recognition of differentiated community preference.

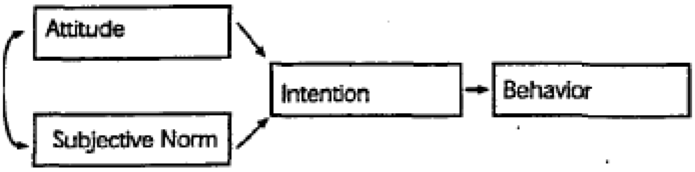
## 2.5 The influence of accessibility on behaviour

Researchers attempted to investigate the relationship between park use, proximity-based accessibility (i.e., distance and travel time) and other external influential factors such as weather conditions (Cohen et al., 2007; Coutts, 2008; Schipperijn et al., 2010; Wolff and Fitzhugh, 2011). Their findings indicated a significant association between physical distance/proximity and actual park use. For example, Giles-Corti et al. (2005) found that distance and park size were two important factors associated with the likelihood of using public parks. In these studies, direct observation was used as a major method to document park use and the frequency of physical activities while proximity-based indicators were used to measure accessibility. Based on these research findings, park planners have been endeavouring to deliver equitable community access to urban parks through achieving standard distributional criteria (e.g., proximity, number and area of parks per capita)(Oh and Jeong, 2007).

Behavioural intention is widely recognised as the most reliable predictor of human behaviour because it provides the most immediate determinant of whether or not an individual will conduct a certain social behaviour in the future (Ajzen, 1991; Bamberg et al., 2007). In the literature on park use, however, few have grounded their research on behavioural theories to investigate the influence of accessibility on park use behaviour. Behavioural theories have been widely adopted in socio-psychological research to investigate and predict human behaviour, wherein the theory of planned behaviour (TPB) was considered as one of the most predominant contributions in the field (Rossi and Armstrong, 1999). The rest of this section is devoted to reviewing TPB and its related theories to provide the theoretical background in this study.

### *2.5.1.* The theory of planned behaviour

The theory of reasoned action (TRA) (Figure 2-2) and the theory of planned behaviour (TPB) (Figure 2-3) provide the most predominant behavioural theories in predicting human social behaviours (Rossi and Armstrong, 1999). TPB is an expanded version of TRA which includes the additional component of perceived behavioural control to address human behaviour that is not entirely under an individual's volitional control (Ajzen, 1991). These two theories have been used to investigate a variety of human behaviours, e.g. smoking (Ajzen et al., 1995), tourist behaviour (Hsu and Lam, 2004), blood donation behaviour (Giles et al., 2004), travel behaviour (Bamberg et al., 2007) , participation in leisure activities (Ajzen et al., 1995), pro-environmental behaviour such as water conservation, littering behaviour in public parks, natural resource related human behaviour like hunting and fishing (Scherer et al., 2011, Rossi and Armstrong, 1999).



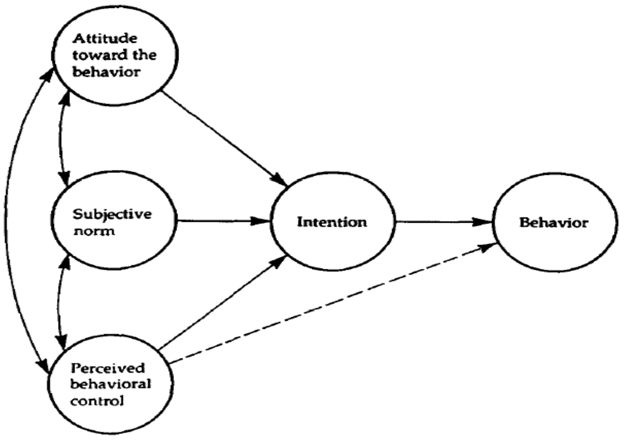
*Source: (Fishbein and Ajzen, 1975, p. 334)*

Figure 2-2 The theory of reasoned action (TRA) model

Developed and refined by Fishbein and Ajzen (1975), TRA has demonstrated its strong power and versatility in predicting behavioural intentions and human behaviour in a wide variety of disciplines (Armitage and Conner, 2001; Rossi and Armstrong, 1999; Scherer et al., 2011), such as social psychology, marketing, and environmental research. Hartwick et. al. (1988) conducted a meta-analysis to investigate the effectiveness of TRA and concluded that the model has a strong predictive utility: the theory of reasoned action can provide a strong basis for predicting and examining the motivational influences on a wide range of behaviours, even when those activities and behaviour violate the theory's conditions for use or fail to fit within the model's framework (Hartwick et al., 1988). With its successful applications in many fields, TRA has served as the fundamental theoretical framework utilised in investigating human decision-making processes and explaining social actions such as attending leisure activities and pro-environmental behaviour (Bagozzi, 1992; Scherer et al., 2011).

The central component of the TRA model is the concept of *behavioural intention*, which refers to the motivations that lead to the engagement in a behaviour (Fishbein and Ajzen, 1975). It is assumed in TRA that *behavioural intention* is the immediate determinant of a particular behaviour: the stronger the intention is, the more likely a person is to perform certain behaviour (Ajzen, 1991; Bamberg et al., 2007). *Behavioural intention* is a function of two independent constructs: *attitude* towards behaviour and *subjective norm*. According to Fishbein and Ajzen's (1975), information on an individual's *attitude* towards a specific behaviour is obtained from combining the measurement of the individual's beliefs with the salient attributes of certain behaviour and his/her subjective evaluation of these attributes as consequences resulting from the performance of the behaviour. TRA proposes that the strength of attitude towards certain behaviour will affect an individual's intention to perform that behaviour or not (Hsu and Lam, 2004), that is, people are more likely to perform the behaviour if they have a stronger positive attitude towards it. *Subjective norm* adds a social component to TRA and is the other construct that contributes to behaviour intention. It refers to people's perception of the appropriateness of performing the behaviour with regard to general social pressures from salient referents (Rossi and Armstrong, 1999). Subjective norm consists of two variables (Scherer et al., 2011). The first variable is an individual's perceived social pressure to perform or not to perform a particular behaviour from people who are important to him/her; and the second variable is the degree to which he/she is influenced to behave by these salient referents. People are more likely to perform a particular behaviour if subjective norms toward it become more favourable (Hsu and Lam, 2004).

Despite its success in examining a variety of behaviours across different disciplines, TRA is criticised for its inadequacy in predicting behaviour which is not under complete volitional control (Rossi and Armstrong, 1999). To address this need, TPB was developed to predict behaviour that is not under an individual's complete volitional control. As an extension to TRA, TPB shares a similar hypothesis about the relationship between intention to act and behaviour, as well as the first two components that contribute to *behavioural intention*: *attitude* and *subjective norm*. The third component, *perceived behavioural control (PBC)*, is included in the model of TPB in order to deal with the circumstances where constraints exist for behaviour (Ajzen, 1991; Ajzen and Madden, 1986).



*Source: (Ajzen, 1991, p.182)*

Figure 2-3 The theory of planned behaviour (TPB)

The inclusion of the component PBC extends the model's ability to address an individual's perception about the potential constraints on performing certain behaviour (Ajzen, 1991; Garling et al., 1998). Ajzen (1991) argued that PBC may has the potential to directly predict behaviours which are not entirely under the control of the actor. The sufficiency of TPB was validated by its successful applications in predicting and explaining a wide range of behaviour in many studies (Hartwick et al., 1988; Hausenblas et al., 1997).In dealing with a real-world context and the fact that the majority of actions belong to the non-volitional range and would require certain resources to perform (e.g., will-power, time, money etc.), empirical studies found TPB a better model in the prediction of human behaviour (Giles et al., 2004; Manstead and Parker, 1995; Rossi and Armstrong, 1999). For example, Hausenblas et al. (1997) conducted a meta-analysis to compare the predictive power between the two models. Their research demonstrated that TPB has higher efficiency in predicting behaviour in attending physical exercise than TRA.

In the context of this research, park use behaviour is not completely under people's volitional control, but is subject to a range of barriers such as safety, leisure time and availability of transport. Therefore, TPB provides a more appropriate model to explain park use intention.

### *2.5.2.* TPB as a theoretical framework for behavioural analysis and its potential to be expanded

Although direct references to the use of TPB in park use studies are lacking, TPB has been widely adopted by socio-psychological researchers and its sufficiency in behaviour prediction has been supported by abundant evidence in behavioural research in related areas (Ajzen, 1986; Brickell et al., 2006; Galea and Bray, 2006; Hartwick et al., 1988). For example, TPB is used by Ajzen et al. (1995) to examine people's intention to participate in six leisure activities (Ajzen et al., 1995); Galea and Bray (2006)'s research supported the sufficiency of the TPB model in predicting human behavioural intention to participate in walking activities. Perceived behavioural control is revealed as a determinant of exercise in their study on the intention of participating in walking activity among people with intermittent claudication (Gretebeck et al., 2007); Similarly, Gretebeck et al., (2007) found TPB an appropriate model in predicting self-reported physical activity behaviour of older adults. In view of their particular target group—the older adults—the model of TPB was expanded by adding an additional construct (*functional ability)* to provide a better prediction of the intention to participate physical activity.

The above review indicates the potential of TPB to be expanded to include other variables according to the specific circumstance of a particular research project. TPB is a user-friendly model and has the flexibility to be amended or expanded to meet the needs of different research (Masser et al., 2009; Rossi and Armstrong, 1999). An expanded version of TPB may provide a more adequate explanation of different behaviours in terms of different groups of people. As an open-ended model, the TPB model changes according to the change of target behaviour. Ajzen (1991) confirmed the potential of TPB to be expanded by positing that the model should be tailored according to the needs of target behaviour. He argued that base variables in the TPB model (attitude, subjective norm and perceived behaviour control) can and should be broken down, rearranged and expanded to meet a researcher's specific need. Besides the three base variables, any components that are able to explain additional variance in behavioural intention and thus increase the power of prediction belong to the TPB model.

Similar to Gretebeck et al., (2007)'s research, which included *functional ability* in model testing, Perugini and Bagozzi (2001) found that two additional variables (*anticipated emotion* and *past behaviour* ) are both significant components in explaining variance in intentions and behaviour (Kitamura et al., 2001). *Past behaviour* was included in the TPB model to explain tourist behaviour and was found significantly associated with respondents' travel intentions

(Hsu and Lam, 2004). In addition, TPB was expanded to include *descriptive norm* in Heath and Gifford (2002)'s research of public transport use. Their result showed that the additional construct of *descriptive norm* can significantly improve the model prediction in this behaviour domain.

## 2.6 Geographic accessibility and perceived accessibility

Accessibility provides one of the key notions that describe the fundamental principles of human activities (Pirie, 1981). In this light, recent decades have witnessed increasing interest in examining the influence of park accessibility on promoting park utilisation and participation in physical activities (Cohen et al., 2007; Coutts, 2008; Schipperijn et al., 2010; Wolff and Fitzhugh, 2011). However, these studies relied heavily on accessibility data that are measured by objective indicators such as physical distance and travel time (Cohen et al., 2007; Coutts, 2008; Erkip, 1997). The advent of geographic information system (GIS) technology has enabled researchers to develop new measurement approaches to include additional components (e.g. available transport modes, service time available) in the evaluation of access to services and opportunities (Comber et al., 2008; Nicholls, 2001; Pitot et al., 2006). For example, the Land Use & Public Transport Accessibility Index (LUPTAI) integrated the impact of public transport availability and walking distance to visualise the opportunity to reach places by public transport and/or walking. However, although these new measures have gone beyond the locational models that are limited to measuring travel distance and time, they are generally destination-based geographic indicators utilising GIS-based analyses and hardly consider the diverse preferences of local communities.

Accessibility is 'one of those common terms which everyone uses until faced with the problem of defining and measuring it' (Gould, 1969). In Section 2.2, the review on conceptual approaches of defining accessibility reveals its geographic origin and ever evolving nature. To date, academics and urban researchers have widely recognised accessibility as a complex multi-dimensional construct that is associated with both spatial-physical and socio-personal factors. For example, Gregory et al. (2009) emphasised that accessibility involves more than spatial mismatch, highlighting the linkage between accessibility and individuals' ability to overcome the cost associated with spatially dispersed opportunities. This research adopts the notion of geographic accessibility to represent accessibility with a spatial-physical focus in order to distinguish it from the broader construct of accessibility with multiple dimensions.

Accessibility does not always equate with these objectively measured geographic indicators (Boehmer et al., 2006; Scott et al., 2007). Subjectively measured access to parks (perceived accessibility) shows poor consistency with objectively measured accessibility (geographic accessibility) based on quantitative standards (e.g., distance to parks and park area per capita) (Ball et al., 2008; Hoehner et al., 2005; Jones et al., 2009; McCormack et al., 2008; Scott et al., 2007). This indicates the presence of other factors (e.g. social psychological factors) which may affect perceived access to parks, and ultimately, park use. For example, using the theory of island biogeography as an analogue, the theory of urban park geography posited that both distance and size of park (both variables are geographic accessibility measures) exert impacts on the diversity of park values (a preference-based measure for the importance of the park relative to others) (Brown, 2008). Nevertheless, when the theory was empirically tested using Anchorage survey data, there was a weak relationship between distance and park value. The finding indicates that accessibility, which is a much more complex construct than geographic measures of distance, might confound the relationship between distance and park value. Similarly, previous studies found that respondents living in more deprived areas had higher potential physical access to green spaces reported poorer perceived accessibility and less frequent use (Jones et al., 2009; Macintyre et al., 2008a), suggesting that perceived accessibility might provide a more reliable approach to predict people's park use behaviour.

Perceived access does not equate with geographic access (Boehmer et al., 2006; Scott et al., 2007) and may be more important in understanding and predicting human behaviour (Kruger et al., 2007; Zondag and Pieters, 2005). Perceived accessibility measures the extent to which individuals consider the service is accessible to them, representing the subjective nature of the accessibility construct. While geographic measures are currently used as the most common method of measuring park access, perceived accessibility has been highlighted for its ability to predict park use as a measure of people's overall evaluation about destination suitability (Joerin et al., 2005). It is doubtful if the traditional proximity-based accessibility measures provide reliable indicators to explain human behaviour, because there is insufficient knowledge of the accessibility construct, especially at an individual perceptual level (Næss, 2006; Pirie, 1981; Pirie, 1979). Zondag and Pieters (2005) argued that public facility use cannot be isolated from perceived accessibility, emphasising that every individual or household has their own perception of access to urban facilities such as parks. Subjective measures are important because the tendencies or willingness to act or avoid an action are the result of collective evaluation towards object attributes based on previous knowledge or information (Back and

Parks, 2003; Oliver, 1997). Similarly, Byrne and Wolch (2009) posited a conceptual park use model wherein individual perceptions of park spaces (including accessibility) provide the most influential component to predict park use decisions. Affected by people's evaluation of destination suitability, perceived accessibility thereby provides a more reliable measure of people's preferences and the diversity of users' needs. Therefore, it is reasonable to consider perceived accessibility as the outcome of individual evaluation of diverse attributes of park access (e.g., footpath connection, proximity, and transport), acting as a potential influential factor in park use intention that ultimately leads to individual park use behaviour.

Previous research provided some empirical supports to the above arguments about the potential of perceived accessibility as a predictor of use behaviour. Some research tried to integrate individual preference components into the measurement of accessibility (Joerin et al., 2005; Kwan, 1998). For example, Joerin et al. (2005) proposed a new accessibility index that considered personal travel thresholds (i.e. willingness to travel) into an accessibility measurement. Their study concluded that an accessibility index with personal preferences taken into account provides greater insights into explaining individuals' travel behaviour than traditional geographic approaches of measuring accessibility. Others research examined if perceived access to places for physical activity, such as parks, plays an important role in influencing physical activities (Kruger et al., 2007; Sotoudehnia and Comber, 2011). The findings from Kruger et al. (2007)'s research showed that having perceived access to fitness facilities is significantly associated with physical activity levels among U.S. adults. However, as individual travel threshold was the only non-physical component incorporated in the development of Joerin et al. (2005)'s accessibility index, the impacts of other important accessibility variables were largely left unexplored. The secondary use of national health survey data in Kruger et al. (2007)'s research made it impossible to distinguish perceived access from actual physical access to fitness facilities. And thus, these studies were unable to investigate the importance of potentially influential factors in self-reported accessibility.

To date, complete knowledge about perceived accessibility—a notion that represents the subjective nature of the accessibility construct—is lacking. Few efforts have been devoted to examining how the multiple accessibility dimensions and variables contribute to self-reported access to urban facilities. In park studies, access to parks has been identified as one of the important factors in shaping park utilisation. For example, Byrne et al. (2009) found that easier access was an important reason for people's decision to use local parks rather than large national parks. This was especially true for people of colour. However, it is still unknown whether perceived accessibility and geographic accessibility play similar roles in explaining and predicting park use. In addition, although existing literature has highlighted the relationship between perceived access to park and park use, few studies have examined people's behavioural intention to use parks and green spaces. Therefore, there is a need to develop a more complete understanding about accessibility from an individual perceptual level. How can physical or non-physical construction of accessibility affect people's perception of accessibility and ultimately their use behaviour? Such effort will significantly contribute to the development of a meaningful accessibility index which is able to represent the subjective nature of accessibility, and is essential to facilitate sound decision-making in planning to improve the quality of urban lives.

## 2.7 Conclusion and key research gaps

Taken as important public health promoting facilities, urban parks are claimed to contribute to community wellbeing, encourage a change of sedentary lifestyle (Cohen et al., 2007), and contribute towards the development of social capital and healthy cities (Chiesura, 2004, Jones et al., 2009). Urban park planning aims to allocate parks and green space to meet urban residents' demands for recreation. Accessibility is central to the planning discipline in general and urban park delivery in particular.

The conceptual review in Section 2.2 confirmed that the notion of accessibility has become broader and more complex, therefore, requiring an increasing conceptual emphasis on its non-physical dimensions. A more comprehensive approach is required to operationalise the accessibility concept to facilitate decision-making in planning. A review of existing accessibility measures (Section 2.3) indicated that the methodological advances in spatial analysis have not successfully addressed the multidimensional nature of the accessibility concept, but left non-physical dimensions such as social conditions and personal constraints, including perceptions, largely unexplored. Section 2.4 reviewed major planning models used in contemporary park planning practice, concluding that these models are largely based on quantitative indicators that can hardly represent the diversity of users' needs and population demands. Section 2.5 justified the appropriateness of the TPB model to be used as the theoretical framework to explain park use behaviour. Section 2.6 emphasised the inconsistency between perceived and geographic accessibility and the important role of perceived accessibility in understanding human behaviour, arguing for the need for a more complete knowledge about the multidimensional construct of accessibility.

The end goal of urban park planning is to address users' demands for parks. This then creates the need to develop a more comprehensive understanding of the accessibility concept, especially at the individual perceptual level. However, to date, there is a lack of knowledge in park planning literature about accessibility dimensions and variables, their relationship with park use intention, and their interactions with other factors that may influence people's use behaviour. This study fills these knowledge gaps by examining the accessibility concept from the perspective of potential users. It posits that the human process of evaluating accessibility is critical to understanding accessibility dimensions and variables, as well as its interactions with park use behaviour. To accurately describe these socio-psychological processes, the next chapter proposes an integrative framework for urban park use as the theoretical framework in this study.

# CHAPTER 3. THEORETICAL FRAMEWORK & MODELS

Chapter 3 presents an integrative theoretical framework to illustrate the relationship between park accessibility and park use, based on findings from the critical literature review in Chapter 2. It aims to address the following questions: Which accessibility variables are worth including in a park planning model? How do these criteria relate to park use? This chapter premises that this step is critical to attain a clearer understanding about the concept of accessibility in the context of urban parks and to potentially establish the relationship between park access and human use behaviour.

The remainder of this chapter is arranged in the following manner: Section 3.1 presents an integrative framework for urban park use. Two processes are described in this framework: (1) a behavioural process wherein perceived accessibility influences human behavioural intention to use (or not use) urban parks; and (2) a psychological process which results from the evaluation of both physical and socio-psychological accessibility variables. Section 3.2 examines the role of perceived accessibility as a predictor of park use intention. An expanded behavioural model is proposed to explain the relationships between place use and accessibility. In Section 3.3, an integrated park accessibility model is proposed arguing that such a representation is a more authentic articulation of the multidimensional concept of accessibility. This is then capped with the chapter's conclusion.

## 3.1 An integrative framework for urban park use

The examination of the relationship between park accessibility and park use leads us to the dichotomy of place versus people. Place accessibility and people accessibility represent different research foci in accessibility research (Ferreira and Batey, 2007; Murray et al., 2003). While place accessibility researchers conceive geographic access as a location attribute, people accessibility researchers, on the other hand, focus more on the ability of different groups or individuals to access the park (Murray et al., 2003). This suggests that place accessibility and people accessibility are different representational frameworks that provide supplementary definitions for accessibility. The decision on which perspective a researcher takes is critical because it determines how to operationalise accessibility, and which measures will be adopted in the study. Horner (2004) distinguished the two perspectives by explaining the different purposes of these measures. Place accessibility measures examine levels of attractiveness of places or locations to all their possible users, which implies that access is an intrinsic feature of location, while people accessibility can be viewed as an individual attribute and can consequently measure the ability of people to reach and engage in opportunities and activities (Farrington and Farrington, 2004; Horner, 2004). In contrast, Ferreira and Batey (2007) argued that place and people accessibility are not mutually exclusive concepts, but outcomes from the same accessibility process. They used a model with five approaches/layers to describe the accessibility process wherein each approach represents a relatively self-contained understanding of the accessibility construct and has the ability to diminish or promote levels of access from the perspectives of both people and place (Ferreira and Batey, 2007).

To capture the interdependent relationship between people and place accessibility, this study concurs that people and place accessibility are not mutually exclusive concepts, but different points of view within the same accessibility spectrum. However, in the process of accessibility, individuals' use behaviour acts as an important mediator to explain the relationship between these two concepts. From the perspective of potential users, accessibility is the outcome of people's integrative evaluation of multiple influential factors, both spatial and non-spatial, which then influences the degree of access to facilities, including to urban parks. On the other hand, place accessibility regards a site as inaccessible even if it is within a certain distance from a population, but not one individual actually utilises it. In this study, place accessibility is defined as the extent to which people utilise the place, representing the objective perspective of the accessibility process. Pirie (1979) argued that it is people's use behaviour that creates place accessibility, positing the relationship between place access and place use. Given this premise, place accessibility is the objective outcome of the accessibility process that is defined by individuals' use behaviour, rather than certain geographic constraints or barriers such as distance and transport.

An integrative framework is proposed in this study to illustrate interrelationships among these concepts (Figure 3-1). The framework consists of four major components: people accessibility, perceived accessibility, place use/non-use behaviour and place accessibility. In the model, the term people accessibility refers to a cognitive/affective process by which people evaluate their level of access to specific facilities, such as parks, through the integrative evaluation of both physical and social-psychological accessibility dimensions. The formation of people's perceived accessibility informs their intent to use specific urban services or places. As Penchansky and Thomas (1981) argued, an individual's perception of accessibility may diminish or promote the use of urban facilities or services (e.g., parks) through behavioural choices. It is therefore hypothesised that perceived accessibility is an important explanatory predictor of people's behavioural intention for place use or non-use that ultimately defines the concept of place accessibility.

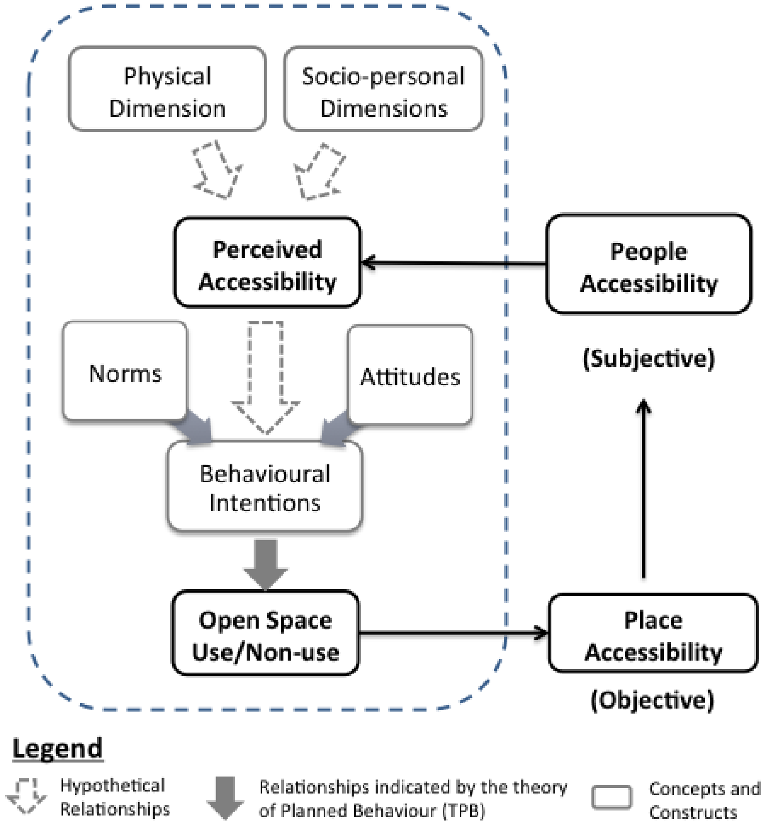


Figure 3-1 The integrative framework for urban park use

The left part of the framework further explains the relationship between accessibility and place use. People's judgement about which place or service is more accessible in comparison to other places initiates an integrated evaluation process. This process considers, evaluates and incorporates multiple accessibility variables, both physical and socio-psychological. The subjective evaluation of personal accessibility is then combined with other subjective components (e.g. norms and attitudes) leading to behavioural intentions or actual use behaviour towards accessing a place or service that contributes to place accessibility. This framework reveals that accessibility and place use are not independent concepts, but interactive constructs. If the conditions associated with different dimensions of accessibility change, individuals will then re-evaluate to modify their perception of accessibility to places or services that will ultimately influence their use behaviour.

This framework is important because it reveals relationships between accessibility and place use, and identifies variables that may influence these two constructs. Accessibility, as illustrated in Figure 3-1, does not equate with place use. Rather, it acts as only one of the potential explanatory variables, together with other important subjective components, contributing to people's use of public facilities and services. Therefore, planners should identify important variables that are addressed in the framework to achieve equitable distribution of services based on accessibility. As mentioned above, accessibility is a multidimensional construct that has been evolved far beyond its geometric origins. So, what are the potential variables that influence people's perceived accessibility to urban open spaces? Which criteria are worth including in an open space planning model? How do these criteria relate to open space use? Seeking answers for these questions creates a need for more specific theoretical models to facilitate an empirical research design. Sections 3.2 and 3.3 will develop this framework further into two models using urban parks as the specific study context.

## 3.2 An expanded TPB model to explain park use

One of the key contributions of this thesis—the proposed expanded TPB model for urban park use (Figure 3-2) —attempts to examine the role of perceived accessibility in contributing to the changes of park use behaviour. This model presents an extension of the lower part of the integrative framework for urban park use (Figure 3-1).

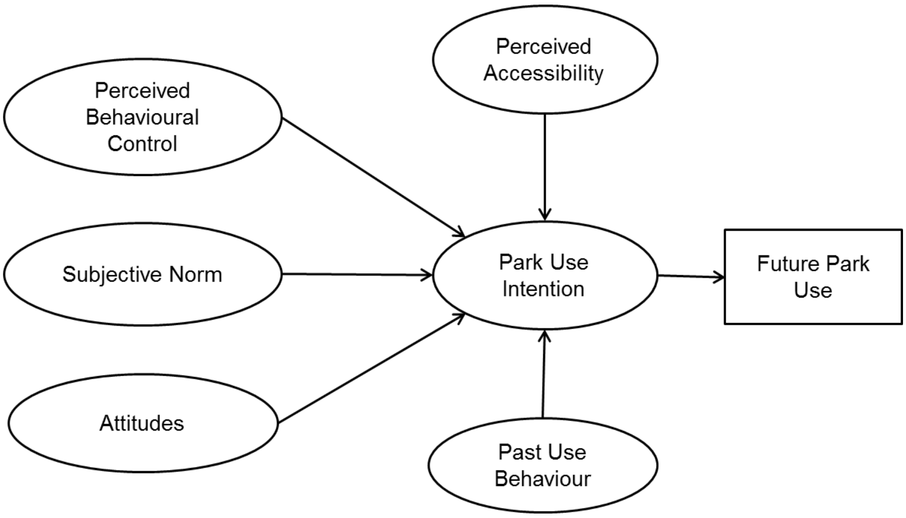


Figure 3-2 The expanded theory of the planned behavioural (TPB) model for urban park use

This model was developed based on the theory of planned behaviour (TPB). The central component of TPB is the concept of *behavioural intention* that refers to the motivations to engage in a certain action (Fishbein and Ajzen, 1975). *Behavioural intention* is a function of three independent constructs: *Attitude* towards behaviour *(ATT), subjective norm (SN)* and *perceived behavioural control (PBC)*. *ATT* measures an individual's attitude towards a specific behaviour. *SN* refers to people's perception of appropriateness to perform the behaviour with regard to general social pressures from salient referents (Rossi and Armstrong, 1999). *PBC* is included in the model in order to deal with the circumstances where constraints exist for behaviour (Ajzen, 1991; Ajzen and Madden, 1986).

Expanding the TPB model, two additional factors were included into the model to explain park use behaviour: *perceived accessibility* and *past use*. *Perceived accessibility* refers to the extent to which individuals consider the service is accessible to them. Existing literature has highlighted the potential role of perceived accessibility in explaining and predicting use behaviour. However, few researchers have treated perceived accessibility as an influential component in behavioural intention or examined it with other behavioural determinants to explain park use. This model illustrates the potential role of perceived accessibility as one of the hypothetical subjective components that may contribute to the formation of behavioural intention and ultimately park use behaviour.

*Past use* is another important factor included to explain park use behaviour. It is used to measure the strength of an individual's habitual behaviour. Although TPB has been widely adopted by researchers and supported by many studies, there has been criticism that the sufficiency of this model is largely dependent on the degrees to which the behaviour is deliberately planned (Herzog and Strevey, 2008). However, not all human behaviours are carried out through conscious decision-making processes. People do not have to consciously guide their actions when they perform habitual behaviour such as physical activities. Perugini and Bagozzi (2001) suggested that if behaviours are well-practised and recur in constant contexts, the frequency of past behaviour—a reliable indicator of the strength of habit—provides a direct predictor of future behaviour. The inclusion of past use in TPB was able to greatly improve the model's predicting ability of various behaviours in leisure studies (Hsu and Lam, 2004; Kitamura et al., 2001; Perugini and Bagozzi, 2001). Similar to these leisure activities, park use behaviour is conducted in stable and constant contexts and can be considered as one of routine activities in people's everyday lives. In view of park use as the target behaviour, it is reasonable to hypothesise that the inclusion of a *past use* variable will increase the amount of variance explained in park use intention. Therefore, the model includes *past use* as a hypothetical explanatory variable with direct influence on park use intention.

The expanded theory of planned behaviour model was proposed to examine how perceived accessibility and past use behaviour influence park use intentions. The proposed model provides for empirical testing. All the factors in the model can be measured using empirical research design to test their contributions to park use.

## 3.3 An integrated model of park accessibility

The proposed integrated model of park accessibility (Figure 3-3) provides another key contribution of this thesis. The model was developed with the recognition of a paradigm shift wherein accessibility as a concept has shifted from a spatial-physical focus to the consideration of more non-physical dimensions. The proposed model presents an extension of the upper part of the integrative framework for urban park use (Figure 3-1).

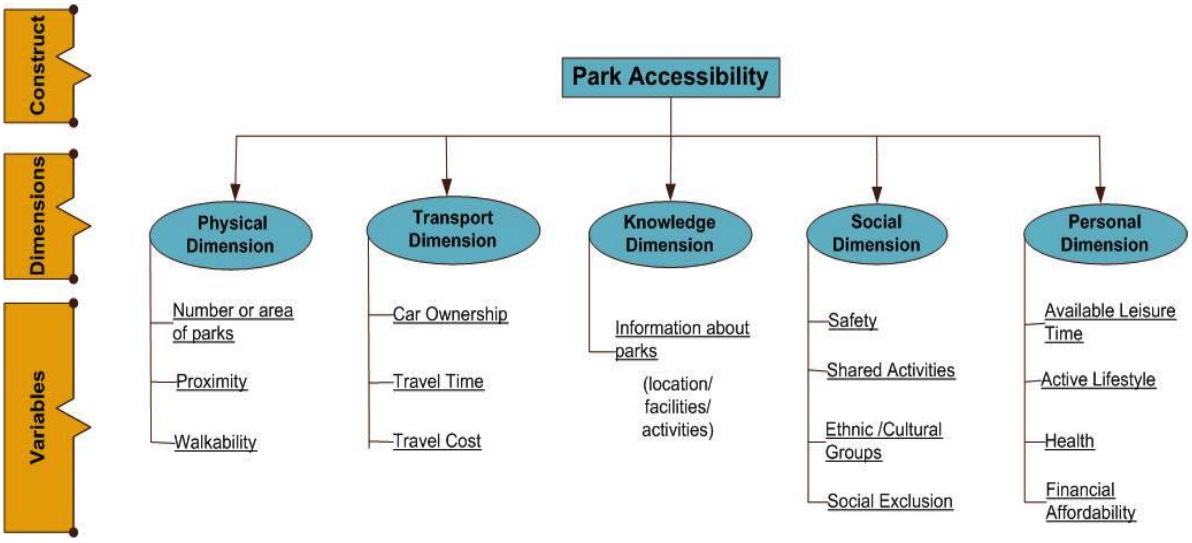


Figure 3-3 The integrated model of park accessibility

The integrated model of park accessibility consists of five dimensions, which are spatial, transport, knowledge, social, and personal. The spatial and transport dimensions are included in the proposed model to represent the geographic aspect of accessibility. These two dimensions encompass a variety of geographic and transport variables such as distance, area, car availability etc. Information is argued to be one of the important constraints that influence people’s access to services (Gregory et al., 2009). In the context of accessibility to public parks, awareness of park location and activities is a common barrier to accessing the facilities. The knowledge dimension represents an aspect of accessibility that associates with the availability of information and people’s cognitive processes (Aday and Andersen, 1974; Bisht et al., 2010; Ferreira and Batey, 2007). The social and personal dimensions are developed to cover socio-personal variables, such as life style, safety, etc., that may influence people’s ability to obtain park service. These dimensions are described below.

### *3.3.1.* Physical and transport dimensions

Accessibility literature points out that proximity and the inconvenience of overcoming distance are presumed to be the most important influential factors in determining the level of access to parks and green space in urban areas. The transport components, such as availability, distance, travel time and cost, determine the level of convenience in overcoming spatial separation (Penchansky and Thomas, 1981). Ferreira and Batey (2007) posited that intellectual abstraction of a geometric space defines access to public facilities. That is, people adjust or deform the reality of geometric space to conform to their beliefs. For example, locations with better transport connections are seen to be much closer or more accessible than the locations with less transport connections in this deformed intellectual space. Besides transport availability, I posit that physical obstacles to parks such as train tracks or freeways can diminish perceived accessibility while a well-designed footpath linking one’s home to the park can increase the perceived accessibility to parks.

### *3.3.2.* Knowledge dimension

The knowledge dimension is another important accessibility dimension. Accessibility literature recognises that information conditions influence people’s access to services (Gregory et al., 2009). In addition, knowledge contributes to one of the three major dimensions in Bisht et. al. (2010)’s accessibility index. In their model, knowledge connects to people’s ability to seek information that is measured by aggregate census data such as the level of formal education or internet access.

Nevertheless, the knowledge dimension identified in this model has a different focus. The knowledge dimension in this model refers to the level of information awareness that individuals have. It connects people’s subjective impressions as the outcome of people’s cognitive processes. This process filters relevant information that is available to potential users to form subjective impressions of information awareness about the place (Ferreira and Batey, 2007). Given the context of a park facility, this dimension associates with information about various aspects of parks, such as location of parks, facilities in parks and activities held in parks. Such variables can be elicited as self-reported information, and can, therefore, be empirically tested to determine their contribution to park use behaviour.

### *3.3.3.* Social and personal dimensions

Social dimension and personal dimension provide two socio-psychological dimensions for park accessibility. Geographic factors alone are not able to represent people's perception of access to public facilities (Aday and Andersen, 1974; Gregory et al., 2009; Marten and Gillespie, 1978). People interact with their urban environments to access services near their place of residence, for example public parks and green spaces. Pirie (1979) posited that it is people's interaction process that creates accessibility. Meanwhile, this statement alleges that non-spatial factors associated with socioeconomic constraints and individuals' capacities (i.e., health status, life-style, stage of life) account for people's accessibility to parks.

Aday and Andesen (1974) used the term "socio-organisational accessibility" to distinguish non-spatial factors from geographic factors. These factors are claimed to influence the ability to obtain service. Similarly, Ferreira and Batey (2007) described an *institutionally aware approach* to explain the influence of social dimensions. In their approach, *institution* refers to the social structures and mechanisms including cultural, ethnic, economic, and demographic attributes. Although *institutions* are said to influence accessibility in general, the term *institution* appears too broad for direct use in empirical accessibility research. For example, in the Ferreira and Batey (2007) model, the term *institution* encompasses a wide range of concepts from segregation brought about by the presence of social barriers (i.e. age groups, social classes, ethnic groups) to the inability to participate (i.e. physical disabilities, mental problems such as anxiety, and financial resources).

In this study, however, it is essential to treat social and personal dimensions as two separate but interrelated dimensions that are represented by their related variables respectively. The social dimension of accessibility consists of four main components (e.g., safety, shared activities, ethnic/cultural groups and social exclusion). Security and safety are important public concerns that significantly influence perceptions of park spaces (Byrne et al., 2009; Chiesura, 2004; Winter and Lockwood, 2005). In addition, two other factors including shared activities/programs and ethnic/cultural groups are considered to either facilitate social cohesion or encourage segregation between groups in public spaces. While the way people perceive public spaces is largely shaped by their cultural backgrounds and values, common interests in certain activities or programs (e.g., sports, supervising children at a playground) can also create affinities to places and produce solidarity benefits. Social exclusion and its antipode, social cohesion, are related to individual perceptions of social identity, connectedness, support, and trust in people. For example, self-reported community perceptions of trust play a significant role in predicting physical activity behaviour (Chen and Jim, 2010). Additionally, strong community bonds also play a role in social capital development and positive perceptions of public spaces (Chiesura, 2004; UN, 2010). In addition to social factors, public park accessibility is subject to a range of personal factors including self-reported physical and mental health, personal life style, stages of life cycle, available leisure time, and financial resources. Health status and life cycle stage influence both the ability and desire to use facilities such as urban parks. Available leisure time and individual financial resources are personal constraints that may limit an otherwise natural propensity to access urban facilities and services.

### *3.3.4.* How well do major accessibility measures address these variables?

The integrated model of park accessibility presents a new approach of defining accessibility to urban parks. This model integrates both spatial and non-spatial variables that have the potential to influence individual access to public parks. It provides an easy way to understand the complexity of the accessibility construct as well as its potential influential factors. Have accessibility measurement addressed the complex nature of the accessibility concept? To address this question, the proposed model was used to examine current accessibility measures. The result shows a clear knowledge gap on the non-physical dimensions of the model (see Table 3-1).

Table 3-1 How well do major accessibility measures address variables in the park accessibility model?

| | | ***Accessibility Dimensions and Variables*** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***Spatial and Transport Dimension*** | | | | | | ***Knowledge Dimension*** | | ***Social Dimension*** | | | | ***Personal Dimension*** | | | | |
| | | No. or Area | Proximity | Walkability | Car Ownership | Travel time | Travel cost | Information about Parks/Facilities | Information about Activities/ Programs | Safety | Shared Activities | Ethnic/Cultural Groups | Social Exclusion | Avail. Leisure time | Active Lifestyle | Health | Personal Life style | Life cycle |
| ***Accessibility Measures*** | **Container Index** | √ | | | | | | | | | | | | | | | | |
| | **Gravity Potential** | √ | √ | | | | | | | | | | | | | | | |
| | **Minimum Distance** | | √ | | | | | | | | | | | | | | | |
| | **Travel Cost** | | √ | | | | | | | | | | | | | | | |
| | **CUM** | | | | √ | √ | | | | | | | | | | | | |
| | **STP** | | | | | √ | | | | | | | | √ | | | | |
| | **NUMD** | | √ | | √ | √ | | | | | | | | √ | | | | |
| | **BAGG** | √ | √ | | | √ | | | | | | | | √ | | | | |
| | **BMAX** | √ | √ | | | √ | | | | | | | | √ | | | | |
| | **AI** | √ | | | | √ | | | | | | | | √ | | | √ | |

In sum, the integrated model of park accessibility was proposed as a logical extension of existing accessibility concepts from the literature, but more authentic representation of the concept in the context of public facilities, urban public parks in particular, with flexibility for psychometric scaling and empirical testing. In this model, each dimension is represented by a list of variables that may influence an individual's evaluation of his access to public facilities. The strengths of the model include:

- The ability to empirically test and validate the model using survey data in a variety of urban settings.
- The identification of five separate dimensions that can be operationalised and individually and collectively analysed for their contribution to the overall accessibility construct.
- The relative ease to generalise the model to other non-park public facilities and services with minor modifications.

The proposed model was used to test current accessibility measures, with the results confirming with previous findings that accessibility measurement has focused on physical factors, leaving important socio-personal factors largely unexplored.

## 3.4 Conclusion

This chapter suggests that park planning can be enhanced by recognising the integrative framework of park use to further develop our knowledge about the concept of accessibility and its process. The framework reveals the relationship between accessibility and park use from the perspective of potential park users. It highlights people's evaluation process of the constraints associated with different accessibility dimensions, and the potential role of accessibility as a predictor of park use behaviour. Two additional models were proposed to elaborate the two individual but interrelated steps in the framework. These include (1) an expanded behavioural model for urban park use that indicates the potential factors that may contribute to park use behaviour, and (2) a conceptual model of park accessibility as a more authentic representation of the accessibility concept in the urban park context. The first model is built on the theory of planned behaviour with recognised power for behaviour prediction, while the second model presents a logical extension of existing definitions of accessibility in the literature.

In the real world, accessibility is not an abstract concept in everyday life. This chapter uncovers human evaluation process on multiple factors that ultimately contribute to an individual's behavioural choices. Research to evaluate the validity of the models presented herein will enhance our understanding of the conditions that lead to the use (or non-use) of urban parks to inform future planning decisions. It is recommended that park planning should go beyond physical indicators to gain more understanding about the diversity of community preferences and demands. The proposed models will facilitate the ability of planners to identify potential variables that may influence people's park use, and are therefore worth including in a park planning model to address the diversity of significant predictors of use behaviour in regard to different population groups.

The proposed models require testing, validation, and refinement. Key research questions include: which dimensions and dimensional variables are most significant in contributing to perceptions of park accessibility? Does perceived accessibility actually predict park use behaviour? How much park use behaviour can be explained by the physical-spatial dimensions of accessibility compared to the social and personal dimensions?  Does the models apply to different urban, social, and cultural settings? These questions will be addressed in subsequent chapters.

# CHAPTER 4. RESEARCH DESIGN AND DATA COLLECTION

The first three chapters (Chapters 1, 2, and 3) have demonstrated the need to understand park accessibility as a multi-dimensional construct, and to develop research objectives and build the theoretical framework from these multi-dimensional perspectives. Chapter 4 explains research design, selection of study areas, and methods used in sampling, data collection and analyses.

## 4.1 Research design

### *4.1.1.* Correlational research design

The selection of an appropriate research methodology relies on an in-depth understanding of research objectives, the nature of research problems, information required and prospective results (Layder, 1993). This study seeks to understand individual preference and decision-making towards urban park use. This involves operationalising and quantifying a wide range of variables and constructs at an individual level such as travel time, distance to parks, individual socioeconomic factors, and self-reported park access and use intention. With a research focus of identifying relationships among these variables, this study adopts correlational research design as its research philosophy.

In correlational studies, researchers observe what naturally goes on in the world without human manipulation of variables (Field, 2009). A correlational study is a type of non-experimental research in which little or no effort is used to control extraneous variables (Price, 2012). This is particularly useful in situations where it is difficult to control for other possible factors that could be causing changes in human behaviour. Correlational research design uses quantitative methods to measure two or more variables and estimate the extent to which the variables are related. It enables identification of statistical co-relationships between variables and generation of predictions through the construction of conceptual models or by expanding existing theoretical frameworks (Graziano and Raulin, 2000). The presence of a co-relationship indicates that an individual's status on one variable (e.g., distance to parks) tends to reflect his or her status on the other variables (e.g., park use). Therefore, given the study's focus on understanding human behaviour towards park use, correlational design provides an appropriate framework to guide the development of methodology in this research.

Following correlational design procedures, this study first constructed conceptual models using an inductive reasoning method based on the critical review of literature. These models represent all hypothetical relationships between variables to be explored. The proposed models were then validated using survey data collected from neighbourhoods of different socioeconomic backgrounds and urban settings. Therefore, this study involves both processes of model development and model validation in correlational research design (Figure 4-1), with a study focus on quantifying relationships between variables and constructs in different contexts.

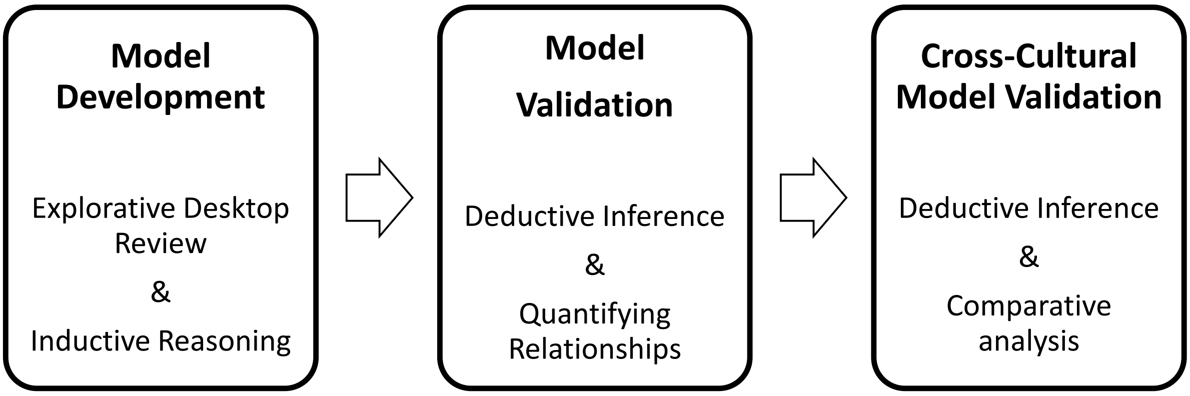


Figure 4-1 Major research approaches in this study

### *4.1.2.* Cross-sectional comparison

Comparative research is an important method in social science to understand complex realities and distinguish between local conditions and universal regularities (Harkness et al., 2003). Most behavioural theories are developed primarily from a Western-based viewpoint. There have been limited attempts at validating behavioural models in other social and cultural settings (Chan and Lau, 2002; Kar and Cumberland, 1984). However, different cultural and social backgrounds can significantly influence people's use behaviour. For example, Chan and Lau (2002) found that people's use behaviour is heavily bounded by their cultural values and norms, indicating that the study of people has to be understood with reference to the settings attached to their activities. Previous research has also recognised the environmental justice issue of park access, with people of lower socioeconomic status and communities of colour often subject to poor access to parks, and degraded facilities (Wolch et al., 2014). And yet, the psychological study of how different population groups will respond to changes in park access factors has rarely been investigated.

The proposed models in this study were built upon existing accessibility and behavioural theories that were developed with an assumption of cultural and socioeconomic conditions in developed countries. This study took into consideration the socio-cultural impacts and therefore, conducted cross-sectional comparisons to validate the proposed models in different settings (e.g., cultural setting and socioeconomic status). It aims to understand how the proposed conceptual models vary between population segments of different cultural and socioeconomic backgrounds.

## 4.2 Research methods

This study used a combination of research methods that include critical literature review, statistical analysis, spatial analysis, structural equation modelling, and comparative analysis. The selected methods are primarily quantitative due to the research design. Quantitative research explains phenomena by collecting numerical data that are analysed using mathematically based methods (in particular, statistics) (Aliaga and Gunderson, 1999). The advantages of quantitative methods lie in the ability to test preconceived hypotheses that are constructed before data are collected. Quantitative research can provide independent and generalisable findings if it is based on a random sample with sufficient size and has been replicated in different contexts (e.g., different subpopulation groups). Although quantitative approaches are criticised for the use of predetermined hypotheses that might not reflect local constituencies (Aliaga and Gunderson, 1999), it fits well into this research’s purposes of model validation and generalisation.

### *4.2.1.* Critical desktop review

Critical desktop review of literature and theories is the major method used in the model development stage of this study. The review of literature focused on fields that include urban planning, accessibility conceptual development, accessibility measurement, public service distribution, public facility access, urban park benefits, urban and spatial equity, environmental justice issues and theories that explain human behaviour. Related studies were critically consulted and analysed in an explorative manner. The review provided the knowledge basis for the development of the theoretical framework of this study that addresses the identified gaps in existing research.

An inductive reasoning approach was used in the review process. It started with a broad, exploratory review of related literature to identify possible components that may contribute to the conceptual models, then a focused review to formulate tentative hypotheses or paths in the models. This was followed by several rounds of modifications of the preliminary models that finally led to the proposed models. Advisors and experts of different disciplines were consulted for their professional opinions for the feasibility of the proposed models.

### *4.2.2.* Statistical analysis

A variety of statistical methods were applied where appropriate. For example, frequency analysis was used to determine sample characteristics. Reliability and confirmatory factor analyses were conducted for the measurement consistency and model validity. The t-test was adopted to identify differences between samples. Chi-square and bivariate correlation were used to examine the associations of discrete and continuous variables respectively.

Statistical analyses were performed using IBM SPSS statistics 22. Data were first entered into Excel spreadsheets and then converted to SPSS files for data cleaning and analysis.

### *4.2.3.* Structural equation modelling

As correlational research allows for very limited causal inferences (Price, 2012), structural equation modelling (SEM) was used as a more appropriate procedure to investigate the multiple and interrelated dependence relationships in the proposed models. SEM is a multivariate technique that seeks to explain the directional relationships between variables, using a confirmatory rather than an exploratory approach (Byrne, 2010; Hair et al., 2010). Therefore, this study adopted SEM to test the hypothesised cause-and-effect relationships and to make causation claims.

### *4.2.4.* Spatial analysis

Geo-spatial analyses were performed to determine geographic accessibility to parks. Both Euclidean and network distance to domiciles were measured using the proximity and network analysis functions in Esri ArcGIS 10.2.

Analytical techniques used for each specific research question will not be elaborated in this chapter because three analytical chapters that follow (Chapters 5, 6 and 7) are prepared in a complete journal article format. Each chapter includes a designated section of *data analyses* that explains detailed methods used to answer associated research questions. A flow-diagram is presented instead to illustrate the links between the objectives, data source, analytical methods applied, and outputs in this study (see Figure 4-2).

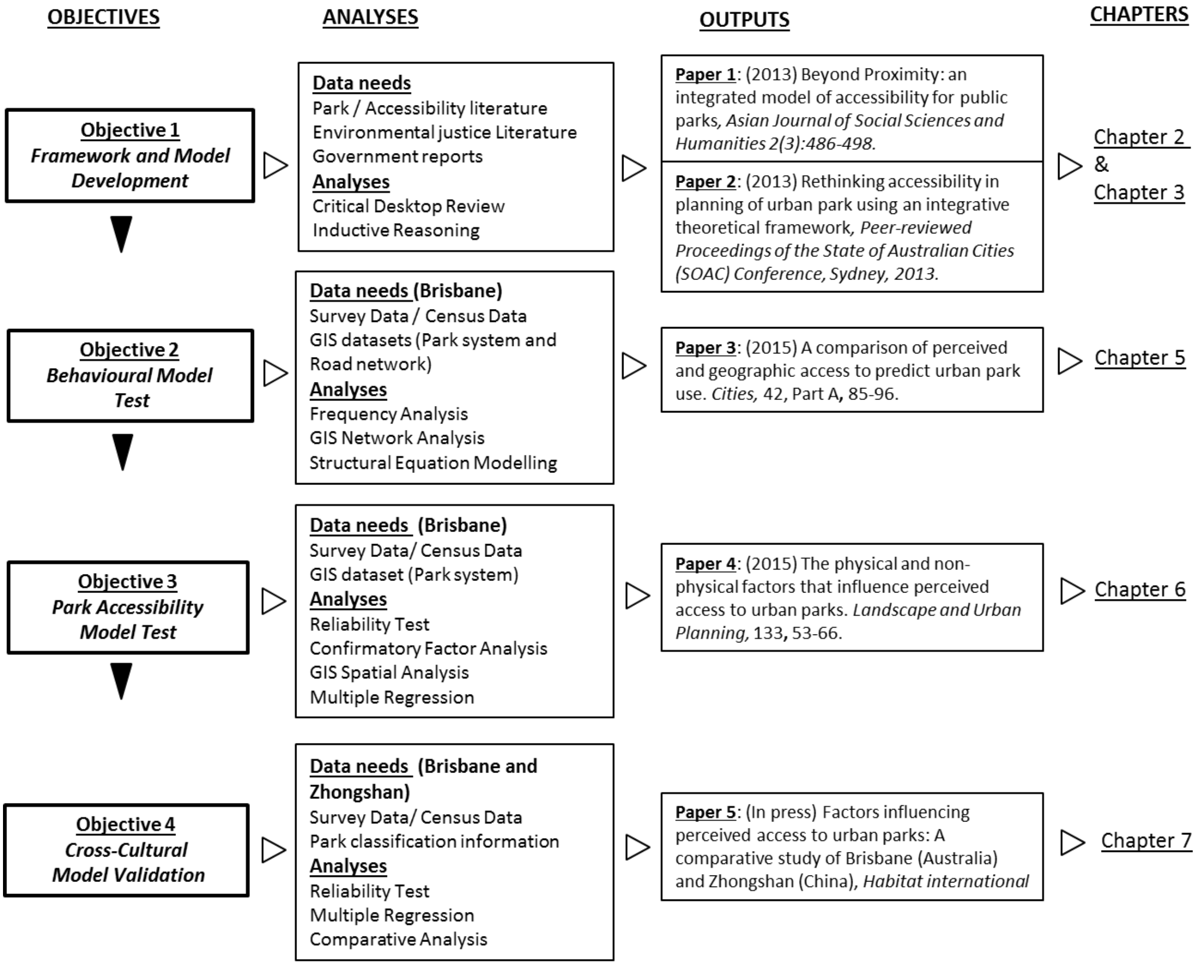


Figure 4-2 The flow-diagram of the links between objectives, analyses, papers and thesis chapters

## 4.3 Questionnaire design

### *4.3.1.* Likert scale

Variables in the two proposed models were operationalised using psychometric scaling method with Likert scales. Developed by Renis Likert in 1932, Likert scale is the most widely used rating scale to measure individual attitudes or opinions (Bowling, 2009; Likert, 1932). It allows individuals to respond to a series of statements related to a research topic and measures the extent to which they agree or disagree with the statements. Using a Likert-type scale, variables are standardised in fixed choice response formats (i.e., on a continuum from strongly agree to strongly disagree), making them suitable for statistical analysis (Norman, 2010). In this study, variables were operationalised on a 5-point Likert scale, with typical response categories of 'strongly disagree', 'disagree', 'neither agree or disagree' 'agree' to 'strongly agree'.

### *4.3.2.* Survey questions and instruments

As each of the analytical chapters that follow (Chapters 5, 6 and 7) includes a designated section describing the questions and scales used in measuring variables for analysis (e.g., Section 5.3.2), this chapter focuses on explaining the strategies used in the development of survey questions. In this study, the questionnaire design followed the scientific procedure recommended by Harkness et al. (2003) for comparative survey research. Three dimensions were considered: (1) Are old or new questions used? (2) Are the parallel or sequential approach used in the survey instrument development? (3) Are questions modified for one or the other culture or identical everywhere in the project?

The questionnaire includes both newly developed and existing questions adapted from other studies. Survey questions from existing studies have been robustly scrutinised for reliability and validity and thus provide reliable measures for this research. For example, the perceived accessibility questions and scales came from a previous city-wide survey research in Bristol (Jones et al., 2009). New survey questions were developed for some accessibility variables, especially to measure the non-physical dimensions in the model, for the following two reasons:

a) Existing accessibility studies have largely focused on geographic accessibility that measures physical distance or availability of services. The socio-personal dimension of accessibility was under-explored.

Existing accessibility studies tend to report observed data (e.g., the number of visitors, the number and type of facilities available in parks) and survey data concerning past park use experience. Unlike previous research, this study examined park accessibility from an individual perceptual level. A wider range of factors and dimensions were taken into consideration, including information, social concerns and personal preferences. For example, *Pleasant walk* variable refers to the walkability of the routes between respondents' residential location and the parks. Ferreira and Batey (2007) posited that it is an individual's intellectual abstraction of a geometric space that defines their access to public facilities (e.g., a better transport connection and well-designed pedestrian infrastructure can make the locations much more accessible). That is, people tend to adjust the reality of geometric space to conform to their personal experience. Therefore, pleasant walking experience (walkability) was hypothesised as variable influencing self-reported access to parks. Two survey questions were developed to operationalise this variable: '*I can easily walk to this park*' and '*The walk to this park is a pleasant experience*', and the respondent was allowed to choose on 5-point Likert scales from 'strongly disagree' to 'strongly agree'.

b) Some social variables are multidimensional, making general questions insufficient to address different dimensions of these variables.

Composite psychometric scales consisting of multiple survey questions were developed for more complex, multi-dimensional variables. For example, people's *awareness* of parks is associated with information about various aspects of parks such as the location of parks, the facilities in parks and the activities conducted in parks. In addition, *safety* and *social exclusion* are complex multi-dimensional social constructs, but are closely associated with park accessibility. Safety concerns significantly influence perceptions of park spaces (Byrne et al., 2009; Chiesura, 2004; Winter and Lockwood, 2005). Perceptions of danger mediate potential users' attitudes towards urban public spaces such as parks. Social exclusion and its antipode, social cohesion, are related to individual perceptions of social identity, connectedness, support, and trust in a community. For example, self-reported community perceptions of trust play a significant role in predicting physical activity behaviour (Chen and Jim, 2010). Therefore, multiple survey questions were developed to capture different aspects of these constructs to suit the specific context of this park study. A copy of the survey questionnaire is included in Appendix I, for the readers to assess the face validity of these questions.

The survey questionnaires were developed using the sequential approach, with the same questions asked in different study areas for the purpose of comparison. Sequential development is the most common approach adopted in comparative research wherein a source questionnaire is first developed without deliberate inclusion of cultural perceptions, then exported abroad via translation and adaption (Harkness et al., 2003). In this study, all survey questions were first developed in English and then translated into Chinese. The questionnaire was translated by a professional English-to-Chinese translator and reviewed by bilingual experts to minimise translation bias.

The questionnaires were pilot tested in both English and Chinese, with selected participants that included local residents, planners, and academics with survey research expertise. Minor revisions were made in the Chinese version in the pilot test to fit the study context (e.g. annual household income). Also, all the measurement items were tested for measurement reliability and validity using data collected from different study areas. The questionnaire package was designed following Dillman (2007)'s recommendations, including a numbered questionnaire booklet, a hand-signed cover letter and a postage-paid envelope.

## 4.4 Study cities

The primary survey data were collected from two cities with different social-cultural backgrounds: Brisbane, Australia and Zhongshan, China (Figure 4-3). The pervasive cultural differences between Western and East Asian countries documented by previous studies led to the decision to select one city with western culture and the other with eastern culture (Harkness et al., 2003; Nisbett et al., 2001). However, there might be other environmental factors that significantly influence park use such as climatic conditions. Therefore, a series of criteria was used to select study cities, with the aim to isolate the variables of interest (e.g., difference in socio-cultural background) but control other extraneous variables (e.g., climatic or topographic characteristics) that may influence park access and use. Table 4-1 summarises the characteristics of the two cities against the selection criteria. It shows that the two cities share comparable features in terms of total area, population, general climatic conditions and geographic characteristics, but differ in their official language and socio-cultural background. Brisbane data provided the primary dataset for model testings, with Zhongshan data used for cross-cultural model validation.

Table 4-1 Selection criteria for study areas

| **Criteria** | **Brisbane, Australia** | **Zhongshan, China** |
|---|---|---|
| *Culture* | Western culture | Oriental culture |
| *Population* | Multi-cultural society (About 33.4% of residents were not born in Australia and 14% of households speak a language other than English at home) | Han Chinese-dominance society (98% of the total population) with a large proportion of temporary residents (52% of the total population) due to internal migration in China |
| *Official Language* | English | Chinese Mandarin |
| *Coordinates* | 27°28′S 153°01′E | 22°32′N 113°21′E |
| *River city* | Brisbane River | Shiqi River |
| *Urban area* | 1340.3 km² | 1800.14km$^2$ |
| *Population Density* | 778 people/ km² | 828 people/ km² (permanent residents only)<br>1734 people/ km² (including temporary residents) |
| *Climate* | Subtropical humid climate | Subtropical humid monsoon climate |
| *Geography* | Hilly floodplain | Hilly alluvial plain |
| *Economic background* | Capital city and primary activity centre in Queensland state | The city's discretionary income per capita is among the highest in China |
| *Urban agglomeration* | South East Queensland (SEQ) | Pearl River Delta (PRD) |

Brisbane is the capital and largest city of the state of Queensland, Australia. The city of Brisbane refers to the local government area that has jurisdiction of the inner part of the Brisbane metropolitan area. Brisbane city is located in the centre of the South East Queensland (SEQ) urban agglomeration, which is a heavily urbanised region that accommodates approximately two-thirds of the total population in the State. SEQ has been the fastest growing metropolitan area in Australia since 1990 (DSDIP, 2009). As of 2013, the region has a population of 3.3 million. This is expected to grow to 5.5million in 2041 (OESR, 2012). Brisbane city is the most densely populated area in SEQ region with a population density of 777.3 people per square kilometre, compared to an average of 2.6 people of the state (ABS, 2011a). The city of Brisbane is located in a hilly floodplain, along the curve of the Brisbane River. Brisbane has a humid subtropical climate, with an average temperature around 25°C.

Zhongshan is a prefecture-level city, located in the south of the Pearl River Delta (PRD) of Guangdong Province, China. PRD serves as the pilot region in China's economic reform since the open door policy of 1979. In particular, the emergence of Guangdong as 'the world's factory' in the second half of the 1990s made the PRD one of the most sought-after destinations for inter-provincial migration within China, leading to massive population growth and unprecedented rapid urban development (Chan, 2013). According to the National Bureau of Statistics of China, in the PRD region, 83.84% of the population lived in urban areas by the end of year 2013, compared to 47.2% in 1998 and only 27.4% in 1980 (GSB, 2013; Shen et al., 2002; Sit and Yang, 1997). Zhongshan is one of the primary migrant-receiving areas in this massive rural-to-urban migration (Sit and Yang, 1997). For example, the population of Zhongshan increased at an average annual rate of 10.2% for over two decades from 1990. According to 2010 Chinese Population Census, the city had a total population of 2.74 million by 2010 wherein 1.423 million are permanent residents who are registered in a household registration system (ZSB, 2011). This indicates that about half of the population are categorised as temporary residents who are not legally entitled to live permanently in the city. Similarly to Brisbane, Zhongshan is located on a hilly alluvial plain to the west of the mouth of the Pearl River. Climate in Zhongshan is warm and humid most of the year, with an average temperature of 22 °C.

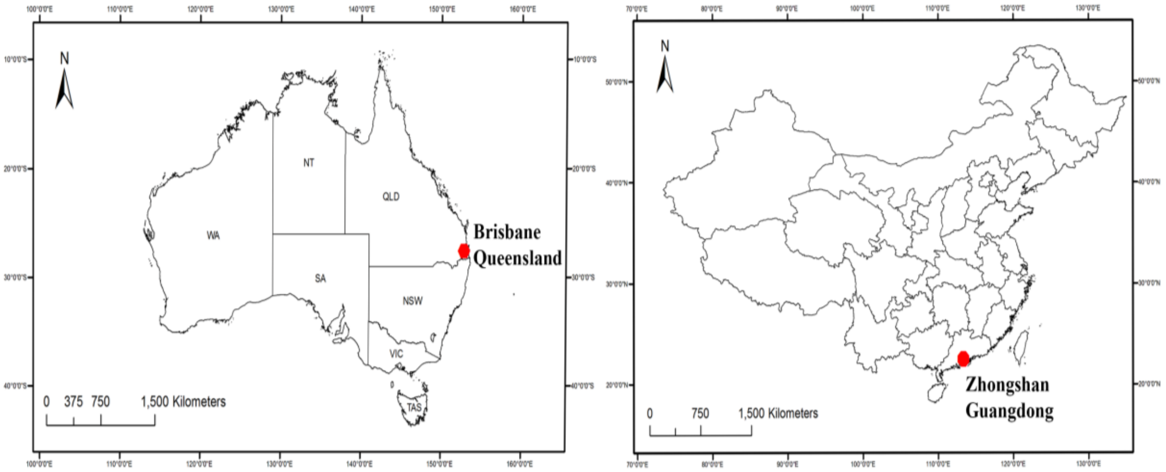


Figure 4-3 Locations of the two study cities with their geographic locations

## 4.5 Sampling design

Sampling provides a useful short-cut, leading to results that can be almost as accurate as those for a full census of the population being studied but only for a fraction of the cost (Gorard, 2003). In this study, primary survey data were collected due to the absence of secondary data in relation to the research questions, with samples used with the considerations of the financial and time constraints. The sampling stages recommended in Gorard (2003) were followed to ensure representative samples were collected. Sampling in Brisbane is used as an example to explain these stages as follows.

### *4.5.1.* Define the population of interest

The target population should be able to address the aim of this study to understand how park access and use vary between communities of different socioeconomic backgrounds. Therefore, purposive sampling approach was used to identify the population of interest. The aim was to select two suburbs with contrasting socioeconomic status (SES) but similar park configuration and similar land uses (residential). Three criteria were used to select the optimal pair of suburbs: (1) the suburbs should be dominantly residential; (2) the suburbs should provide contrast in SES (e.g., one relatively high and one relatively low); and (3) the suburbs should have comparable physical park features of varying scales (e.g., number of parks, area per capita, land use ratio).

The SES for each suburb in Brisbane was operationalised using the *Index of Relative Socio-economic Advantage and Disadvantage* (IRSAD) which is a component of the *Socio-Economic Indexes for Areas* (SEIFA) developed by the Australian Bureau of Statistics (ABS, 2011b). IRSAD provides a general index based on the economic and social conditions within an area. The index is a comprehensive measure that summarises information on a wide range of socioeconomic variables about people and households, including income, education, skilled occupation, disability, unemployment, and overcrowding dwellings (ABS, 2011b). Higher scores of the index indicate areas of greater advantage (higher SES level) with higher household incomes and better dwelling conditions or more people with higher formal education and skilled occupations (ABS, 2011b). To select the two study suburbs, all Brisbane suburbs were sorted according to the IRSAD rankings. Resident population, park features and the major land use type were then compared between potential study suburbs. The SES of spatially adjacent suburbs was also examined to ensure that the selected suburbs were not isolated ‘islands’ of low or high SES, but consistent with proximate suburbs. Using these criteria, two Brisbane suburbs were selected for this study: Graceville and Salisbury (Figure 4-4).

Table 4-2 summarises key criteria other than SEIFA that were used in the suburb selection process. Compared with surrounding suburbs (e.g., Coopers Plains and Rocklea), Salisbury and Graceville are both dominantly residential areas with comparable characteristics on all the selection criteria. Thus, they provided the best pair of study areas for this research. In the purposive sampling process, criteria such as green space per capita and green space per household were used as control factors to ensure that the selected suburbs represented comparable physical park features.

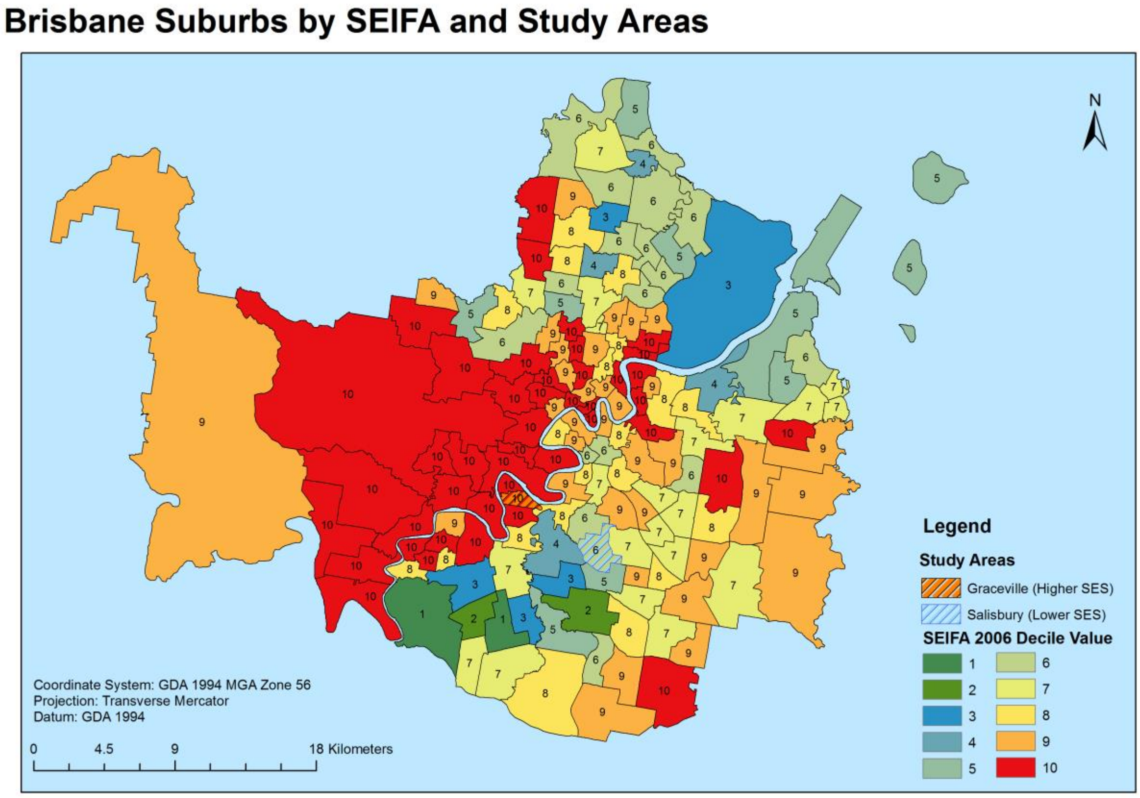


Figure 4-4 Brisbane suburbs by SEIFA and location of the study areas

Table 4-2 Selection criteria used in the purposive sampling process

| | | Coopers Plains | Rocklea | Salisbury | Graceville |
|---|---|---|---|---|---|
| Land Use Type | Green space areas ($m^2$) | 217439 | 1010980 | 559025 | 333620 |
| | Industrial areas ($m^2$) | 1321691 | 3158667 | 1317279 | 0 |
| | Residential areas ($m^2$) | 1103309 | 495138 | 1648738 | 997129 |
| Selection Criteria | Ratio- Industrial to residential | 1.20 | 6.38 | *0.80* | *0* |
| | Ratio- Green space to residential | 0.20 | 2.04 | *0.34* | *0.33* |
| | Green space per household | 142.30 | 2132.87 | *268.38* | *234.94* |
| | Green space per capita | 51.56 | 573.77 | *91.60* | *79.19* |

*Note*: land use data were drawn from Brisbane land classification map 2012 and population data were from ABS 2011 Census.

### *4.5.2.* Create a sampling frame

The previous stage has identified that the population in this study consisted of all households (3503 in total) living in the two selected suburbs of Brisbane. A comprehensive Brisbane street directory (69 streets in Graceville and 106 streets in Salisbury) was used as the sampling frame of this study, due to the absence of a complete list for all residential addresses.

### *4.5.3.* Estimate the size of samples

It is important to determine an appropriate sample size for the study because: 1) if a sample is too small, it may lead to the loss of statistical power to identify genuine effects of the population, 2) If a sample is too large, it will require additional resources that may hinder the progress of research (Gorard, 2003; Stevens, 2012). A general rule of thumb for determining sample size is to consider the number of parameters to be estimated, that is, the sample size should be at least five times the number of variables used (Gorard, 2003; Worthington and Whittaker, 2006). Nevertheless, multivariate research generally requires larger samples to accomplish data analysis. For example, a sample size between 100 and 200 is considered appropriate for research using structural equation modelling (SEM) estimation (Kline, 2011). Hair et al. (2010) argued that the ‘always maximize your sample size’ guideline is no longer appropriate for SEM. They suggested that sample size decisions for SEM estimation should be based on a combined consideration of three factors: 1) model complexity, 2) communalities and 3) the number of unidentified constructs. And, multi-group analyses require an adequate sample for each group. Therefore, this study was targeted to meet the requirement of a minimum sample size of 150 cases for each suburb as recommended by Hair et al. (2010) for a SEM model with 7 or fewer constructs, modest communalities and no underidentified constructs.

Mail survey was adopted as the primary implementation mode in this study because it continues to be regarded as an effective method in household surveys, especially when names are unavailable. However, the response rates in mail survey research are typically low (Dillman et al., 2014; Kotrlik and Higgins, 2001; Salkind and Rainwater, 2003). Therefore, oversampling was necessary to account for lost mail and uncooperative respondents. The increase of sample size was calculated using an estimated response rate of  30% based on prior experience with mail survey research (Kaplowitz et al., 2004; Salkind and Rainwater, 2003). The larger sample for Salisbury was based on the larger number of households in the suburb and the presupposition that lower SES populations are less likely to participate in survey research due to the common occurrence of higher non-response rates in minority groups (Goyder, 1987; Groves et al., 1992; Groves and Peytcheva, 2008; Van Loon et al., 2003). A combination of techniques recommended by Fox et al. (1988) were adopted in this study to increase the response rate, such as the use of a cover letter, follow-up survey, stamped return postage, incentives and sponsorship by local government. Participants were asked to return their completed questionnaires using the postage-paid envelope provided.

#### *4.5.4.* Choose a method of sample selection

Systematic probability sampling method was used to draw a representative random sample for the population of each selected suburb. In this process, all the streets in the two suburbs were first extracted from the street directory (Figure 4-5) and listed in alphabetical order. The sampling approach started from a random selection of street name in each suburb and then sampled street using the sampling interval. The sampling interval was calculated as follows: 1) the average number of households per street was calculated by dividing the total number of households by the total number of streets in each suburb; 2) the number of streets to be sampled was computed by dividing the target household sample size by the average number of households per street (69 streets in Graceville and 106 streets in Salisbury); and 3) the sampling interval was set to the total number of streets divided by the number of streets to be sampled (three in both suburbs). Survey questionnaires were also delivered to households located on each selected street. To ensure the spatial representation of selected areas, the sample also included households located on streets that either intersect or are adjacent to the sampled streets.

A quadrat analysis was conducted using variance-means ratio (VMR) to test for the spatial independence of the samples. A 150 by 150 metre grid was defined in Graceville to cover the study area, with a 200 by 200 metre grid in Salisbury. The larger grid size in Salisbury was due to the larger area of this suburb compared with Graceville. The results showed that the sample locations in both suburbs were significantly close to a spatially random distribution: Graceville model had a VMR of 1.15 ($\chi^2 = 51.9$, $p_{df=45} > 0.05$) and the VMR in the Salisbury model was 1.025 ($\chi^2 = 52.29$, $p_{df=51} > 0.05$).

Sampling in Zhongshan followed the same procedure as in Brisbane. SES was operationalised using the median dwelling prices in the absence of a comprehensive SES index at the neighbourhood level such as SEIFA in Brisbane.

## 4.6 Data collection

### *4.6.1.* Study areas in Brisbane

The Graceville suburb is located approximately 8km southwest of Brisbane's central business district (CBD). Land use in Graceville is predominately residential with a population of 4,213 according to the 2011 Australian Census. Graceville is situated in one of the most affluent areas in Brisbane with an IRSAD percentile of 96/100 and is surrounded by the residential suburbs of Chelmer (99/100) and Sherwood (91/100).

The Salisbury suburb is located 11km south of the Brisbane CBD. In 2011, this suburb had a resident population of 6,103, and an IRSAD percentile of 57/100. The dominant type of land use in Salisbury is residential. In addition, Salisbury is surrounded by other lower SES suburbs including Coopers Plains (38/100) and Rocklea (28/100) (ABS, 2011a; ABS, 2011b). There are eleven public parks in Salisbury with a per capita park area of 91.6 $m^2$, compared to eight public parks in Graceville with 79.2 $m^2$ per capita. In this study, the lower SES suburb (Salisbury) has a higher provision of green space compared to the higher SES suburb (Graceville) based on quantitative park standards (e.g., park number, total park area and park area per capita).

After purposively selecting the suburbs, three parks were selected in each suburb using information drawn from a 2012 park classification table provided by the Brisbane City Council (Figure 4-5). The parks were selected based on their size, location, type, and facilities. In each suburb, the three parks were selected to represent large, medium and small area parks; to be relatively spatially dispersed rather than clustered; and to represent different types of parks (local, district and metropolitan) with comparable features in terms of the variety and quality of park facilities (e.g., bikeways, dog areas, sports facilities, playgrounds, toilets and picnic areas). All parks selected in both suburbs were maintained by Brisbane City Council.

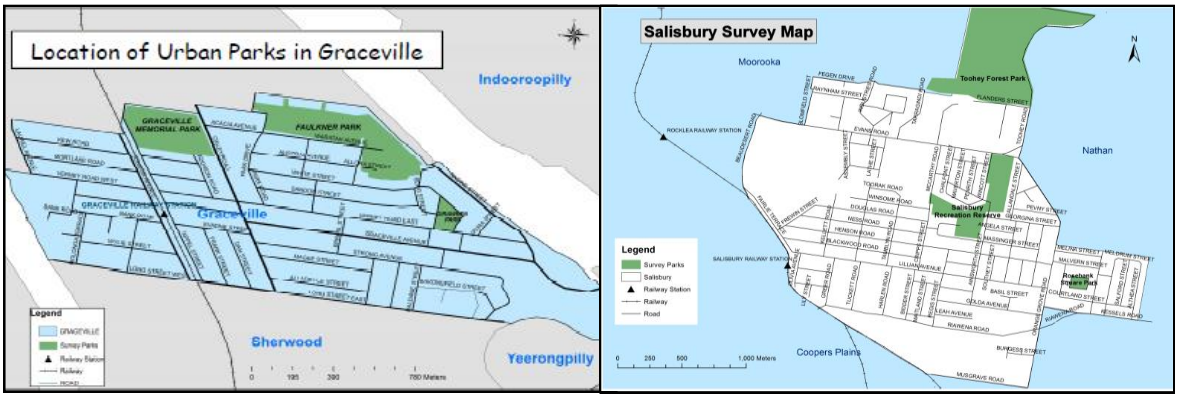


Figure 4-5 Street maps for the two study suburbs in Brisbane.

### *4.6.2.* Study areas in Zhongshan

The survey in Zhongshan was conducted in a residential area of the inner city. Zhongshan inner city has a population density of 20.98 people per hectare. In 2011, the inner urban area had a green space ratio in built-up areas of 39%, among the highest level in Chinese cities. There are six public parks available for free public use with a total area of 179 hectares. The survey was implemented in an area of approximately 200 hectares located in the south-central part of the city, bounded by Zhongshan Si road, Xinwen road, Xingzhong avenue and Qiwan avenue (Figure 4-6). This area was selected because it is one of the primary residential neighbourhoods with diverse dwelling types. Residential dwellings of different median prices were sampled in order to recruit respondents of diverse income backgrounds. Following the same criteria as those used in the Brisbane survey, three parks of different types were selected in the study area based on information drawn from a park classification table provided by the Zhongshan Bureau of Urban and Rural Planning.

(Adapted from *(BaiduMap, 2014)*)

Figure 4-6 Study areas in Zhongshan, China.

### *4.6.3.* Primary data collection

The mail survey in Brisbane was finished by May, 2013, with 1300 questionnaire packages delivered to households in the two study areas (500 in Graceville and 800 in Salisbury). The overall response rate in Brisbane was 24.5%, with 32% in Graceville and 20% in Salisbury. The sample is small compared to large-scale survey research, largely due to the low response rate in the lower SES suburb (20% in Salisbury) and limited resources that were available for this research. It is acknowledged that external validity (generalisation) is necessarily weak in this type of study given the available resources for sampling effort. Nevertheless, the sampling response represents 11.3% of total local households in Graceville and 7.6% in Salisbury, thus providing reasonable representation of the local population. In addition, the sample size has successfully satisfied the target minimum number for multi-group SEM analysis set in Section 4.5.3. And thus, it is sufficient to make claims about the internal validity of this study design.

The Zhongshan survey was implemented in June 2013, with a total of 400 questionnaires delivered to local households. A face-to-face implementation mode was used instead of the mail survey used in Brisbane in order to increase the sample representativeness. Survey participants were asked to answer the survey questions independently and returned the completed questionnaires to their interviewers or by mail using the postage-paid envelope provided. The change of mode has successfully increased the overall response rate to 81%.

Ethical clearance was finished in 2012 following the procedure in the University of Queensland ethical guidelines. Ethical issues addressed in this study included: 1) informed participant consent; 2) no involvement of children and vulnerable groups; 3) the use of an anonymous survey to ensure confidentiality and protect participant privacy and 4) data storage and access plan to ensure data security. A participant information sheet was included in the survey package to address ethical concerns and provide study background to survey participants. The ethical clearance approval of this study can be found in Appendix II for more details.

### *4.6.4.* Secondary data collection

Table 4-3 lists the secondary data and documents collected in this study. Appendix III includes a signed contract with Brisbane City Council for the supply of digital data that were exclusively used in this research. Other data are published and available for public access.

Table 4-3 Secondary data collection in this study

| Data | Format | Data Source |
|---|---|---|
| Spatial data for Brisbane park and road network | shapfile | Brisbane City Council |
| Spatial data for Brisbane suburbs | shapfile | Australian Bureau of Statistics |
| Brisbane park classification data | spreadsheet | Brisbane City Council |
| Socioeconomic Indexes for Areas (SEIFA) | spreadsheet | Australian Bureau of Statistics |
| Census data for Brisbane population characteristics | spreadsheet | Australian Bureau of Statistics |
| South East Queensland regional plan | document | Queensland Government |
| Zhongshan Park classification data | spreadsheet | Zhongshan Bureau of Urban and Rural Planning |
| Census data for Zhongshan population characteristics | spreadsheet | Zhongshan Statistical Bureau |
| Zhongshan socioeconomic characteristics | spreadsheet | Guangdong Statistical Bureau |
| Guangdong regional and urban system plan | document | Guangdong Government |

## 4.7 Conclusion

To conclude, Chapter 4 has explained the methods used in research design and data collection of this study. It identifies the research philosophy, provides an overview of analytical methods used to address the research objectives, and answers questions in relation to sampling and survey implementations.

The next three chapters (Chapters 5, 6, and 7) present major analytical outcomes of this study. Primary survey data collected from Brisbane suburbs were used in both Chapter 5 and 6 to empirically test the proposed models. Chapter 5 focuses on testing the expanded TPB model and compares the strength of geographic and perceived accessibility in predicting behavioural intention to visit urban parks. Chapter 6 investigates the multi-dimensional factors that may influence the construct of accessibility and compares the significance of these factors in neighbourhoods of different socioeconomic status. Using data from both Australian and Chinese cities, Chapter 7 provides a cross-national comparative study to validate the proposed models in a larger socio-cultural context of urban settings, extending the analyses in the previous two Chapters. These three chapters are presented in the format of complete journal articles. Some information presented in this chapter may be repeated due to the need to explain methodological issues in these articles.

# CHAPTER 5. A COMPARISON OF PERCEIVED AND GEOGRAPHIC ACCESS TO PREDICT URBAN PARK USE

Chapter 5 has been published as a journal article in *Cities*. Therefore, the related information presented in the previous chapters may be repeated in the introduction and method design sections of this chapter.

**ABSTRACT:** Park use and accessibility have been the focus of research in many green space studies, but the psychological study of behavioural intentions to use urban parks has rarely been investigated. This study proposes and evaluates an expanded model of the theory of planned behaviour (TPB) that incorporates the variables of perceived park accessibility, geographic proximity, and past use behaviour. The expanded TPB model was empirically tested using primary data collected from community level surveys (n=319) in Brisbane, Australia, from two suburbs with contrasting socioeconomic status. We compared the explanatory and predictive quality of the expanded model for park use with the general model of TPB and a model operationalising the theory of reasoned action (TRA). Results from structural equation modelling (SEM) indicate that the expanded model with perceived accessibility has the best model fit and highest explanatory power, while also enhancing prediction of park use intentions. Moreover, our results indicate that perceived access is more important than geographic access or proximity in predicting park use. These findings suggest that physical park provision is a necessary, but insufficient condition to encourage greater park utilisation. Park management should account for differentiated preferences and perceptions of park access to increase the collective benefits of urban parks.

**KEYWORDS:** Park access; behavioural intention; theory of planning behaviour; structural equation model

## 5.1 Introduction

In recent decades, there has been unprecedented growth in urban populations, with over 70% of the world’s population predicted to live in cities by 2050 (UNFPA, 2011). This dramatic demographic shift to urban areas has raised concerns about the increasing disconnect between urban dwellers and the natural environment (Maller et al., 2008; Maruani and Amit-Cohen, 2007). A widening range of competing urban land uses in modern cities exacerbates the challenge of meeting the demands for urban green infrastructure such as urban parks and open spaces. Green spaces, especially neighbourhood parks that provide convenient access, are purported to promote health for their urban population catchments by providing recreational opportunities that encourage active lifestyles (Cohen et al., 2007), reduce obesity-related diseases and combat mental stresses (Giles-Corti et al., 2005; Lee and Maheswaran, 2011; Maller et al., 2006; Pretty et al., 2005), and foster inclusive communities and the generation of social capital (Chiesura, 2004; Jones et al., 2009). However, the health benefits can only be realised if these parks and green spaces can be reasonably accessed by urban residents. Within this context, the study of access to, and use of urban parks, takes on increasing importance.

Researchers have identified access to parks as one of the important factors in shaping park utilisation. For example, Byrne et al. (2009) found that easier access was an important reason for a decision to use local parks rather than large national parks, especially for people of colour. Similarly, Giles-Corti et al. (2005) found that distance and park size were two important factors associated with the likelihood of using public parks. But other studies reported that variations in accessibility measurement could significantly impact the empirical results (Guy, 1983; Kwan, 1998; Neutens et al., 2010; Weber, 2003) and the ability to predict human behavioural changes (Joerin et al., 2005). Further, there have been extensive studies revealing inconsistencies between subjectively measured accessibility (perceived accessibility) and geographic measured accessibility based on quantitative standards (e.g., distance to parks and park area per capita) (Ball et al., 2008; Hoehner et al., 2005; Jones et al., 2009; McCormack et al., 2008; Scott et al., 2007; Talen and Anselin, 1998). Perceived access does not equate with geographic access (Boehmer et al., 2006; Scott et al., 2007) and may be more important to understand and predict human behaviour (Kruger et al., 2007; Zondag and Pieters, 2005). To date, quantitative criteria have been the predominant methods to measure accessibility in park-related studies (Murray et al., 2003). However, it is unknown whether perceived accessibility and geographic accessibility play similar roles in explaining and predicting park use.

Poor access to environmental benefits such as urban parks and open spaces has emerged as an important theme in the environmental justice literature (Byrne and Wolch, 2009; Byrne et al., 2009) with research examining the implications of park distribution for population segments with different socioeconomic backgrounds (Hung et al., 2005; Preston and Rajé, 2007; Wolch et al., 2005). In some studies, parks and open spaces appear inequitably distributed within cities, with communities of lower socioeconomic status (SES) having inferior geographic access to urban parks, thus constraining park visitation and use (Byrne et al., 2009; Estabrooks et al., 2003; Macintyre et al., 2008a). Other studies contradict these findings, reporting that disadvantaged groups have higher levels of geographic access but less perceived access to parks, thus, resulting in less frequent use (Jones et al., 2009; Macintyre et al., 2008a). The conflicting findings may, in part, be attributed to the different measures used to quantify park access. However, the weight of the evidence from the different studies points to less frequent park use in communities with lower SES, suggesting that perceived accessibility may be a more reliable predictor of park use behaviour.

Research has examined a wide range of factors that potentially influence park use, including park facilities and features, park maintenance, knowledge and awareness of parks, and alternative opportunities (Bedimo-Rung et al., 2005; Byrne et al., 2009; Kaplan et al., 2004; Loukaitou-Sideris, 1995; Loukaitou-Sideris and Stieglitz, 2002). In these studies, observed park visitation or repeated park use self-reported by park visitors were used to examine the relationships between park attributes and park utilisation (see, e.g., Loukaitou-Sideris (1995); Loukaitou-Sideris and Stieglitz (2002) and Reed et al. (2012)). However, studies focusing on repeated park use were criticised for neglecting the complexity of decision-making or evaluative processes that lead to future behaviour (Tepeci, 1999). The type of data collected has not generally focused on the motivations or behavioural intentions to use parks; they also fail to capture information from both park users and non-users.

This study seeks to understand park use behaviour of local residents by identifying the underlying social and psychological factors that inform their decision-making process to use (or not use) urban parks. To date, few studies have grounded their research in behavioural theories that investigate motivations and behavioural intentions to use parks. Park use intention describes an individual’s attitudinal commitment to use park services in the future and thus provides the most immediate information about future park use behaviour (Ajzen, 1991). The theory of planned behaviour (TPB) provides a theoretical framework to examine how the multi-dimensional concept of accessibility potentially explains and predicts people’s behavioural intention to use parks. We used empirical research conducted in Brisbane, Australia, to complete the following research objectives: (1) examine behavioural intentions to use local parks by comparing results from three alternative behavioural models: the theory of reasoned action (TRA), the theory of planned behaviour (TPB) and an expanded TPB model; (2) compare the predictive power of perceived accessibility (a psychological construct) and geographic accessibility on behavioural intentions to use parks; and (3) apply the model to examine its fit with population segments with different socio-demographic characteristics.

## 5.2 Theoretical framework and hypotheses

### *5.2.1.* Theory of reasoned action (TRA) and theory of planned behaviour (TPB)

The theory of reasoned action (TRA) and its extension, the theory of planned behaviour (TPB), provide the most well-known theories to predict human behavioural intentions and subsequent actions in various disciplines including social psychology, marketing, and environmental research (Armitage and Conner, 2001; Rossi and Armstrong, 1999; Scherer et al., 2011). Hartwick et al. (1988), for example, conducted a meta-analysis of 31 studies using TPB, confirming the model's predictive capacity and versatility across different settings. In addition, TPB has also been applied to predict diverse leisure behaviours. For example, Ajzen et al. (1995) used the model to explain people's intention to participate in six leisure activities, while Galea and Bray (2006) found TPB sufficient to predict human behavioural intention to participate in walking activities.

TRA posits that individuals are rational when deciding whether to perform a particular behaviour (Ajzen, 1991; Ajzen and Fishbein, 1980). Central to the TRA model is the concept of behavioural intention, the motivation that leads to engagement in the particular behaviour such as park use (Ajzen and Fishbein, 1980). Behavioural intention describes the immediate determinant of the subsequent behaviour: the stronger the behavioural intention is, the more likely a person would perform that particular behaviour (Ajzen, 1991; Bamberg et al., 2007).

Behavioural intention is postulated to be a function of two independent constructs: attitude (ATT) towards the behaviour and subjective norm (SN). ATT is defined as an individual's overall disposition/evaluation towards the possible outcomes of a specific act (Rossi and Armstrong, 1999), imposing a positive impact on the behavioural intention: the more positive the attitude towards an action, the more likely the behaviour. SN refers to the extent to which an individual perceives general social pressure towards the appropriateness to perform the behaviour (Rossi and Armstrong, 1999).

TPB was proposed by Ajzen (1988; 1991) to address the inadequacy of TRA in explaining behaviours that are not under complete volitional control (Han et al., 2011; Lee and Choi, 2009; Rossi and Armstrong, 1999). Performing these non-volitional behaviours requires additional resources such as skills and money (Ajzen, 1991; Ajzen and Madden, 1986). As a reformulation of TRA, the TPB model includes an additional construct called perceived behavioural control (PBC) that describes the ease or difficulty of performing non-volitional behaviours. Based on the TPB model, we examine three relationships in this study: *ATT*→ park *use intention (UI)*; *SN→UI*; and *PBC→UI.*

### *5.2.2.* Expanded TPB model

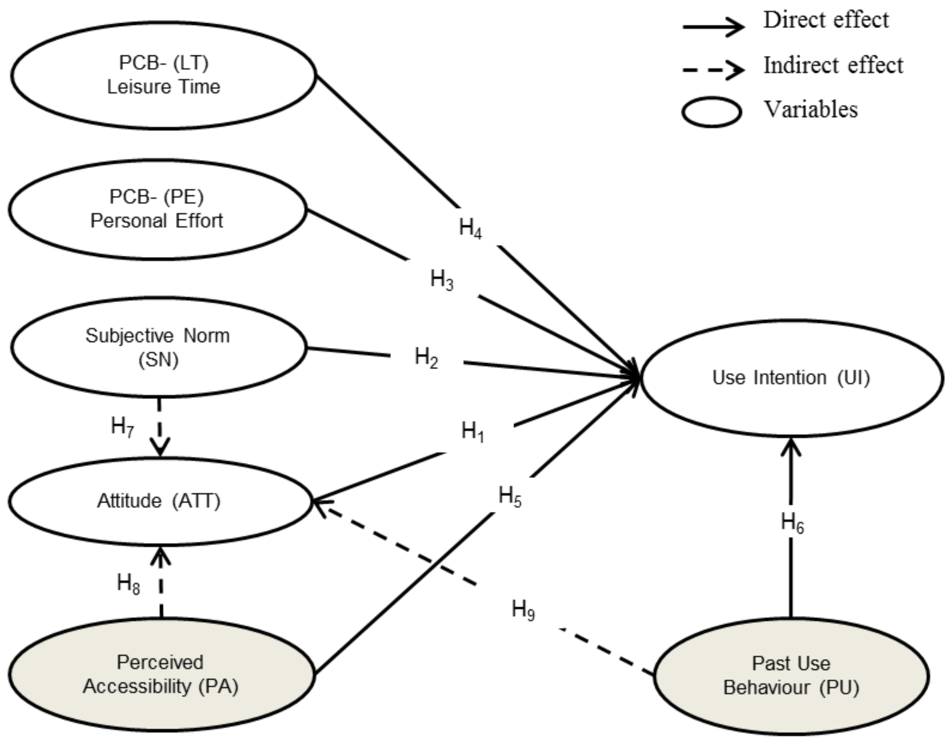
TPB provides an open-ended model that can be adapted to specific research contexts. Ajzen (1991) also claimed that TPB is a user-friendly model and open to modification where the base paths and variables can be rearranged and expanded to meet research needs. Thus, variables that have not been identified in previous literature can then be included to investigate the target behaviour. In this study, we included two additional variables (*accessibility* and *past use*) and paths in an expanded TPB model to examine their relative contribution to intention to use parks (*accessibility → UI* and *past use → UI*).

Accessibility refers to the ease with which a resident can reach a service such as a park (Nicholls, 2001; Talen, 2003). Perceived accessibility represents the subjective dimension of the accessibility concept and measures the extent to which individuals consider the service accessible. While geographic measures are commonly used to measure park access, perceived accessibility provides an evaluation about the opportunity to access a park (Joerin et al., 2005). Zondag and Pieters (2005) argued that use of public facilities is related to perceived accessibility because every individual or household has their own perception of access to urban facilities such as parks. Subjective measures are important because the willingness to act or avoid action results from a collective evaluation towards objective attributes based on previous knowledge or information (Back and Parks, 2003; Oliver, 1997). Similarly, Byrne and Wolch (2009) posited a conceptual park use model wherein individual perceptions of park spaces (including accessibility) provide the most influential component to predict park use decisions. Therefore, we consider perceived accessibility as the outcome of individual evaluation of diverse attributes of park access (e.g., footpath connection, proximity, and transport), that suppositionally influences park use intention that results in park use behaviour.

Previous studies have also indicated that inclusion of a *past use* behaviour variable in TPB improved the model's predictive ability for various leisure behaviours (Hsu and Lam, 2004; Kitamura et al., 2001; Perugini and Bagozzi, 2001). Not all human behaviours are carried out consciously. For example, habitual behaviours such as routine physical activities are not necessarily caused by a conscious decision-making process. If behaviours recur in similar contexts, the frequency of past behaviour provides a reliable indicator of the strength of habit and a direct predictor of future behaviour (Perugini and Bagozzi, 2001). Therefore, in this study, we hypothesise that the inclusion of a *past use* variable will improve TPB's predictive ability for park *use intention*.

Major components in the TRA model are not independent but interact with each other (Randall, 1989). We refer to the linkages between predictor variables as crossover effects and propose three additional paths in the expanded TPB model: *subjective norm → attitude*, *accessibility → attitude* and *past use → attitude*. *Subjective norm* and *attitude* represent cognitive outcomes that are logically aligned in memory and should exert direct influence on each other (Shimp and Kavas, 1984). Empirical evidence confirms the causal path from *subjective norm* to *attitude* as tenable because the inclusion of this path significantly improved the model fit to the data while the opposite linkage of *attitude* to *subjective norm* was rarely supported (Chang, 1998; Oliver and Bearden, 1985; Ryu and Jang, 2006; Vallerand et al., 1992). Thus, we included a *subjective norm → attitude* linkage in our proposed model. We also included an *accessibility → attitude* path because park accessibility is associated with perceived barriers or constraints that may contribute to an evaluation of the park use experience. Lastly, we included a *past use → attitude* linkage in the expanded TPB model under the assumption that previous park use frequency may be a proxy for positive experiences that can induce favourable appraisal or attitude towards a service or product (Han and Back, 2008; Oliver, 1993).

Figure 5-1 presents the proposed, expanded TPB model with all theoretical hypotheses depicted as paths.



**Hypotheses:**

$H_1$: Attitude (ATT) has a positive effect on intention to use local public parks (UI).
$H_2$: Subjective norm (SN) has a positive effect on intention to use local public parks (UI).
$H_3$: Control over personal effort (PE) has a negative effect on intention to use local public parks (UI).
$H_4$: Control over leisure time (LT) has a positive effect on intention to use local public parks (UI).
$H_5$: Perceived accessibility (PA) has a negative effect on intention to use local public parks (UI).
$H_6$: Past use behaviour (PU) has a positive effect on intention to use local public parks (UI).
$H_7$: ATT positively and partially mediates the positive relationship between SN and UI.
$H_8$: ATT positively and partially mediates the negative relationship between PA and UI.
$H_9$: ATT positively and partially mediates the positive relationship between PU and UI.

Figure 5-1 The conceptual expanded TPB model and hypotheses

## 5.3 Methods

### *5.3.1.* Selection of study location

Neighbourhood-level surveys were conducted to collect primary data in two suburbs of Brisbane, Australia. To achieve the aim of understanding the impact of socioeconomic status on community perception and use of local parks, we purposively selected two study suburbs with: (1) predominantly residential land use; (2) contrasting socioeconomic status (SES) (i.e., one relatively high and one relatively low in SES); and (3) comparable park features (i.e., number and types of parks, park facilities) to minimise the impacts of difference in physical components. SES was operationalised by using Socio-Economic Indexes for Areas (SEIFA) reported by the Australian Bureau of Statistics because SEIFA provides comprehensive information about both the economic and social resources within an area in Australia (ABS, 2011b). To identify survey locations, a 3-step selection process was followed: (1) all Brisbane suburbs were first sorted according to their SEIFA rankings; (2) potential contrasting suburb pairs were selected in terms of their resident population, park features, and major land use types; (3) the SES of spatially adjacent suburbs was examined. The aim was to ensure that the study suburbs were not isolated 'islands' and were consistent with the SES of proximate areas. We selected two suburbs using these criteria, Graceville (higher SES) and Salisbury (lower SES), with the study population consisting of residents in the two suburbs.

### *5.3.2.* Measurement design

We operationalised major variables using psychometric scaling methods and Likert-type survey items. Multi-item scales were developed to capture different aspects of complex constructs. For example, *attitude* and *subjective norm* were measured using three questions on a five-point Likert scale (i.e., from 1=strongly disagree to 5=strongly agree). Two questions were developed to measure park *use intention* on a five-point Likert scale. Perceived accessibility was operationalised with three survey items: one question measured the respondent's overall perception of ease of access to parks and the other two questions measured two hypothetical dimensions of park accessibility—physical and socio-personal. Perceived behavioural control (PBC) can be operationalised either through global questions that ask about the ease or difficulty towards performing the action (see, for example, PBC measures used in Bamberg et al. (2003); Courneya et al. (1999) and Han et al. (2011)), or through belief-based measures that combine personal beliefs about specific inhibitors to perform the action and perceptions of the power of the inhibitors (Ajzen, 1991; Rossi and Armstrong, 1999). Belief-based measures are more appropriate for this study because they permit empirical testing of potential inhibitors and provide greater insight into the formation of park *use intention*. We used belief-based measures adapted from Hsu & Lam (2004) and Rossi & Armstrong (1999) for two potential inhibitors: *available leisure time* and *personal effort.* For each inhibitor, two different types of questions were asked. The first question measured control beliefs (CB) about the inhibitor and the second question measured the perception of strength or power (P) of the inhibitor. Each question was measured using a five-point Likert scale. We multiplied the results of the two questions (CB×P) to obtain an overall level of control for each inhibitor. *Past use* behaviour was operationalised by asking the frequency of park use per month. The survey questions used in this study appear in Table 5-1. We conducted a pilot test to refine the survey questions in August 2012 using purposive selection of ten individuals that included survey design experts and residents from the two suburbs.

Table 5-1 Measurement items for variables in the model

| **Variables** | **Description** | **Mean** | **SD** | **Standardised loadings** | **Cronbach's alpha** |
|---|---|---|---|---|---|
| *Attitude (ATT)* | ***Strongly Disagree (1) to Strongly Agree (5)***<br>Visiting this park is | | | | |
| | 1. – enjoyable | 4.175 | 0.745 | 0.920 | 0.909 |
| | 2. – a positive experience | 4.169 | 0.747 | 0.955 | |
| | 3. – fun | 3.915 | 0.853 | 0.791 | |
| *Subjective Norm (SN)* | ***Strongly Disagree (1) to Strongly Agree (5)*** | | | | |
| | 1. My family and relatives would choose neighbourhood parks as a place to spend free time | 3.642 | 0.895 | 0.865 | 0.831 |
| | 2. My friends would choose neighbourhood parks as a place to spend free time | 3.508 | 0.846 | 0.756 | |
| | 3. People who are important to me would encourage my use of neighbourhood parks | 3.529 | 0.860 | 0.726 | |
| *Perceived Accessibility (PA)* | ***Very Easy (1) to Very Difficult (5)*** | | | | |
| | 1. How would you rate your overall ease of access to this park? | 2.082 | 1.139 | 0.921 | 0.801 |
| | 2. How easy is it for you to physically get to this park? | 1.972 | 1.073 | 0.876 | |
| | 3. Are there any socio-personal issues (e.g., perceived safety issues or antisocial behaviour) that make you avoid visiting this park? and allowed the respondent to choose from *'no concerns at all ' (1) to 'very high concerns' (5)* | 1.430 | 0.819 | 0.502 | |
| *Use Intention (UI)* | ***Strongly Disagree (1) to Strongly Agree (5)*** | | | | |
| | 1. I intend to visit this park in the near future. | 3.645 | 1.237 | 0.922 | 0.936 |
| | 2. It is highly likely that I will visit this park in the near future. | 3.622 | 1.285 | 0.957 | |
| *Perceived Behavioural Control* | ***Strongly Disagree (1) to Strongly Agree (5)*** | | | | |
| *Available Leisure Time (PBC- LT)* | 1. Visiting park requires available leisure time (CB). | 14.089 | 4.797 | | |
| *CB×P* | 2. My available leisure time influences my decision to visit parks (P). | | | | |
| Personal Efforts<br>*(PBC- PE)* | 1. Visiting parks requires large personal efforts (CB) | 7.399 | 5.093 | | |
| *CB×P* | 2. The effort needed to visit a park will influence my decision to visit (P). | | | | |
| *Past Use Behaviour (PU)* | ***Times Per Month***<br>On average, about how many times do you visit public parks in your neighbourhood each month? | 7.507 | 8.390 | | |

### *5.3.3.* Sampling and data collection

A self-administered questionnaire survey was used to collect data for the study. Each questionnaire package included a questionnaire booklet, a hand-signed covering letter describing the purpose and benefits of the research, and a self-addressed, postage-paid return envelope. The population of this study consisted of all households living in the two study areas (Graceville and Salisbury). A total of 1300 questionnaire packages were distributed in the two study areas, 500 in Graceville and 800 in Salisbury. The larger sample for Salisbury was based on: (1) the larger number of households in Salisbury compared with Graceville (2083 and 1420 households, respectively); (2) an expected lower rate of survey response in a suburb with lower SES. A total of 319 responses were received resulting in an overall response rate of 24.5%. The lower SES suburb (Salisbury) had a lower response rate of 20% compared to 32% in the higher SES suburb (Graceville).

### *5.3.4.* Respondent characteristics

Table 5-2 provides a demographic profile of survey respondents. The combined responses indicate the majority of respondents were middle aged, Australian, native English speaking, college educated, homeowners and have been living in their neighbourhoods for more than five years. Over half (56.3%) of the respondents reported that they were married with children. This demographic profile is generally consistent with Australian Bureau of Statistics (ABS) census data. However, our respondents were more likely to be female (64.2% of the sample versus 49.7% in the census) and have a higher median age (45 years in the sample versus 34 years in the census) (ABS, 2011a). Overall, responses from the two suburbs show a high degree of similarity across the demographic variables.

Table 5-2 Socio-demographic characteristics of survey respondents (N= 319)

| | Overall | | Graceville (Higher SES) | Salisbury (Lower SES) |
|---|---|---|---|---|
| | Frequency | Percent (%) | Percent (%) | Percent (%) |
| Gender | | | | |
| Male | 114 | 35.8 | 37.5 | 34.2 |
| Female | 204 | 64.2 | 62.5 | 65.8 |
| Age | | | | |
| Under 21 | 2 | 0.6 | 1.3 | 0 |
| 21-30 | 30 | 9.6 | 7.5 | 11.7 |
| 31-40 | 93 | 29.7 | 30.2 | 29.2 |
| 41-50 | 67 | 21.4 | 22.6 | 20.1 |
| 51-60 | 53 | 16.9 | 16.4 | 17.5 |
| 61-70 | 37 | 11.8 | 12.6 | 11 |
| 71 or Older | 31 | 9.9 | 9.4 | 10.4 |
| Length of residence in the neighbourhood | | | | |
| Less than 1 year | 43 | 13.6 | 14.5 | 12.7 |
| 1-5 years | 84 | 26.5 | 22.6 | 30.4 |
| 5-15 years | 97 | 30.6 | 32.7 | 28.5 |
| 15-25 years | 40 | 12.6 | 13.8 | 11.4 |
| 25-35 years | 14 | 4.4 | 5.7 | 3.2 |
| 35 years and longer | 39 | 12.3 | 10.7 | 13.9 |
| Birth Place | | | | |
| Australia | 247 | 77.4 | 76.3 | 78.6 |
| Overseas | 72 | 22.6 | 23.8 | 21.4 |
| Language spoken at home | | | | |
| English only | 285 | 89.6 | 91.3 | 88 |
| Other languages | 33 | 10.4 | 8.8 | 12 |
| Family Composition | | | | |
| One parent family | 32 | 12.2 | 10.1 | 14.4 |
| Couple Family with no children | 83 | 31.6 | 31.2 | 32 |
| Couple Family with children | 148 | 56.3 | 58.7 | 53.6 |
| Homeowner | | | | |
| Rent | 55 | 17.4 | 18.8 | 16.5 |
| Own | 262 | 82.6 | 81.2 | 83.5 |
| Education | | | | |
| Secondary school | 47 | 15 | 12.7 | 17.4 |
| High School or three- year bachelor’s degree | 161 | 51.5 | 55.7 | 47.1 |
| Graduate School (including Honours) | 105 | 33.5 | 31.6 | 35.5 |
| Household Annual Income | | | | |
| Under 41,599 | 64 | 22.9 | 13.9 | 31.5 |
| $41,600-$103,999 | 104 | 37.1 | 35.0 | 39.2 |
| Above $104,000 | 112 | 40.0 | 51.1 | 29.4 |
| Health | | | | |
| Excellent to Very Good | 153 | 48.1 | 52.2 | 44.3 |
| Good | 108 | 34 | 34 | 34.2 |
| Poor to Fair | 57 | 17.9 | 13.8 | 21.5 |

## 5.4 Analyses

The datasets were first checked for missing values and outliers. Statistical analyses were conducted using IBM SPSS® and Amos while spatial data analyses were performed using ArcGIS® software.

### *5.4.1.* Measurement model and invariance test

Prior to estimating the structural relationships in the model, we assessed the measurement items for adequacy of representing the latent constructs. Descriptive statistics were reported for each individual item listed in Table 5-1. The overall fitness of the measurement model was examined using confirmatory factor analysis (CFA). CFA differs from exploratory factor analysis in its capacity to empirically test the reliability and validity of a hypothetical construct factor structure, allowing researchers to examine a theoretical pattern of factor loadings based on preconceived hypotheses (Hair et al., 2010). For each construct in our model, internal consistency of measurement items was assessed using Cronbach's alpha. We examined construct validity by generating statistics for both convergent and discriminant validity, including standardised factor loadings, construct reliability (CR), and average variance extracted (AVE).

Prior to evaluating overall model invariance at the structural level, we tested measurement model validity for each of the two suburbs (groups) to determine cross-group measurement invariance. We ran two tests to confirm measurement equivalence between the groups: a configural invariance test that examines whether the same factor structure exists for both groups and a metric invariance test that determines the equivalence of factor loadings between the groups.

### *5.4.2.* Structural model evaluation and comparison

Three alternative structural models (TRA, TPB and expanded TPB) were constructed and evaluated with *intention to use local parks* as the dependent variable (shortened to *use intention*). Structural equation modelling (maximum likelihood method) was used to examine the validity of these models. Each model was first evaluated for fit to the data, then measured for explanatory power for the target behaviour—park *use intention*. Model statistics, including the goodness-of-fit index and the total variance explained ($R^2$), were generated to determine which model performed best in explaining park *use intention*. Model hypotheses, represented by path relationships, were examined for both direct and indirect effects of the predictor variables.

### *5.4.3.* Geographic accessibility or perceived accessibility

To answer the research question about the influence of the two park accessibility measures (*geographic* and *perceived*) on park *use intention*, we substituted a *geographic accessibility* variable for *perceived accessibility* in the expanded TPB model. The explanatory power of *geographic accessibility* was compared with *perceived accessibility* by holding all other variables constant in the model. The *geographic accessibility* variable was operationalised by network distance (in metres) between respondents' domicile and the closest park entry point. Network distance was adopted because it measures distance in actual travel routes based on local road network, providing a more reliable geographic accessibility measure than conventional linear (Euclidean) distance (Oh and Jeong, 2007). Park entry points were defined as road intersections adjoining the park boundary. The shortest travel distance was calculated for each respondent using the closest facility function in GIS network analysis.

### *5.4.4.* Structural model invariance test

To validate the model for suburbs with different SES, separate structural equation models were constructed using individual suburb data. Multi-group SEM was performed to test the moderating effect of the *suburb* variable on path structure of the model, with the level of moderating effect indicated by the Chi-square difference between the baseline (unconstrained) model and the full path (structural path constrained) model. Individual path relationships were then compared between the two suburbs.

## 5.5 Results

### *5.5.1.* Measurement model

The measurement model was assessed by confirmatory factor analysis (CFA) using structural equation modelling method. The results are represented in Table 5-3. The model demonstrated good fit ($\chi^2$ =63.66, $df$ =51, $p$=.110), with normed Chi-square ($\chi^2 / df$ ) =1.248, comparative fit index (CFI) and normed fit index (NFI) greater than 0.95, and the index of root mean square error of approximation (RMSEA) less than 0.05.

Table 5-3 Correlations (r), construct reliability (CR) and average variance extracted (AVE) for latent variables

| Latent variables | ATT | ($r^2$) | SN | ($r^2$) | PA | ($r^2$) | UI | (CR) | (AVE) |
|---|---|---|---|---|---|---|---|---|---|
| Attitude (ATT) | 1 | | | | | | | 0.921 | 0.795 |
| Subjective norm (SN) | 0.347 | (0.120) | 1 | | | | | 0.827 | 0.616 |
| Perceived accessibility (PA) | -0.379 | (0.144) | -0.203 | (0.041) | 1 | | | 0.823 | 0.622 |
| Use intention (UI) | 0.517 | (0.267) | 0.355 | (0.126) | -0.57 | (0.325) | 1 | 0.938 | 0.883 |

*Note:* correlation coefficient was estimated using SPSS AMOS 22.
Measurement model-fit indices: $\chi^2$ = 63.657 (*df* = 51, *p*= .110), $\chi^2/df$ = 1.248, RMSEA= 0.028, CFI= 0.994, NFI= 0.973.

#### 5.5.1.1. *Reliability and Validity*

Of the seven variables in the model, four were latent constructs represented by multiple scales (Table 5-1). Scale reliability was first examined by conducting a reliability test. Cronbach's alphas of all scales exceeded the cut-off value of 0.7, indicating adequate internal consistency of measurement (Hair et al., 2010). Scale reliability was also confirmed by a construct reliability (CR) value calculated using SEM, with CR values ranging from 0.823 to 0.938, indicating that the scale items consistently represent the same latent construct (Table 5-3).

The convergent validity of the latent constructs was determined by the magnitude and significance of factor loadings, construct reliability (CR), and average variance extracted (AVE). Factor loadings were generally greater than 0.7 (Table 5-1) and all scale items were statistically significant at alpha level 0.01, confirming the items converge on their associated constructs. In addition, all AVE values, a summary indicator of item convergence, exceeded a value of 0.5 (Table 5-3), indicating adequate convergence of scale items. The model also showed adequate discriminant validity because the AVE values were significantly greater than the estimates of squared correlation between constructs, indicating that each latent construct is unique and different from the other constructs.

#### 5.5.1.2. *Measurement model invariance*

A configural test was conducted to determine whether the measurement model achieved adequate fit for respondents from each suburb. Grouped by *suburb*, a totally free multiple group model (TF model) was constructed with no constraints applied. The TF model demonstrated adequate fit to the data ($\chi^2$ = 122.45, *df* = 102, p= 0.082), with normed Chi-square ($\chi^2$ /*df*) = 1.2, CFI of 0.99, and RMSEA of 0.025 (Table 5-4), confirming congeneric construct structures in the two groups. To test the metric invariance, we constructed another multiple group model with all factor loadings constrained to be equal between groups. Table 5-4 shows that the Chi-square difference between these two models was insignificant ($\Delta\chi^2$ = 3.232, *p*= 0.863), confirming the cross-group validity of the measurement model.

Table 5-4 Measurement invariance tests for suburbs with different socioeconomic status

| | Model Fit Measures | | | | | | Model Difference | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Tested | $\chi^2$ | *df* | *p* | $\chi^2/df$ | RMSEA | CFI | $\Delta\chi^2$ | $\Delta df$ | *p* |
| Separate groups | | | | | | | | | |
| Graceville (Higher SES) | 69.77 | 51 | 0.041 | 1.368 | 0.048 | 0.983 | | | |
| Salisbury (Lower SES) | 52.67 | 51 | 0.409 | 1.033 | 0.014 | 0.998 | | | |
| Configural invariance (TF model) | 122.45 | 102 | 0.082 | 1.2 | 0.025 | 0.99 | | | |
| Metric invariance (Constrained model) | 125.68 | 109 | 0.131 | 1.15 | 0.022 | 0.992 | 3.232 | 7 | 0.863 |

### *5.5.2.* Structural model

#### *5.5.2.1. Model evaluation and comparison*

Having established valid and reliable measurement model components with acceptable goodness-of-fit, structural relationships were examined for the three alternative models in this study (TRA, TPB, and expanded TPB) using SEM maximum-likelihood-estimation procedure. Figure 5-2 and Table 5-5 provide a summary of model fit indices and path estimates for the three models. To assess the relative performance of each model, the results were compared across models.

The TRA model demonstrated good fit to the survey data ($\chi^2$ = 27.326, $p$ > 0.05), with normed Chi-square ($\chi^2/df$ ) of 1.607, RMSEA less than 0.050, and incremental indices of Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) greater than 0.95 (block1, Table 5-5). Both predictor variables *attitude* (ATT) and *subjective norm* (SN) were significant determinants of the dependant variable. Jointly, the two variables explained about 30.6 percent of the variance in park *use intention*. To assess the relative importance of the independent variables, standardised beta coefficients were assessed. The results (Model 1, Figure 5-2) showed positive relationships between park *use intention* and both predictors, however, ATT had stronger explanatory power than SN based on the magnitude of the standardised coefficients ($\beta_{ATT \rightarrow UI}$ = 0.445, $p< 0.01$; $\beta_{SN \rightarrow UI}$= 0.209, $p < 0.01$, respectively).

The TPB model included two additional predictor variables, representing perceived behavioural control: *personal effort* (PBC-PE) and *leisure time* (PBC-LT). The SEM results showed adequate model fit ($\chi^2/df$ = 1.533; RMSEA= 0.041; CFI= 0.992) (block 2, Table 5-5). A total of 31.7% of the variance in park *use intention* was explained by TPB, indicating marginally better explanatory power than the TRA model ($\Delta R^2 = 0.011$). However, when the significance of individual predictors was examined (Model 2, Figure 5-2), both PBC variables were not statistically significantly different from zero, indicating they are less reliable predictors of park *use intention*.

The third model tested was an expanded TPB model that incorporated two additional hypothetical predictors: *perceived accessibility* (PA) and *past use* frequency (PU). These two predictor variables were external to the TPB model, but were posited to impose direct impacts on the dependent variable. The results of SEM analyses (block 3, Table 5-5) showed that the expanded model fit the data very well, with $\chi^2/df$ = 1.133, RMSEA less than 0.05, and CFI greater than 0.95. The expanded TPB model had the smallest AIC/CAIC value (0.414) among all three models, indicating that it is the most parsimonious fitting model. In addition, the expanded TPB model demonstrated significantly better explanatory power compared to the other models by increasing explained variance ($R^2$) from 0.306 to 0.456 ($\Delta R^2 = 0.15$). Of the two new predictor variables, *perceived accessibility* ($\beta_{PA \rightarrow UI}$ = -0.429) appears far more important than *past use* ($\beta_{PU \rightarrow UI}$ = 0.017) in explaining the variance in park *use intention* (Model 3, Figure 5-2).

Table 5-5 SEM model fits and explained variance for park use intention (UI) variable

| | | Model1: TRA | Model 2: TPB | Model 3: Exp. TPB | Cut-off value[a] |
|---|---|---|---|---|---|
| Model Fit Indices | $\chi^2$ | 27.326 | 41.395 | 65.699 | |
| | *df* | 17 | 27 | 58 | |
| | *p* | 0.053 | 0.038 | 0.228 | >0.05 |
| | $\chi^2/df$ | 1.607 | 1.533 | 1.133 | <3.0 |
| | RMSEA | 0.044 | 0.041 | 0.020 | <0.05 |
| | CFI | 0.994 | 0.992 | 0.997 | >0.90 |
| | TLI | 0.990 | 0.986 | 0.995 | >0.95 |
| | AIC/CAIC | 0.419 | 0.422 | 0.414 | |
| Variance Explained | $R^2$ | 0.306 | 0.317 | 0.456 | |
| | $\Delta R^2$ | | 0.011 | 0.129 | |

[a] Cut-off values were suggested by Hair et al. (2010) and Byrne (2010)

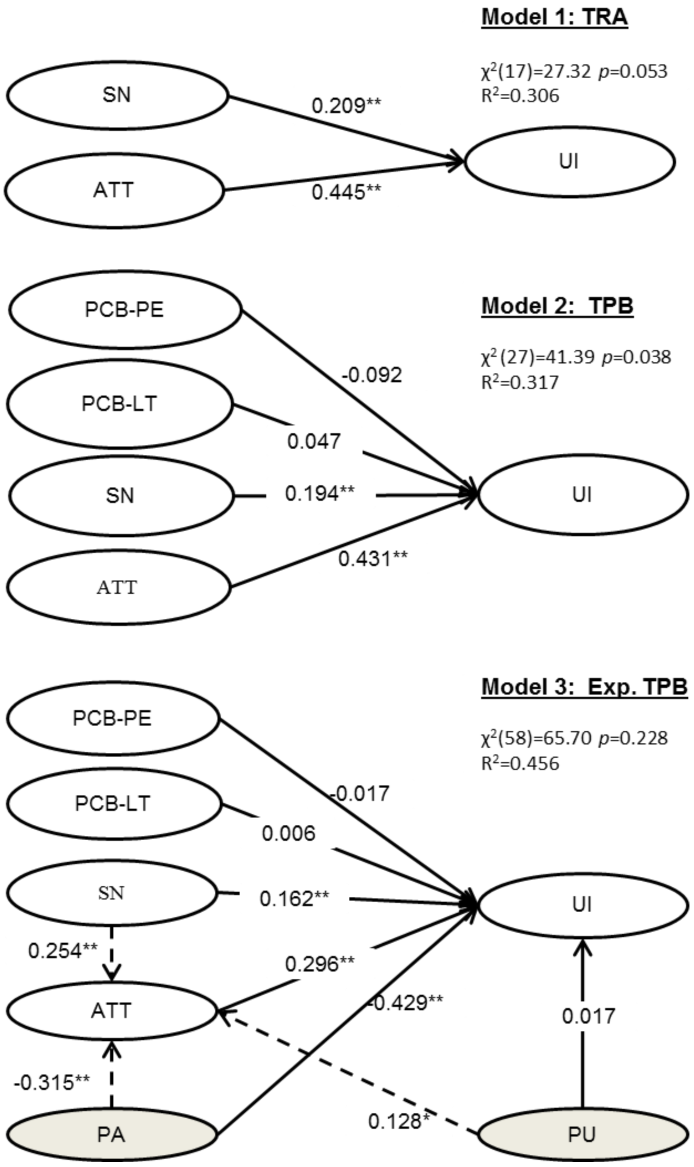


Figure 5-2 Estimates and model fits for the three models (TRA, TPB and expanded TPB)

### *5.5.2.2. Hypotheses testing*

We ran a complete (all respondents) conceptual model (Figure 5-1) with all hypothesised direct and indirect relationships. Table 5-6 shows that the *attitude* variable has a significantly positive relationship ($\beta_{ATT \rightarrow UI} = 0.296$, $p < 0.01$) with park *use intention*, supporting $H_1$. *Subjective norm* has a significantly positive effect on park *use intention* ($\beta_{SN \rightarrow UI} = 0.162$, $p < 0.01$) and *attitude* ($\beta_{SN \rightarrow ATT} = 0.254$, $p < 0.01$), and thus $H_2$ and $H_7$ are supported. The effects of *perceived accessibility* on park *use intention* ($\beta_{PA \rightarrow UI} = -0.429$, $p < 0.01$) and *attitude* ($\beta_{PA \rightarrow ATT} = -0.315$, $p < 0.01$) are both statistically significant and negative, showing support for $H_5$ and $H_8$.

However, estimates for the hypothesised structural paths for *personal effort* to park *use intention* ($\beta_{PE \rightarrow UI} = -0.017$, $p > 0.05$), *leisure time* to park *use intention* ($\beta_{LT \rightarrow UI} = 0.006$, $p > 0.05$), and *past use* to park *use intention* ($\beta_{PU \rightarrow UI} = 0.017$, $p > 0.05$) were not statistically different from zero. The results indicate that genuine predictive relationships for these three variables do not exist, thus $H_3$, $H_4$, and $H_6$ are not supported. Although the direct relationship between *past use* and park *use intention* was insignificant, *past use* had a significantly positive effect on *attitude*. This result suggests that *past use* has an indirect effect on park *use intention* through the *attitude* variable and thus $H_9$ is supported.

Table 5-6 Standardised parameter estimates and effects (direct, indirect and total) on park use intention (UI)

| Hypothesised paths | Std. estimates | t-value | Direct Effect (DE) | Indirect Effect (IE) | Total Effect (TE) | Hypotheses |
|---|---|---|---|---|---|---|
| $H_1$: Attitude→ UI | 0.296 | 5.388** | 0.296 | - | 0.296 | Supported |
| $H_2$: Subjective norm→ UI | 0.162 | 2.952** | 0.162 | 0.075 | 0.238 | Supported |
| $H_3$: Personal effort→ UI | -0.017 | 0.362 |  | - | - | Rejected |
| $H_4$: Leisure time→ UI | 0.006 | 0.139 |  | - | - | Rejected |
| $H_5$: Perceived accessibility→ UI | -0.429 | 6.051** | -0.429 | -0.093 | -0.522 | Supported |
| $H_6$: Past use→ UI | 0.017 | 0.360 |  | - | - | Rejected |
| $H_7$: Subjective norm→ATT | 0.254 | 4.211** |  | - | - | Supported |
| $H_8$: Perceived accessibility→ ATT | -0.315 | 4.908** |  | - | - | Supported |
| $H_9$: Past Use→ATT | 0.128 | 2.400* | 0.017 | 0.038 | 0.055 | Supported |
| Variance Explained ($R^2$): | *Use intention* (UI) = 0.456 |  |  | *Attitude* (ATT) = 0.236 |  |  |

*$p < 0.05$.
**$p < 0.01$.

#### *5.5.2.3. Direct, indirect, and total effect*

Table 5-6 reports all the direct and indirect effects of potential predictor variables on park *use intention*. Two predictor variables (*subjective norm* and *perceived accessibility*) were found to have both significant direct and indirect effects on park *use intention*, with direct effect providing the largest contribution to total effect, confirming a partial mediating relationship through the *attitude* variable. For the *past use* variable, only the path estimate to the mediator *attitude* was confirmed to be significant.

With respect to total effect (TE) that shows the combined effects of both direct and indirect relationships, the *perceived accessibility* variable was the most important predictor (-0.522) of park *use intention*, followed by *attitude* (0.296), *subjective norm* (0.238) and *past use* (0.055). *Perceived accessibility* also had the largest direct effect (-0.429) among all the significant predictor variables, with *attitude* (0.296) second largest, followed by *subjective norm* (0.162). When the indirect effects on park *use intention* mediated by *attitude* were examined, *perceived accessibility* was also found to have the largest indirect effect (-0.093).

These results indicated the initial conceptual model could be improved. A revised model was developed with all the insignificant paths removed. Figure 5-3 shows the revised, expanded TPB model with path estimates and model fit indices. The revised model results confirm the significance of *perceived accessibility* in influencing behavioural intention to use (or not use) local parks. But, does perceived accessibility have a similar impact on park *use intention* to *geographic distance*? The next section compares the explanatory power of *perceived accessibility* and *geographic accessibility* in the revised, expanded TPB model.

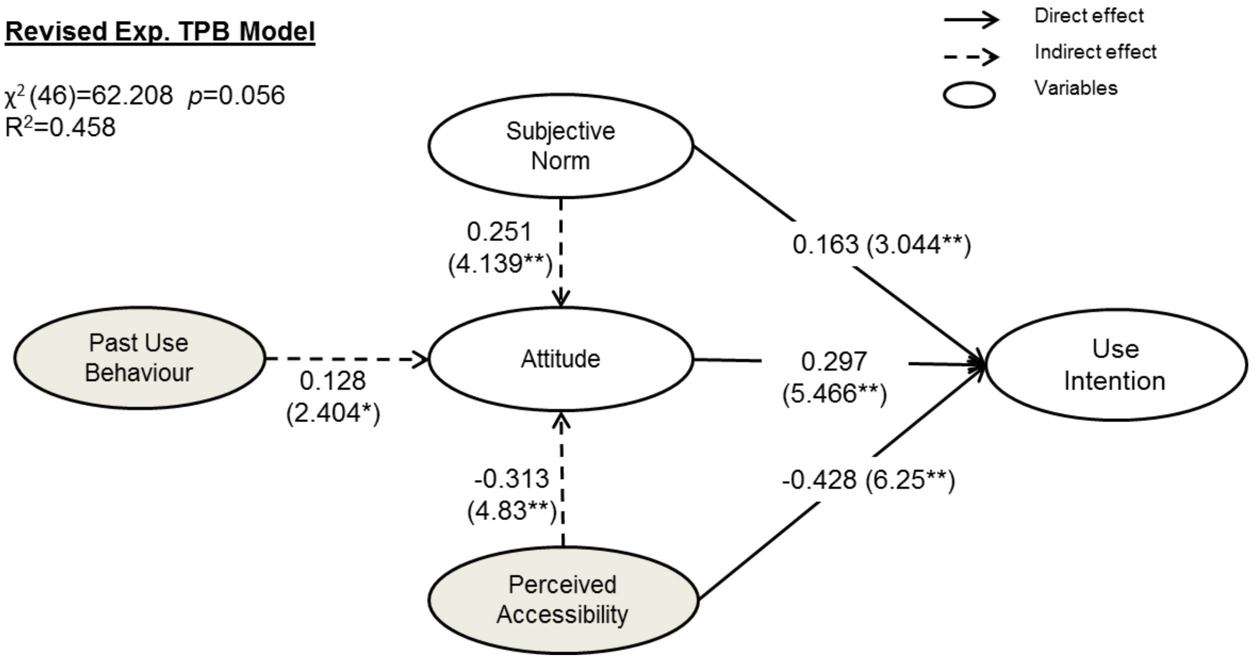


Figure 5-3 The revised, expanded TPB model with estimates and model fits

### *5.5.3.* Influence of geographic and perceived accessibility on park use intention

To compare the predictive power of perceived accessibility and geographic accessibility on park *use intention*, we replaced *perceived accessibility* with *geographic accessibility* as measured by physical network distance. The new model was named 'geographic accessibility (GA)' model and compared with the 'perceived accessibility (PA)' model. Table 5-7 shows that both models demonstrate adequate fit to the data, indicating that the structural relationships in the model were not affected by variable replacement. However, the variance-explained estimates for park *use intention* decreased significantly from 0.458 in the PA model to 0.344 in the GA model, indicating that the PA model has better explanatory power than the GA model.

Furthermore, when inter-construct relationships were compared between the two models, both the *perceived accessibility* and *geographic accessibility* variables were found to have a significant effect on park *use intention* ($\beta_{PA \rightarrow UI} = -0.428$, $p<0.01$; $\beta_{GA \rightarrow UI} =-0.205$, $p<0.01$). *Perceived accessibility* demonstrated superior predictive power over *geographic accessibility* to explain changes in the *use intention* variable. In the PA model, *perceived accessibility* was the most important predictor among all the predictive variables, having both the largest total (TE= -0.521) and direct effect on the dependent variable. By comparison, holding all the other variables and path relationships constant, the effect of *geographic accessibility* was the second smallest (TE= -0.284) in the GA model, only better than the effect of the *past use* variable. In addition, the total effect of *attitude* on park *use intention* increased from 0.297 in the PA model to 0.395 in the GA model, further confirming the weak predictive power of the *geographic accessibility* variable.

In summary, the result indicates that both perceived and geographic accessibility measures help predict behavioural intention to visit urban parks, but the predictive power of the perceived accessibility is much higher than the geographic accessibility as measured by physical distance.

Table 5-7 Comparison between perceived accessibility and geographic accessibility models

| | Perceived Accessibility (PA) Model | | | Geographic Accessibility (GA) Model | | |
|---|---|---|---|---|---|---|
| | Direct effect | Total effect | t-Value | Direct effect | Total effect | t-Value |
| Attitude→ UI | 0.297 | 0.297 | 5.466** | 0.395 | 0.395 | 7.047** |
| Subjective norm→ UI | 0.163 | 0.237 | 3.044** | 0.185 | 0.295 | 3.208** |
| Accessibility→ UI | -0.428 | -0.521 | 6.25** | -0.205 | -0.284 | 4.038** |
| Past Use→ATT→UI | - | 0.038 | 2.404* | - | 0.047 | 2.135* |
| Model Fit Indices | $\chi^2$ | 62.208 | | 36.02 | | |
| | *df* | 46 | | 28 | | |
| | *p* | 0.056 | | 0.142 | | |
| | $\chi^2/df$ | 1.352 | | 1.286 | | |
| | RMSEA | 0.033 | | 0.030 | | |
| | CFI | 0.993 | | 0.996 | | |
| | TLI | 0.990 | | 0.993 | | |
| Variance Explained | $R^2$ | 0.458 | | 0.344 | | |
| | $\Delta R^2$ | | | -0.114 | | |

$^*p < 0.05$.
$^{**}p < 0.01$.

### *5.5.4.* Structural model comparison between suburbs

The multi-group confirmatory factor analysis confirmed the equivalence of the measurement model between the two suburbs with different SES. Given this result, we compared the structural model to examine the potential moderating effect of the *suburb* variable on the structural relationships (objective 3). The results show that the moderating effect of *suburb* is statistically insignificant ($\Delta\chi^2$ (13) = 7.77, $p$ = 0.858), confirming the structural invariance between groups (see Table 5-8). When individual path estimates were compared between groups, there was no statistically significant difference in all of the structural paths. These results indicate that the structural relationships in the expanded TPB model appear valid for both lower and higher SES suburbs.

Table 5-8 Structural invariance between suburbs

| | Graceville (Higher SES) | | | Salisbury (Lower SES) | | | |
|---|---|---|---|---|---|---|---|
| | Estimate | Total effect | $p$ | Estimate | Total effect | $p$ | z-score |
| PerAccess → Attitude | -0.377 | | 0.000 | -0.262 | | 0.010 | 1.612 |
| Subjective norm → Attitude | 0.130 | | 0.134 | 0.317 | | 0.000 | 1.478 |
| Past Use → Attitude | 0.135 | 0.041 | 0.081 | 0.113 | 0.026 | 0.142 | -0.041 |
| Subjective norm→ UI | 0.160 | 0.199 | 0.035 | 0.183 | 0.257 | 0.019 | 0.036 |
| PerAccess → UI | -0.408 | -0.524 | 0.000 | -0.436 | -0.497 | 0.000 | 1.078 |
| Attitude→ UI | 0.305 | 0.305 | 0.000 | 0.233 | 0.233 | 0.003 | -0.883 |
| | | Baseline model | | Full path model | | | |
| Model Fit Indices | $\chi^2$ | 115.11 | | 122.88 | | | |
| | $df$ | 92 | | 51 | | | |
| | $p$ | 0.052 | | 0.112 | | | |
| | $\chi^2/df$ | 1.251 | | 1.17 | | | |
| | RMSEA | 0.28 | | 0.23 | | | |
| | CFI | 0.989 | | 0.991 | | | |
| | TLI | 0.984 | | 0.989 | | | |
| Group Model Difference | $\Delta\chi^2 = 7.77$ | $\Delta df = 13$ | | $p = 0.858$ | | | |

## 5.6 Discussion, conclusion and further studies

This study supports the validity of an expanded TPB model that explains behavioural intention to use urban parks. The expanded TPB model was validated in two suburbs with different SES levels. *Perceived accessibility* was the strongest predictor variable in the model, having both direct and indirect (mediated) effects on park *use intention*. An individual's *attitude* towards parks was the second strongest predictor and an important mediator variable in the model. The *subjective norm* variable was also a significant and important predicator of park *use intention*. There was no empirical support for the influence of *perceived behaviour control* (PBC) or *past use* on intention to use parks. The use of belief-based behavioural control measures, combined with the relative ease to get to parks in the study area, may help explain the insignificance of behavioural control variables. Future studies may address this limitation by using global PBC rather than belief-based questions.

Both perceived and geographic accessibility significantly contributed to the explanatory power of the expanded TPB model, but *perceived accessibility* was a more important predictor of park *use intention*. This result supports previous findings suggesting that self-reported access to urban parks does not accurately reflect objectively measured access (Macintyre et al., 2008b).

The model showed that *perceived accessibility* has both direct and indirect effects on park *use intention* such that changes in perceived access to parks will influence park use decisions through both the direct causal effect (PA→UI) and the sequential effect mediated by the *attitude* variable (PA→ATT→UI). These results identify a significant role for *perceived accessibility* in determining future urban park use.

The outcomes of this study have both theoretical and practical implications. This study provides empirical support for using an expanded TPB model to explain and predict the use of public facilities such as urban parks. The model was developed based on willingness to use parks, thus providing a reasonable predictor of future park use behaviour. Our findings also suggest that the TPB model could be modified to suit the context of other public facilities. In this study, all of the three crossover relationships significantly accounted for the improved predictive power of the expanded TPB model, highlighting the importance of *attitude* as a mediating variable. In the context of urban park use, the predictor constructs are not independent as hypothesised in the TPB model but rather are interrelated. These findings are consistent with Chang (1998) and Randall (1989) who suggested that linkages between the major components in a TPB model merit consideration when investigating human behaviour in certain contexts.

Our results highlighted two variables from the TPB model that have implications for future park utilisation. First, positive *attitudes* towards urban parks were significantly associated with positive behavioural intentions to use parks. This finding is consistent with Byrne and Wolch (2009) who found perception of park spaces is closely associated with choices to use parks. Thus, policy interventions that seek to increase positive attitudes towards park spaces are likely to increase park utilisation. Second, *subjective norms* were important to park use decisions. This finding is consistent with literature suggesting that park visitation is significantly affected by social support from family, friends, colleagues, or close relatives (Davison et al., 2003; Eyler et al., 1999; Treiber et al., 1991). Thus, park experience, both positive and negative, may be amplified through informal communication networks (i.e., word of mouth). Park management should address potentially negative park issues in a timely fashion to foster positive attitudes towards public park spaces, encouraging greater use and more active life styles. This could be achieved by improving communication channels with the community.

Our results indicate that the provision of parks is a necessary, but insufficient condition to actually increase park use. Contemporary urban planning principles advocate compact city forms to address metropolitan challenges such as road congestion and automobile dependency. Urban consolidation and densification, however, often results in increased land value and a loss of public open spaces, making accessibility planning for parks even more imperative. Conventional quantitative approaches that use standards (e.g., park area per capita or distance) for measuring park accessibility are insufficient to address the multidimensional nature of the accessibility construct because these geographic-based measures leave other important non-physical variables (e.g., safety and cultural/ethnic related preferences) largely unexplored (Lindsey et al., 2001; Wang et al., 2015a). Previous studies have also recognised that environmental design is closely associated with improved user experiences (Byrne et al., 2009; Giles-Corti et al., 2005; Gobster, 1998; Goličnik and Ward Thompson, 2010). A park's physical location and design may determine whether it becomes an unwanted urban vacuum or a valued neighbourhood space that fosters social interaction. For example, Byrne et al. (2009) highlighted the importance of good signage as a potential driver of park use while Gobster (1998) suggested that locating high-use facilities such as playgrounds and trails along the perimeter of parks that are visible and accessible can help integrate adjacent neighbourhoods. These findings provide some guidance for future park design to improve the user experience and foster positive attitudes towards parks.

This study found that perceived accessibility was a more reliable predictor of one's intention to use parks than geographic distance, suggesting that park access is multi-dimensional and may be influenced by both physical and socio-personal factors such as safety, social exclusion, and ethno-racial background. These findings concur with Byrne and Wolch (2009) who asserted that park perceptions can be affected by a variety of factors ranging from historical context of park provision to ethno-racial contestation around access to park space. The emergence of perceived accessibility as a key determinant of park use, in combination with empirical evidence that accessibility is a multi-dimensional construct consisting of both physical and non-physical dimensions (Wang et al., 2015a), suggests the need to expand or refocus urban accessibility research. The old adage, 'build it and they will come' that characterises a physical standards approach to urban parks, appears overly simplistic if the actual goal is to expand the public benefits derived from using urban parks.

To improve the quality of urban life through greater utilisation of urban parks, the planning and management of urban parks should account for differentiated preferences and perceptions of park space, especially for people from different socioeconomic backgrounds. Given that this case study was limited to two suburbs within a single city located in Australia, future studies should determine the applicability of the expanded TPB model to other urban areas with different socio-cultural settings. It seems reasonable that the importance of the physical and non-physical variables that encourage or constrain park use is also influenced by the larger social and cultural context of urban settings, e.g., cities in Asia versus cities in Europe. Given the significant trend towards global urbanisation, future research should address the universality of urban park use behaviour with the associated implications for providing and managing urban park space. The socio-personal dimensions of perceived park accessibility appear especially sensitive to the larger social and cultural context of the urban setting, suggesting the need to expand urban accessibility research to include a greater diversity of urban settings, including cross-cultural studies.

# CHAPTER 6. THE PHYSICAL AND NON-PHYSICAL FACTORS THAT INFLUENCE ACCESS TO URBAN PARKS

Chapter 6 has been published as a journal article in *Landscape and Urban Planning*. The related information presented in the previous chapters may be repeated in the introduction and method design sections of this chapter.

**ABSTRACT:** Access to urban parks and green space is purported to contribute to community well-being and inclusive neighbourhoods. While accessibility has been developed as a multidimensional construct in the literature, few studies have empirically investigated the mix of both physical and non-physical factors that influence self-reported access to urban parks. To fill this knowledge gap, we conducted community level surveys in Brisbane, Australia, to empirically test a multivariate model of park accessibility. We collected primary data in two suburbs with contrasting socioeconomic status (SES) but comparable park infrastructure. Multiple regression models containing both physical and non-physical variables were developed and tested. Our findings concur with existing studies indicating lower perceived park accessibility in the lower SES neighbourhood. The most important factors influencing perceived accessibility to urban parks were physical and locational features such as proximity to the park, a pleasant walking experience, and a sufficient number of parks in the neighbourhood. Less important, but statistically significant social variables included cultural groups using the parks, shared activities, safety, and leisure time available. These findings provide empirical support for the multidimensional nature of the accessibility construct. We discuss the implications of our findings for park planning in metropolitan areas.

**KEYWORDS:** Accessibility; park planning; park access; perceived access; community survey; socioeconomic status

## 6.1 Introduction

Rapid urbanisation has converted more than half of the world's population to urban dwellers during the past few decades. This wave of rural-to-urban migration will continue into the future, with an estimated 70% of the world population living in urban areas by 2050 (UN, 2012; UNFPA, 2007). There are growing concerns about effective and equitable urban service delivery to meet the needs of this rapidly increasing urban population (Koehler and Wrightson, 1987; Talen, 1997). For example, parks and green spaces are considered therapeutic elements within an urban landscape and offer a variety of benefits to individual and community well-being, including physical and psychological health benefits as well as social and economic benefits (Bedimo-Rung et al., 2005; Byrne and Wolch, 2009; Cohen et al., 2007; Ulrich and Addoms, 1981). Further, access to parks promotes the development of social capital and the fostering of sustainable urban livelihoods (Byrne and Wolch, 2009; Chiesura, 2004). And yet, these benefits can be only realised if parks can be reasonably accessed and used by urban residents.

The quality of urban life is closely associated with access to nature and recreational opportunities in cities (Nicholls, 2001; Pred, 1977). As a result, park accessibility and utilisation are frequently investigated within leisure and geography disciplines (Byrne and Wolch, 2009; Scott and Munson, 1994; Wright Wendel et al., 2012). Park accessibility is identified as one of the major factors in influencing park utilisation. For example, Byrne et al. (2009) found that easy access is an important reason for the preferred use of local parks rather than large national parks, especially for people of colour. Similarly, Giles-Corti et al. (2005) found that distance and park size are two important factors associated with the likelihood of using public parks.

Accessibility refers to the ease with which a site may be reached, providing a measure that evaluates the relative opportunity for contact or use (Gregory et al., 1986). Traditional accessibility studies were founded in Location Theory with the aim to minimise operational costs of service distribution, making physical distance or proximity to the service the key variable in operationalising accessibility (Gregory et al., 1986; Hass, 2009; Nicholls, 2001). However, distance-based analyses do not take into account the multidimensional nature of the accessibility construct. Conceptually, accessibility has been developed as a construct that encompasses both physical and non-physical dimensions (Aday and Andersen, 1974; Ferreira and Batey, 2007; Gregory et al., 2009; Lindsey et al., 2001; Wang et al., 2013). For example, Aday and Andersen (1974) distinguished the social and geographic aspects of accessibility, arguing for the importance of non-spatial attributes (social accessibility) in influencing people’s ability to obtain services such as parks and green spaces. Similarly, the Gregory et al. (2009)’s definition of accessibility emphasised the socio-personal aspects of the concept that include potential language and cultural barriers, gender ideologies, skills, information, and other socioeconomic barriers.

In the context of urban park studies, Lindsey et al. (2001) observed that research has emphasised spatial-physical variables rather than the socio-cultural dimensions of park accessibility. More recent park research has continued to rely on measures derived from spatial-physical variables. For example, common criteria used to examine park accessibility include quantitative standard approaches such as distance to parks (Euclidean or network-based distance), park area per capita, and number of parks (Maruani and Amit-Cohen, 2007; Nicholls, 2001; Oh and Jeong, 2007). These indicators emphasise the spatial-physical aspects of accessibility but still require operational definitions and measurement protocols for empirical investigation. Variations in accessibility measurement can significantly influence research outcomes (Guy, 1983; Kwan, 1998; Neutens et al., 2010; Nicholls, 2001; Talen and Anselin, 1998; Weber, 2003) and the ability to predict human behavioural changes (Joerin et al., 2005). Although physical standards provide a relatively simple means to operationalise accessibility, they do not address the complexity of the concept, excluding a more authentic and comprehensive representation that includes perceived access to parks. Recent accessibility literature has identified the need to integrate the physical and socio-personal dimensions into the operationalisation of the accessibility concept (Brown, 2008; Nicholls, 2001).

Access to environmental benefits provided by urban parks and green spaces has emerged as an important theme in environmental justice research. Various studies have examined the implications of park distribution for population segments with different socioeconomic or cultural backgrounds (Byrne and Wolch, 2009; Byrne et al., 2009; Tsou et al., 2005). Some research has concluded that urban parks appear inequitably distributed within cities, with communities of lower socioeconomic status (SES) and people of colour having inferior geographic access to parks, constraining the frequency of park use (Byrne et al., 2009; Estabrooks et al., 2003; Sister et al., 2010; Wolch et al., 2005). For example, in Los Angeles, low-income neighbourhoods and those dominated by ethnic minorities (e.g., African-Americans and Latinos) have significantly lower levels of access to parks (Wolch et al., 2005) and higher risk of potential park congestion (Sister et al., 2010). People of colour and the poor are largely excluded from accessing the city’s largest urban national park as the park is surrounded by predominantly white and wealthy neighbourhoods (Byrne et al., 2009). Such uneven distribution of park spaces has raised compelling environmental equity concerns wherein park benefits are not equally distributed amongst population subgroups.

These findings contrast with other studies reporting that the distribution of green spaces has no significant association with deprivation (Jones et al., 2009; Lindsey et al., 2001; Macintyre et al., 2008a; Nicholls, 2001). For example, in the UK, poorer neighbourhoods are not always subject to poorer access to urban resources such as parks (Macintyre et al., 2008a). In Bristol, England, people living in more deprived areas were found to be closer to urban green spaces, but used parks less frequently than people in more affluent areas. Similar results were reported from the U.S. where less advantaged groups (ethnic minorities and people of lower incomes) were found to have better geographic access to public parks and green trails or be more likely to live in walkable neighbourhoods (Cutts et al., 2009; Lindsey et al., 2001; Nicholls, 2001; Wendel et al., 2011). However, the advantage of physical proximity to parks and green spaces may be offset by the quality, diversity, and size of the green spaces (Wendel et al., 2011) or by socio-personal characteristics including age, income, safety, and cultural concerns (Cutts et al., 2009).

Previous research has also revealed inconsistency between subjectively measured accessibility (perceived accessibility) and objectively measured accessibility (geographic accessibility) (Ball et al., 2008; Jones et al., 2009; McCormack et al., 2008; Scott et al., 2007). Perceived accessibility does not equate with actual park provision or physical distance (Boehmer et al., 2006; Scott et al., 2007). For example, an empirical study in Melbourne, Australia, confirmed that urban residents of lower income were more likely to have mismatches between their perceptions of the physical environment and objective measures (Ball et al., 2008). In the UK, residents of deprived neighbourhoods who lived closer to parks tended to report less perceived access to parks and less frequent use (Jones et al., 2009). These results indicate that people may have lower levels of perceived access even if the actual number of parks and facilities in their neighbourhoods is comparable to other areas. The disparity in these findings may result from variation in how accessibility is conceptualised and measured, suggesting that existing knowledge about accessibility is incomplete, especially at the individual perceptual level (Kruger et al., 2007; Wang et al., 2013). For example, empirical studies found that the frequency of physical activity was closely associated with self-reported use but not with objectively measured environmental factors such as number of facilities (Hoehner et al., 2005). A conceptual park use model developed by Byrne and Wolch (2009) posited that people’s perception of park space (including accessibility) is the most influential factor in a park use decision. This argument supports other scholars who suggest that perceived accessibility is more important to understand and predict human behaviour (Kruger et al., 2007; Zondag and Pieters, 2005).

Both park-based and user-based factors may affect people’s perception of park access and park use (Byrne and Wolch, 2009). Perceived park access can be explained by park-based factors (internal features that operate within park areas), including lighting, signage, locations of facilities, program and activities, landscape design, and maintenance frequency (Gobster, 1995;

Gobster, 1998; Reynolds et al., 2007). For example, Gobster (1998) observed that location of park facilities (e.g., trails, playgrounds) and active park management were important factors in attracting diverse users to local parks, providing an example of how interactive park design and management may address diverse needs of surrounding neighbourhoods. People from other racial/ethnic groups may find public park spaces less attractive if park designs are guided exclusively by Anglo-Celtic landscape aesthetics (Loukaitou-Sideris, 1995; Loukaitou-Sideris and Stieglitz, 2002; Rishbeth, 2001).

Potential park users' characteristics provide another important aspect to explain differentiated park access and use. Park access is influenced by an individual's socioeconomic (e.g., income, education) and socio-demographic (e.g., ethnicity, age, sex) characteristics (Byrne and Wolch, 2009). Other user-based variables associated with park access include neighbourhood characteristics, perception of safety, and personal sense of belonging to the community (Chen and Jim, 2010; Chiesura, 2004; Hille, 1999; Winter and Lockwood, 2005). Leisure studies have focused on these user-based factors to explain ethno-racially differentiated user preferences and racial segregation observed in park use (Byrne and Wolch, 2009; Gobster, 1998; Hutchinson, 1987). For example, ethnic minorities may confront socioeconomic barriers that constrain park use (Washburne, 1978). These user-group based studies tend to treat space and place as homogeneous entities, overlooking spatial-physical barriers that may constrain choice in park use. Few studies have examined the mix of both physical and non-physical factors that influence self-reported access to parks and green spaces. This article addresses this knowledge gap by exploring the multivariate dimensions of accessibility using an empirical study conducted in Brisbane, Australia.

### *6.1.1.* Model and research question

We hypothesise that a combination of physical and non-physical variables account for the perception of park accessibility (Figure 6-1). This exploratory model conceptualises park accessibility as a multi-dimensional construct that includes physical, transport, knowledge, social, and personal dimensions of accessibility. The model represents a logical extension of existing conceptual accessibility models in the urban park context with the potential for empirical investigation and validation. The identification of separate dimensions and variables can be operationalised and collectively analysed for their contributions to the overall accessibility construct.

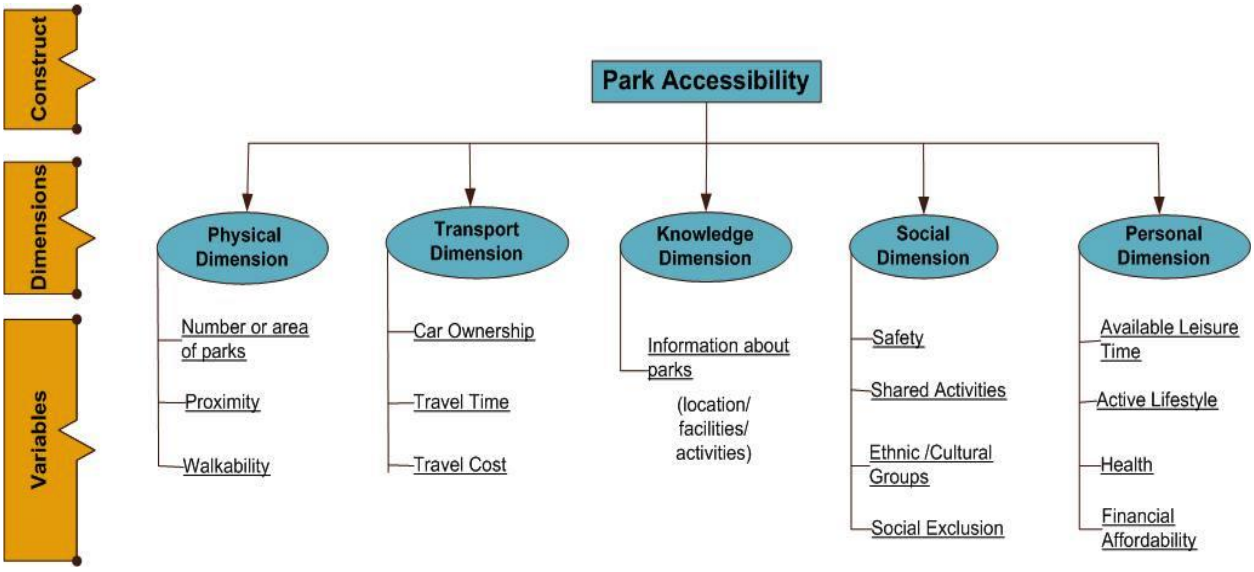


Figure 6-1 An integrated model of park accessibility

Thus, the purpose of this study is to empirically examine the validity of a multi-dimensional accessibility model by seeking answers to the following research questions: 1) does perceived accessibility to parks differ between suburbs with comparable physical park provision, but different socioeconomic status (SES)? 2) Is geographic proximity to parks significantly related to perceived access to parks? 3) which major component of accessibility (physical or socio-personal) most influences perceived access to urban parks? 4) which specific variables within the model most strongly contribute to perceptions of access to urban parks? 5) does perceived accessibility vary according to respondents' socio-demographic characteristics?

## 6.2 Methods

### *6.2.1.* Suburb selection

We conducted neighbourhood-level surveys to collect primary data in the suburbs of Brisbane, Australia. Two study suburbs were purposively selected for contrasting SES, but otherwise comparable in terms of actual public park provision. Three criteria were used to select the two suburbs: (1) the suburbs should be dominantly residential; (2) the suburbs should provide contrast in SES (e.g., one relatively high and one relatively low); and (3) the suburbs should have comparable physical park features of varying scales (e.g., number of parks, area per capita, land use ratio). The SES for each suburb was measured using the *Index of Relative Socio-economic Advantage and Disadvantage* (IRSAD) which is a component of the *Socio-economic Indexes for Areas* (SEIFA) developed by the Australian Bureau of Statistics (ABS, 2011b). SEIFA has been widely accepted as a reliable indicator that reflects relative advantage and disadvantage at an area level in Australia (Ball et al., 2008). IRSAD provides a general index based on the economic and social conditions within an area. The index is a comprehensive measure that summarises information about a wide range of socioeconomic variables about people and households, including income, education, skilled occupation, disability, unemployment, and overcrowded dwellings (ABS, 2011b). Higher scores of the index indicate areas of greater advantage (higher SES level) with higher household incomes and better dwelling conditions or more people with higher formal education and skilled occupations (ABS, 2011b).

To select the two study suburbs, all Brisbane suburbs were sorted according to the IRSAD rankings. Resident population, park features, and the major land use type were then compared between potential study suburbs. The SES of spatially adjacent suburbs was also examined to ensure that the selected suburbs were not isolated ‘islands’ of low or high SES, but consistent with proximate suburbs. Using these criteria, we selected two Brisbane suburbs for our study: Graceville and Salisbury.

### *6.2.2.* Description of selected suburbs

The Graceville suburb is located approximately 8km southwest of Brisbane’s Central Business District (CBD). Land use in Graceville is predominately residential with a population of 4,213 according to the 2011 Australian Census. Graceville is situated in one of the most affluent areas in Brisbane with an IRSAD percentile of 96/100 and is surrounded by the residential suburbs of Chelmer (99/100) and Sherwood (91/100).

The Salisbury suburb is located 11km south of the Brisbane CBD. In 2011, this suburb had a resident population of 6,103, an IRSAD percentile of 57/100. The dominant type of land use in Salisbury is residential. In addition, Salisbury is surrounded by other lower SES suburbs including Coopers Plains (38/100) and Rocklea (28/100) (ABS, 2011a; ABS, 2011b). There are eleven public parks in Salisbury with a per capita park area of 91.6 $m^2$, compared to eight public parks in Graceville with 79.2 $m^2$ per capita. In this study, the lower SES suburb (Salisbury) has higher provision of green space compared to the higher SES suburb (Graceville) based on quantitative park standards (e.g., number of parks, total park area, and park area per capita).

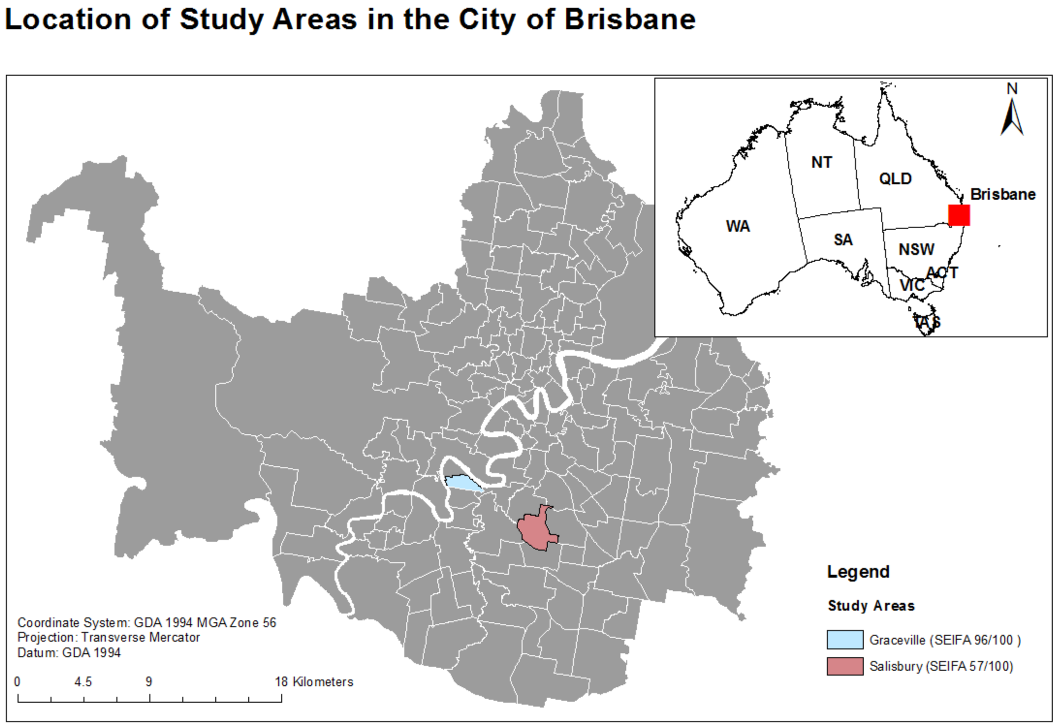


Figure 6-2 Locations of the two study suburbs with their SEIFA rankings

### *6.2.3.* Survey design

We operationalised variables in the park accessibility model using psychometric scaling with 5-point Likert scales. Psychometric scaling is an important method in social research that identifies and measures constructs that underlie judgements or positions on social issues (Neuman, 2011). For more complex constructs such as safety, more than one survey question was developed to measure different aspects of the construct. Table 6-1 lists the survey questions used in this study. We completed a pilot test of the survey from July to August 2012, using a purposively selected group of individuals (N = 10) that included both academics with survey research expertise and residents living in the two suburbs.

Table 6-1 Variables used to analyse people’s perception of park accessibility and associated attributes.

| **Variable** | **Description** |
|---|---|
| **Perceived Accessibility Measures** | |
| *Perceived Accessibility* | “How would you rate your overall ease of access to this park?” and allowed the respondent to choose from “very easy” to “very difficult” |
| *Perceived Physical Accessibility* | “How easy is it for you to physically get to this park?” and allowed the respondent to choose from “very easy” to “very difficult” |
| *Perceived Socio-personal Accessibility* | “Are there any socio-personal issues (e.g., perceived safety issues or antisocial behaviour, etc.) that make you avoid visiting this park?” and allowed the respondent to choose from “no concerns at all” to “very high concerns” |
| **Regression Independent Variable: Physical dimension** | |
| *Number or Area of parks* | “There are a sufficient number of parks in my neighbourhood.<br>There is a sufficient area of parks in my neighbourhood.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Proximity* | “This park is close to where I live.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Walkability* | “I can easily walk to this park.<br>The walk to this park is a pleasant experience.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| **Regression Independent Variable: Transport dimension** | |
| *Car Ownership* | “Do you own a private vehicle?” and allowed the respondent to choose from “Yes” and “No” |
| *Perceived Distance* | “How far would you estimate the travel distance (in meters) is from your house to each park?” |
| *Estimated Travel Time* | “How long would you estimate it would take you (in minutes) to get to each park using your common method?” |
| *Estimated Travel Cost* | “How much money would you estimate it would cost you (in dollars) to get to each park using your most likely method to go there?” |
| **Regression Independent Variable: Knowledge dimension** | |
| *Information about parks* | Sum of rating for significant measures:<br>“I am aware of parks and park facilities in my neighbourhood;<br>I know where the parks are located in my neighbourhood and how to get there;<br>I have good knowledge on public parks in my neighbourhood. I am aware of the activities and programs held in the parks;<br>I know how to attend park activities in my neighbourhood;<br>I have good knowledge on changes to activities and programs held in the parks.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |

| | |
|---|---|
| **Regression Independent Variable: Social dimension** | |
| *Safety* | Sum of rating for significant measures:<br>“I am concerned with my personal safety when I travel to this park.<br>I feel unsafe when visiting this park.<br>There are people participating in illegal activities (e.g., selling drugs) around this park.<br>This park is regularly patrolled by police.<br>This park is a place with high crime at night.<br>Homeless or vagrant people are frequent in this park.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Shared Activities* | “This park is attractive to me because I can do my favourite activities with other people of shared interest (e.g., soccer, football etc.).” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Ethnic /Cultural Groups* | “This park is attractive to me if there are people from my ethnic or cultural background” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Social Exclusion* | Sum of rating for significant measures:<br>“Most people in my neighbourhood are friendly.<br>Most people in my neighbourhood are trustworthy.<br>Residents in my neighbourhoods share similar interest.<br>Residents in my neighbourhoods help each other.<br>I feel a strong connection with the neighbourhood.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| **Regression Independent Variable: Personal dimension** | |
| *Available Leisure Time* | “I have a good work-life balance.<br>I have enough leisure time to visit parks if I want.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Active lifestyle* | “I prefer outdoor climate to staying indoors.<br>Outdoor exercise is an important part of my life.” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |
| *Health Status* | “How would you say your health is in general?” and allowed the respondent to choose from “Excellent, Very good, Good, Fair or Poor” |
| *Financial Affordability* | “Visiting and using public parks in my neighbourhood is an affordable activity” and allowed the respondent to choose from “strongly disagree” to “strongly agree” |

After purposively selecting the suburbs, we selected three parks in each suburb using information drawn from a 2012 park classification table provided by the Brisbane City Council. The parks were selected based on their size, location, type, and facilities. In each suburb, the three parks were selected to represent large, medium, and small area parks; to be relatively spatially dispersed rather than clustered; and to represent different types of parks (local, district and metropolitan) with comparable features in terms of the variety and quality of park facilities (e.g., bikeways, dog areas, sports facilities, playgrounds, toilets and picnic areas). All parks selected in both suburbs were maintained by Brisbane City Council.

### *6.2.4.* Subject selection

All households in the two study areas constituted the target population for this study. To draw a representative sample, we used the list of street names as a sampling frame. We selected streets in each suburb using systematic random sampling to reduce the likelihood of sampling bias. All the streets in the two suburbs were first extracted from a comprehensive Brisbane street directory (69 streets in Graceville and 106 streets in Salisbury), listed in alphabetical order. The sampling interval was calculated as follows: 1) the average number of households per street was calculated by dividing the total number of households by the total number of streets in each suburb; 2) the number of streets to be sampled was computed by dividing the target household sample size by the average number of households per street (69 streets in Graceville and 106 streets in Salisbury); and 3) the sampling interval was set to the total number of streets divided by the number of streets to be sampled (three in both suburbs). Survey questionnaires were delivered to households located on each selected street. To ensure the spatial representation of selected areas, our sample also included households located on streets that either intersect or are adjacent to the sampled streets.

We distributed survey questionnaires to 1300 households in the two study areas, 500 in Graceville and 800 in Salisbury. The larger sample for Salisbury was based on the larger number of households in the suburb and the presupposition that lower SES populations are less likely to participate in survey research due to the common finding of higher non-response rates in minority groups (Goyder, 1987; Groves et al., 1992; Groves and Peytcheva, 2008; Van Loon et al., 2003). Participants were asked to return their completed questionnaires using the provided postage-paid envelope.

A quadrat analysis (using VMR statistic) was conducted to test for the spatial independence of our sample points (households). We defined a 150 by 150 metre grid in Graceville and a 200 by 200 metre grid in Salisbury to cover the study area. The larger grid size in Salisbury was due to the larger area of this suburb compared with Graceville. Our results show that the sample locations in both suburbs were significantly close to a spatially random distribution: Graceville model had a VMR of 1.15 ($\chi^2 = 51.9$ $p_{df=45} > 0.05$), compared to 1.025 ($\chi^2 = 52.29$, $p_{df=51} > 0.05$) for the Salisbury model.

## 6.3 Analyses

We used IBM SPSS® v20 for statistical analyses and ESRI ArcGIS Desktop 10.1 for spatial calculations.

### *6.3.1.* Study participants and perceived access

The representativeness of the participants in this study was examined by comparing the socio-demographic profiles of the participants with those reported in the 2011 Australian census. Descriptive statistics were generated for the socio-demographic variables in the survey.

Perceived access was measured for each of the selected parks in each suburb. To answer the first research question – whether perceived accessibility differs by suburb – we compared the distribution of responses on *perceived accessibility* by suburb. Our accessibility question used the same wording and response scale as Jones et al. (2009) in their Bristol (U.K.) study (see Table 6-1 for survey questions). We compared our responses with those reported in the Bristol study in order to check the reliability and validity of the perceived accessibility construct and its scale.

### *6.3.2.* Relationship between distance to park and perceived access

The distance between domicile and park destination is an important measure of park access (Talen and Anselin, 1998) and forms the basis for the second research question. To examine the relationship between distance and perceived access, we used two measures of distance: *physical* distance and *perceived* distance to a park. Physical distance was operationalised as the Euclidean distance (in metres) between respondents' domicile and the park centroid. Perceived distance was measured by asking survey respondents to estimate the distance (in metres) between their homes and each park. Bivariate correlations were run with the two variables measuring distance and perceived access to parks for each suburb.

### *6.3.3.* Assessing importance of physical vs. socio-personal dimension

To answer the third research question about which major dimension of accessibility (physical or socio-personal) is most predictive of perceived access to urban parks, we constructed a two factor regression model using responses to two general questions about physical and socio-personal accessibility as predictor variables, and the perceived accessibility question as the dependent variable. Three separate regression models were run, one for respondents from each suburb and a combined model for all respondents from both suburbs.

### *6.3.4.* Measuring the dimensions of accessibility

The variables representing each dimension of the accessibility model (described in Figure 6-1) were measured using single or multiple survey questions to develop psychometric scales. For example, each uni-dimensional variable (e.g., *perceived accessibility, estimated travel time)* was measured by a single survey question, while more complex, multi-dimensional variables such as *safety* were measured using a composite psychometric scale consisting of multiple survey questions. Three hypothesised dimensions in the model (*safety, information* and *social exclusion*) were operationalised as composite psychometric scales. A reliable scale should consistently reflect the construct it is measuring (Field, 2009). We conducted reliability analysis to check the internal consistency of the three scales. Cronbach's alpha ($\alpha$) was used to measure scale reliability where larger $\alpha$ values indicate a higher level of reliability for the items comprising the scale.

We ran confirmatory factor analysis (CFA) to examine the construct validity for the three composite measures. CFA provides a method to test a theoretical pattern of factor loadings on a specified construct. Unlike exploratory factor analysis in which the number of potential factors is unknown, CFA enables a researcher to test the validity of the factor structures based on preconceived theories (Hair et al., 2010). We used IBM SPSS® AMOS software to generate goodness-of fit indices to evaluate scale validity for each congeneric measurement model.

### *6.3.5.* Full regression model

Our preliminary model included 15 explanatory variables representing all five dimensions hypothesised to contribute to park accessibility. However, the survey data revealed that two variables in the transport dimension (*car ownership* and *travel cost*) lacked sufficient variance to be included in the model, with 91% of respondents reporting that they own private cars and 90% indicating that there was no cost involved in using public parks within the suburb. These results appear reasonable in the context of neighbourhood public parks in Australia where access to the parks is free and over 75% of the Australian population owns private motor vehicles (ABS, 2013). Therefore, we excluded these two variables leaving 13 variables for the regression analyses.

We constructed and evaluated three different multiple regression models (ordinary least squares, enter method) for each suburb. In the first model, the general perceived accessibility variable was regressed against all 13 independent, predictor variables representing all five dimensions of the accessibility model. In the second regression model, the perceived physical accessibility variable was regressed against only variables from the two physical accessibility dimensions (four variables). In the third model, the socio-personal accessibility variable was regressed against variables from the three socio-personal dimensions (nine variables).

### *6.3.6.* Relationship of perceived accessibility to individual socio-demographic variables

The previous analyses were designed to compare models between neighbourhoods with different SES status. However, individual socio-demographic characteristics may also influence perceived park access. To answer the final research question, we examined potential associations between the responses to the perceived accessibility variables and the socio-demographic variables of age, sex, education, income, self-reported health status, length of residence, and language spoken at home. We conducted correlation analysis between perceived accessibility and the two ratio variables of age and length of residence, and t-tests to identify potential differences in perceived accessibility on the variables of sex, education, income, self-reported health status, and language spoken at home.

## 6.4 Results

### *6.4.1.* Response rates and respondent characteristics

Of the 1300 survey questionnaires sent to households in the two suburbs in Brisbane, a total of 319 full or partial responses were received. A full response is an individual that answered all questions about the three parks in the suburb (N = 306) and a partial response (N = 13) is an individual that answered questions for at least one park but did not finish all questions for the other two parks. The response rates for Graceville and Salisbury were 32% and 20% respectively, with an overall response rate of 24.5%.

Table 6-2 compares the self-reported socio-demographic characteristics by our respondents with those reported in the Australian Census of Population and Housing (ABS, 2011a). Our sample results showed general consistency with the census data on most socio-demographic variables (e.g., residential status, vehicle ownership), however, the survey respondents were more likely to be female (Graceville: 62.5% sample vs. 51.7% Census; Salisbury: 65.8% vs.

49.7%), have a higher median age (Graceville: 43 vs. 37; Salisbury: 45 vs. 34), and consist of proportionately more home-owners in the lower SES suburb (Salisbury: 83.4% vs. 72.5%). The discrepancy may be partially explained because our survey targeted adult respondents with households as the sampling unit without randomisation within the household.

When respondents from the two suburbs were compared with each other, there was a high degree of similarity on all basic socio-demographic variables (Table 6-2), indicating we captured comparable samples between suburbs. As expected, there were differences on the two variables related to suburb socioeconomic status. Graceville households reported higher before-tax incomes than Salisbury households, with approximately 13.9% of Graceville respondents reporting annual household income of less than $41,599 compared to 31.5% of Salisbury respondents. At the higher end of the income scale, 51.1% of respondents in Graceville reported earning more than $104,000 per year, compared to only 29.4% of Salisbury respondents. There were also differences in self-reported health status between the two suburbs. More Salisbury respondents (21.5%) than Graceville respondents (13.8%) reported that they were in *poor* to *fair* condition of general health and fitness. At the other end of the health scale, 52.2% of Graceville respondents reported *excellent* to *very good* condition of health compared to only 44.3% for Salisbury respondents.

Table 6-2 Survey respondents' socio-demographic characteristics compared to census data

| | | Graceville | | Salisbury | |
|---|---|---|---|---|---|
| | | Sample | Census | Sample | Census |
| Median age (years) | | 43 | 37 | 45 | 34 |
| Length of residence (years) | | 13.4 | - | 13.9 | - |
| Sex | Male | 37.5% | 48.3% | 34.2% | 50.3% |
| | Female | 62.5% | 51.7% | 65.8% | 49.7% |
| Home ownership | Rent | 18.8% | 19.5% | 16.5% | 27.5% |
| | Own | 81.3% | 80.5% | 83.4% | 72.5% |
| Motor vehicles ownership | Yes | 92.5% | 94.6% | 91.5% | 91.7% |
| | No | 7.5% | 5.4% | 8.5% | 8.3% |
| Birth place | Australia | 76.3% | 79.5% | 78.6% | 73.5% |
| | Overseas | 23.8% | 20.5% | 21.4% | 26.5% |
| Language spoken at home | English only | 91.3% | 92.1% | 87.6% | 81.2% |
| | Other languages | 8.7% | 7.9% | 12.4% | 18.8% |
| Family composition | One parent family | 10.1% | 11.8% | 14.4% | 19% |
| | Couple family with no children | 31.2% | 30.3% | 32% | 35% |
| | Couple family with children | 58.7% | 55.9% | 53.6% | 42.7% |
| Before-tax household income | Below $41,599 | 13.9% | | 31.5% | |
| | $41,600-$103,999 | 35% | | 39.2% | |
| | Above $104,000 | 51.1% | - | 29.4% | - |
| Health status | Excellent to very good | 52.2% | | 44.3% | |
| | Good | 34% | | 34.2% | |
| | Fair to poor | 13.8% | - | 21.5% | - |

Source of Census Data: (*ABS, 2011a)*

### *6.4.2.* Perceived accessibility by suburb

For each of the three parks, respondents were asked about their perceived access to parks on a 5-point Likert scale from ‘very easy’ to ‘very difficult’. Over 75% of respondents reported that park access in their local area was ‘very easy’ or ‘easy’ (see Table 6-3). Graceville respondents were more likely to report ‘very easy’ park access in their local area with no respondents indicating their access to any of the parks was ‘very difficult’. In Salisbury, over three times the percentage of respondents (38.1% Salisbury vs. 10.6% Graceville) reported that access to parks was ‘not easy’. For comparison, Table 6-3 also includes the frequency distribution from a similar study in Bristol, UK (Jones et al., 2009) that measured perceived park accessibility in communities of contrasting SES status. Our results were consistent with the UK study and showed a lower level of perceived accessibility among respondents in the less affluent community and a higher level of perceived access to parks in the more affluent community.

Table 6-3 Perceived accessibility to parks in Brisbane (%) with a comparison to Bristol

| | | Very Easy | Easy | Neither Easy or Difficult | Difficult | Very Difficult |
|---|---|---|---|---|---|---|
| Brisbane[a] | Graceville (Higher SES) | 56.1 | 33.3 | 7.9 | 2.7 | 0 |
| | Salisbury (Lower SES) | 31.3 | 30.5 | 21.6 | 13.2 | 3.3 |
| | All | 44 | 31.9 | 14.6 | 7.8 | 1.6 |
| Bristol (Jones et al., 2009) | Most Affluent | 66.2 | 26.0 | 4.4 | 2.3 | 1.1 |
| | Least Affluent | 44.6 | 36 | 8.6 | 7.3 | 3.5 |

[a] Mean difference between two suburbs is statistically significant at the 0.01 level (t = -10.92, $p < 0.01$)

### *6.4.3.* Influence of distance on perceived access

Table 6-4 shows the bivariate correlation results for both suburbs with significant relationships ($p < 0.01$) between the two measures of distance (physical and perceived) and perceived accessibility. However, the strength of these relationships was weak, indicating that both physical and perceived distance have limited power to explain variation in perceived accessibility. For instance, the strength of relationship between physical distance and perceived accessibility in the Graceville model was 0.27, where physical distance only accounts for 7.2% of the variation in perceived accessibility, leaving 92.8% to be explained by other variables.

When the models were compared between suburbs, the Salisbury models indicated somewhat stronger relationships between both distance measures and perceived accessibility.

Table 6-4 Bivariate correlation between physical distance, perceived closeness and perceived accessibility

| | Graceville (Higher SES) | | | Salisbury (Lower SES) | | |
|---|---|---|---|---|---|---|
| Variables | Physical Distance | Perceived Distance | Perceived Accessibility | Physical Distance | Perceived Distance | Perceived Accessibility |
| Physical Distance | | -.57** | .27** | | -.58** | .36** |
| Perceived Distance | | | -.25** | | | -.40** |

*Note:* Physical distance was calculated using ESRI ArcGIS software.
** Correlation is significant at the 0.01 level (2-tailed).

### *6.4.4.* Influence of physical and socio-personal dimensions on perceived access

Three regression models were constructed to examine the influence of the two dimensions (physical and socio-personal) on perceived park access—one model for each suburb and one for all respondents from both suburbs. Table 6-5 provides the regression results. All regression models were statistically significant ($p \leq 0.01$) and in all three models, both the physical and socio-personal dimensions were statistically significant predictors of the perceived accessibility variable. However, the physical dimension (standardised coefficient of 0.69 in the model for the lower SES suburb) was much stronger than the socio-personal dimension (standardised coefficient of 0.17 in the model for the lower SES suburb) in all regression models. This indicates that the physical dimension has more explanatory power in predicting perceived access to urban parks than the socio-personal dimension. When the models were compared between suburbs, the socio-personal dimension was stronger in the model for the suburb with lower SES.

Table 6-5 Regression models of two accessibility dimensions to perceived access to parks

| Variables | All Respondents | | Graceville (Higher SES) | | Salisbury (Lower SES) | |
|---|---|---|---|---|---|---|
| | Stand. Coeff. | *p* | Stand. Coeff. | *p* | Stand. Coeff. | *p* |
| Perceived Physical Accessibility | 0.73 | 0.000** | 0.78 | 0.000** | 0.69 | 0.000** |
| Perceived Socio-personal Accessibility | 0.16 | 0.000** | 0.11 | 0.000** | 0.17 | 0.000** |
| *N* | 942 | | 474 | | 468 | |
| R | 0.79 | | 0.81 | | 0.74 | |
| Adjusted $R^2$ | 0.63 | | 0.65 | | 0.55 | |
| F | 787.78** | | 443.86** | | 286.33** | |

*Note:* see Table 6-1 for explanation of variables.
** $p< 0.01$ (2-tailed)

### *6.4.5.* Scale reliability and validity

We conducted reliability and validity testing on the three scales used to measure the explanatory variables of *safety, information* and *social exclusion*. Table 6-6 shows the wording of the scale items for these variables.

Results from the reliability analyses (Table 6-6) indicated a high level of internal consistency for all three scales with Cronbach alpha scores above 0.83. We also checked the inter-item and item-total correlations for these scale items. All item-total correlation coefficients were well above 0.3 and the deletion of any single item would not significantly improve the overall reliability of the scales. Therefore, all of the survey items for each scale were retained and used in subsequent analyses.

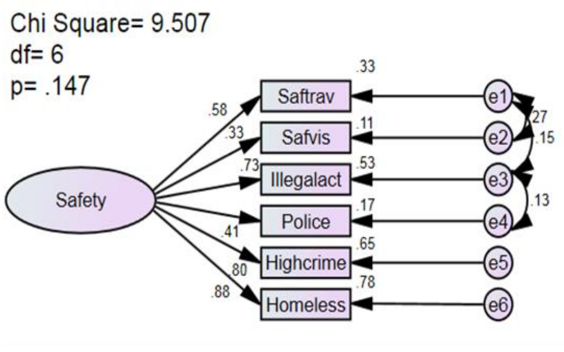
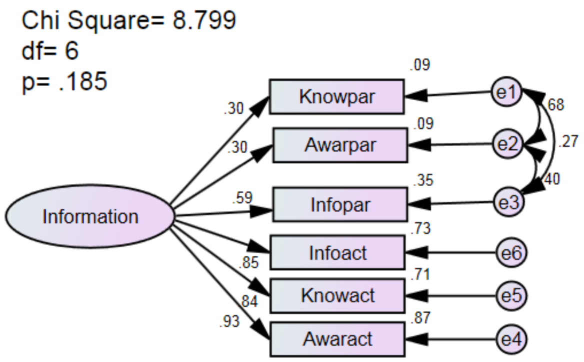
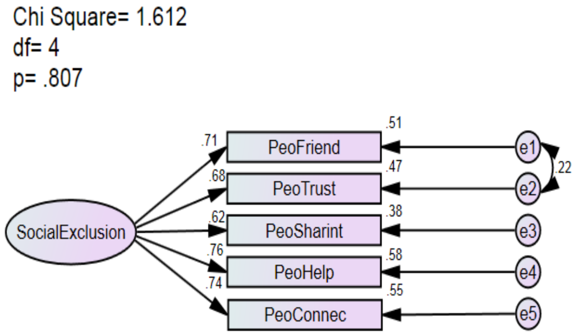
To examine the construct validity, separate congeneric measurement models were constructed for each of the three explanatory variables. Table 6-7 shows various goodness-of-fit (GFI) measures for the models tested. All three measurement models demonstrated good model fit ($p_{\text{safety}} = 0.147$; $p_{\text{infomation}} = 0.185$; $p_{\text{social}} = 0.807$), with the indices of GFI and adjusted goodness-of-fit (AGFI) greater than 0.95 and root mean square error of approximation (RMSEA) less than 0.05. Further, all the scale items were statistically different from zero, confirming that they were valid indicators of their associated construct.

Table 6-6 Reliability test for composite scales

| *Safety* | | | | *Information* | | | | *Social exclusion* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Items** | **Questions** | **Item-Total Correlation** | **α if Item Deleted** | **Items** | **Questions** | **Item-Total Correlation** | **α if Item Deleted** | **Items** | **Questions** | **Item-Total Correlation** | **α if Item Deleted** |
| Saftrav | I am concerned with my personal safety when I travel to this park. | 0.649 | 0.824 | Awarpar | I am aware of parks and park facilities in my neighbourhood. | 0.464 | 0.842 | PeoFriend | Most people in my neighbourhood are friendly. | 0.670 | 0.789 |
| Safvis | I feel unsafe when visiting this park. | 0.707 | 0.811 | Knowpar | I know how to get to the parks located in my neighbourhood. | 0.435 | 0.846 | PeoTrust | Most people in my neighbourhood are trustworthy. | 0.644 | 0.794 |
| Illegalact | There are people participating in illegal activities (e.g., selling drugs) around this park. | 0.696 | 0.813 | Infopar | I have good knowledge of any changes made to park facilities in my neighbourhood. | 0.627 | 0.815 | PeoSharint | Residents in my neighbourhoods share similar interest. | 0.551 | 0.819 |
| Police | This park is regularly patrolled by police. | 0.416 | 0.862 | Awaract | I am aware of the activities and programs held in the parks. | 0.794 | 0.777 | PeoHelp | Residents in my neighbourhoods help each other. | 0.667 | 0.788 |
| Highcrime | This park is a place with high crime at night. | 0.693 | 0.815 | Knowact | I know how to attend park activities in my neighbourhood. | 0.705 | 0.797 | PerConnec | I feel a strong connection with the neighbourhood. | 0.648 | 0.798 |
| Homeless | Homeless or vagrant people are frequent in this park. | 0.656 | 0.822 | Infoact | I have good knowledge of any changes to activities and programs held in the parks. | 0.711 | 0.796 | | | | |
| **Cronbach's Alpha (α)** | | | 0.850 | **Cronbach's Alpha (α)** | | | 0.841 | **Cronbach's Alpha (α)** | | | 0.831 |
| **Cronbach's Alpha Based on Standardised Items** | | | 0.850 | **Cronbach's Alpha Based on Standardised Items** | | | 0.838 | **Cronbach's Alpha Based on Standardised Items** | | | 0.836 |
| **Number of Items** | | | 6 | **Number of Items** | | | 6 | **Number of Items** | | | 5 |

*Note:* all the above questions are measured based on 5-point Likert scales (‘strongly disagree’ to ‘strongly agree’).

Table 6-7 Summary of model fit measures and path diagrams for composite scales

| ***Safety*** | | | ***Information*** | | | ***Social exclusion*** | | |
|---|---|---|---|---|---|---|---|---|
| **Items** | **Estimate** | **Sig** | **Items** | **Estimate** | **Sig** | **Items** | **Estimate** | **Sig** |
| Saftrav | 0.592 | .000 | Awarpar | 0.192 | .000 | PeoFriend | 0.49 | .000 |
| Safvis | 0.65 | .000 | Knowpar | 0.183 | .000 | PeoTrust | 0.501 | .000 |
| Illegalact | 0.672 | .000 | Infopar | 0.59 | .000 | PeoSharint | 0.47 | .000 |
| Police | 0.361 | .000 | Awaract | 0.881 | .000 | PeoHelp | 0.56 | .000 |
| Highcrime | 0.729 | .000 | Knowact | 0.856 | .000 | PerConnec | 0.693 | .000 |
| Homeless | 0.778 | .000 | Infoact | 0.856 | .000 | | | |
| **CMIN/DF** | | 1.584 | **CMIN/DF** | | 1.467 | **CMIN/DF** | | 0.403 |
| ***p*** | | 0.147 | ***p*** | | 0.185 | ***p*** | | 0.807 |
| **GFI** | | 0.99 | **GFI** | | 0.991 | **GFI** | | 0.998 |
| **AGFI** | | 0.967 | **AGFI** | | 0.967 | **AGFI** | | 0.992 |
| **RMSEA** | | 0.043 | **RMSEA** | | 0.039 | **RMSEA** | | 0 |
|  | | |  | | |  | | |

### *6.4.6.* Influence of physical and non-physical variables on perceived access

We ran three different multiple regression models: (1) general perceived accessibility regressed against all 13 predictor variables (hereafter called the 'general accessibility model'); (2) perceived physical accessibility regressed against four physical accessibility variables (hereafter called the 'physical accessibility model'); and (3) perceived socio-personal accessibility regressed against nine socio-personal variables (hereafter called the 'socio-personal accessibility model'). The results of the regression models appear in Table 6-8.

All three regression models were statistically significant ($p < 0.01$) but the strength of the models differed. Examining the $R^2$ values, the general accessibility models explained about 52% and 40% of the overall variance for the Graceville and Salisbury suburbs respectively, the physical accessibility models explained about 48% and 39% of the variance, and the non-physical, socio-personal models explained about 10% and 12% of the variance.

In the general accessibility models, variables from both the physical and socio-personal dimensions were statistically significant predictors of perceived accessibility. The *proximity* variable was the most significant predictor variable in both suburbs based on the magnitude of the standardised coefficients (-0.46 for both suburbs). The *proximity* variable was positively related to perceived accessibility, indicating the closer one is to a park, the greater the perceived access to the park. The second most influential predictor variables were variables measuring *pleasant walk* in Graceville (-0.26) and *estimated travel time* in Salisbury (0.15). Because 83% of Graceville respondents indicated that *walking* is the most common way to travel to local public parks, this may help explain why the *pleasant walk* variable is one of the more important variables for explaining park accessibility.

The third most influential variables in the general accessibility models were non-physical variables: *cultural groups* for respondents in Graceville and *shared activities* for Salisbury respondents. This result supports the hypothesis that factors from both the physical and non-physical accessibility dimensions influence perception of access to parks, although the actual predictor variables differed in the two communities with different SES levels. The respondents from the higher SES community of Graceville found neighbourhood parks more accessible if people from similar cultural or ethnic backgrounds used the parks whereas respondents in the lower SES community of Salisbury perceived parks as more accessible if other people using the parks participated in activities of shared interest. However, while statistically significant, these socio-personal variables were much weaker predictors of general perceived accessibility than the physical variables.

In the physical accessibility models, *proximity, estimated travel time,* and *pleasant walk* were the most important explanatory variables for both suburbs based on standardised coefficients. The *proximity* and *pleasant walk* variables were the strongest predictors. In Graceville, the *sufficient parks in the neighbourhood* variable was also a statistically significant predictor of perceived physical access to parks.

In the socio-personal accessibility models, the *safety* and *cultural groups* variables were the most influential variables in both suburbs with *safety* being most important. The *available leisure time* variable was also statistically significant in the Salisbury suburb (lower SES), suggesting that free time may be an important factor in less affluent communities.

In summary, the regression results indicate that both physical and non-physical factors contribute to perceived accessibility, but physical factors are most influential in determining perceived accessibility to parks. In particular, *proximity* to parks is the most influential variable in the physical dimension of accessibility followed by *pleasant walk*, while perceived *safety* is the most influential variable among socio-personal variables, followed by parks used by similar *cultural groups.*

Table 6-8 Regression models for three measures of perceived accessibility

| | ***General Perceived Accessibility Against All Variables*** | | | | ***Physical Accessibility Against Physical Variables*** | | | | ***Socio-personal Accessibility Against Non-physical Variables*** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | Graceville (Higher SES) | | Salisbury (Lower SES) | | Graceville (Higher SES) | | Salisbury (Lower SES) | | Graceville (Higher SES) | | Salisbury (Lower SES) | |
| | Stand. Coeff. | ***p*** | Stand. Coeff. | ***p*** | Stand. Coeff. | ***p*** | Stand. Coeff. | ***p*** | Stand. Coeff. | ***p*** | Stand. Coeff. | ***p*** |
| **Physical Variables** | | | | | | | | | | | | |
| Sufficient parks in neighbourhood | -0.108 | 0.005* | 0.038 | 0.364 | -0.1 | 0.005** | 0.057 | 0.162 | | | | |
| Proximity | -0.463 | 0.000** | -0.458 | 0.000** | -0.4 | 0.000** | -0.337 | 0.000** | | | | |
| Estimated travel time | 0.011 | 0.795 | 0.154 | 0.001** | 0.117 | 0.004** | 0.161 | 0.000** | | | | |
| Pleasant walk | -0.257 | 0.000** | -0.087 | 0.125 | -0.287 | 0.000** | -0.284 | 0.000** | | | | |
| **Non-Physical Variables** | | | | | | | | | | | | |
| Information | 0.019 | 0.628 | -0.023 | 0.613 | | | | | -0.036 | 0.48 | -0.006 | 0.901 |
| Social exclusions | 0.000 | 0.999 | 0.036 | 0.425 | | | | | 0.003 | 0.955 | 0.008 | 0.876 |
| Leisure time available | -0.097 | 0.010* | -0.031 | 0.509 | | | | | -0.072 | 0.149 | -0.132 | 0.010* |
| Active lifestyle | -0.034 | 0.427 | 0.043 | 0.344 | | | | | 0.097 | 0.084 | 0.093 | 0.067 |
| Health | 0.02 | 0.624 | 0.041 | 0.333 | | | | | 0.001 | 0.979 | 0.081 | 0.085 |
| Afford | 0.011 | 0.775 | -0.031 | 0.456 | | | | | -0.11 | 0.026* | 0.005 | 0.922 |
| Safety | 0.022 | 0.562 | 0.059 | 0.192 | | | | | 0.233 | 0.000** | 0.246 | 0.000** |
| Shared activities | 0.024 | 0.585 | -0.092 | 0.047** | | | | | -0.064 | 0.244 | -0.023 | 0.656 |
| Culture Groups | -0.14 | 0.001** | -0.028 | 0.568 | | | | | -0.198 | 0.000** | -0.187 | 0.001** |
| R | 0.729 | | 0.645 | | 0.696 | | 0.628 | | 0.345 | | 0.376 | |
| Adjusted $R^2$ | 0.517 | | 0.395 | | 0.48 | | 0.388 | | 0.1 | | 0.123 | |
| F | 35.27** | | 20.09** | | 102.606** | | 62.418** | | 6.341** | | 7.739** | |

*Note:* see Table 6-1 for explanation for variables.
**p*< 0.05 (2-tailed).
***p*< 0.01(2-tailed).

### *6.4.7.* Influence of socio-demographic variables on perceived accessibility

Multiple socio-demographic variables were analysed to assess their potential relationship to perceived accessibility. Our results showed that perceived accessibility is significantly related to income, self-reported health, and language spoken at home, but not with age, sex, or education. Individuals from low-income families, with poorer self-identified health status, and non-native English speakers were more likely to report lower levels of access to neighbourhood parks (see Table 6-9).

Table 6-9 Relationship of perceived accessibility to individual socio-demographic variables

| **Socio-demographic Variables** | | **Mean** | **t** |
|---|---|---|---|
| Language spoken at home | English Speaker | 1.88 | -2.44* |
| | Non-English Speaker | 2.14 | |
| Self-reported health status | Good Health | 1.86 | -3.56** |
| | Fair to Poor Health | 2.17 | |
| Income | Lower Income | 2.26 | 3.92** |
| | Higher Income | 1.84 | |
| Sex | Male | 1.87 | 0.90 |
| | Female | 1.93 | |
| Education | High school and below | 1.87 | -0.66 |
| | University and above | 1.92 | |

*$p < 0.05$ (2-tailed).
**$p < 0.01$(2-tailed).

## 6.5 Discussion

This study provides support for the hypothesis that park accessibility is a multi-dimensional construct, where both physical and socio-personal dimensions significantly contribute to the construct. There was empirical support for the presence of four of the five hypothesised dimensions (physical, transport, social, personal), with no empirical support for the informational dimension. Our findings indicate that the physical dimension of accessibility, especially *proximity*, is the strongest component of the accessibility construct with socio-personal dimensions assuming lesser importance. In this study, we compared two suburbs with higher and lower SES levels to provide contrast and to evaluate accessibility in different social contexts. Our results support the finding of Jones et al. (2009) wherein residents of lower SES areas perceive lower levels of access to parks compared to residents from higher SES areas, even with comparable levels of park infrastructure. Thus, the provision of park infrastructure is an important, but incomplete explanatory factor in determining urban park use. By inference, providing more parks in the lower SES suburb may not actually increase park accessibility, but may have a positive influence on accessibility for residents in a higher SES suburb. *Safety* and having *pleasant walking* options to parks were important variables in both suburbs. Further, the physical and non-physical variables of accessibility do not apply to all residents equally, but appear to vary by suburb. In the lower SES suburb, *available leisure time* emerged as a significant predictor of park accessibility but this variable was not a significant predictor in the higher SES suburb.

The physical accessibility model evaluated in the study was moderately strong, with all four variables significantly contributing to the overall construct. In contrast, the socio-personal model of accessibility, though statistically significant, was much weaker. This outcome was not unexpected as the socio-personal dimensions of the accessibility construct, as well as the individual variables included in the model, are more subjective and ambiguous than the physical accessibility variables. The lack of variability in survey responses to the socio-personal variables is also likely to have contributed to the relatively poor model performance. However, there were some important signals in the otherwise weak socio-personal model. Both the lower and higher SES suburbs identified *safety* and park use by similar *cultural groups* as important determinants of park accessibility. We speculate that the importance of these socio-personal variables (i.e., family compositions, age structure, racial/ethnic groups) would be amplified in communities with greater social and ethnic diversity than was present in our study.

From a planning and policy perspective, our results suggest that urban planners and researchers should not rely exclusively on objective accessibility measures (e.g., quantitative open space standards) if urban parks are to provide a full range of benefits to all residents. Increases in green infrastructure may not necessarily result in increased park visitation, especially in lower SES communities because lack of access is more complex than just transport constraints or facility availability (Gregory et al., 2009). The failure of park planners and managers to provide culturally appropriate park types and amenities to meet diverse community needs may result in the underutilisation of neighbourhood parks, especially in communities of disadvantage.

By selecting comparable park infrastructure through purposive sampling, this study was able to evaluate the potential effect of park user variables by comparing communities with different SES levels. We offer a few recommendations to inform future urban planning and interventions based on inferences from our findings.

1) Ensure public parks are reasonably proximate to residential locations with special attention to population segments with less mobility.

In our study, self-identified proximity to parks was the single most important factor influencing the perception of park accessibility. This result supports previous studies where distance was the most important factor in explaining park use frequency, particularly for mini and neighbourhood parks (Nicholls, 2001; Scott and Munson, 1994). Parks that are easily reachable within walking distance are more frequently used by local communities compared to large regional parks that are only accessible by cars, especially for those with limited means and mobility (Byrne et al., 2009; Giles-Corti et al., 2005; Nicholls, 2001). A maximum distance of 0.8 kilometres is recommended as an appropriate walking distance to local neighbourhood parks.

And yet, self-identified proximity does not necessarily equate with actual physical distance between parks and residential locations. The bivariate correlations between physical distance to parks and perceived accessibility were statistically significant in our models but not particularly strong. Other factors such as self-mobility, transport availability, and travel cost may also influence the self-identified proximity variable. Unfortunately, several of our hypothesised variables (e.g., *car ownership* and *travel cost*) could not be evaluated in this study due to a lack of variability in the survey responses. However, people who reported poorer health tended to report poorer access to local parks. Therefore, in addition to ensuring that parks are physically proximate to residential locations, assistance programs for special groups, especially people with restricted mobility, may be needed.

2) Provide footpath amenities such as shade and lighting to encourage walking and cycling.

Having a pleasant walking experience to parks is an important influential factor in perceived access to parks. In our survey, over 75% of respondents selected walking as the most preferred mode for visiting parks in their neighbourhood. Quality footpath connections and other pedestrian infrastructure that contribute to a pleasant walking experience play an important role in encouraging walking and biking in neighbourhoods and active use of park spaces. This recommendation is consistent with previous studies that found significant associations between park use and the presence of certain park features such as footpaths (Giles-Corti et al., 2005; Goličnik and Ward Thompson, 2010). Creating a walkable urban landscape is clearly within the domain of urban planning activity.

3) Provide interventions that more specifically address the needs of lower SES communities.

The environmental justice literature suggests that lower SES communities have lower quality or diversity of neighbourhood parks: parks are often poorly located, lack amenities, are poorly maintained, or inappropriately sized for physical activities that people desire (Byrne and Wolch, 2009; Maller et al., 2008; Wendel et al., 2011; Wright Wendel et al., 2012). Our study cannot address the question of environmental justice in park infrastructure because our sampling strategy attempted to match park infrastructure in the two study communities. However, our results did confirm that people living in the lower SES area reported poorer perceived access to parks and less frequent use, indicating the inconsistency between objectively and subjectively measured park accessibility for urban residents of lower income. Thus, socio-personal dimensions appear more important to perceived park accessibility in lower SES areas, regardless of park infrastructure.

Special attention to the needs and preferences of lower SES communities may be required if planners want to achieve effective service delivery. Specifically, *safety* was the most important social factor influencing park accessibility in the lower SES suburb in our study. Urban park departments may consider management actions that increase park safety through environmental design such as increasing visibility from streets, upgrading facilities (e.g., lighting), and increasing security patrol frequency. Previous studies have linked park design features with improved user experiences (Goličnik and Ward Thompson, 2010; Wright Wendel et al., 2012) and their findings may be used to improve public perceptions of park spaces in lower SES areas.

4) Provide opportunities to develop and sustain an inclusive community culture.

Our results indicate that survey respondents report higher levels of perceived access to parks if there are people from similar cultural backgrounds using them. Being around similar cultural groups in parks was most important in the higher SES suburb in our study. This finding concurs with researchers who found segregation of racial/ethnic groups in park use, suggesting that preferences for visiting parks vary by racial/ethnic groups (Byrne and Wolch, 2009; Gobster, 1998; Hutchinson, 1987; Payne et al., 2002).

Redistributing cultural groups within suburbs to ensure that urban parks are frequented by groups with similar racial/ethical background is beyond the scope and control of urban governments, but our study suggests at least one possible intervention to help bridge the cultural divide. Social interventions such as community multicultural events, especially held in parks, may enhance the perception of shared culture within a park setting.

5) Organise programs and events that capture local residents' shared interests in activities.

Different people use parks in different ways. The way people perceive and use parks is not only shaped by their cultural background and values but also by their common interests in certain activities (e.g., soccer, picnicking, dog-walking and supervising children at playgrounds) (Byrne and Sipe, 2010; Byrne and Wolch, 2009; Chiesura, 2004). Group activities provide another effective way to increase the perception of park accessibility and to promote an active lifestyle. For example, Gobster (1998) found that active park programs played a key role in the success of Warren Park, Chicago, in attracting diverse users to the park throughout the year. Similarly, Brisbane City Council's Active Parks Program (BCC, 2013) offers a wide range of activities in local parks that target different population segments such as families and different age groups.

Unlike physical infrastructure, park programs can be easily designed to address the specific needs of a target population according to local demographic characteristics (family composition, age structure, racial/ethnic groups), providing flexibility to respond to 'needs-based' assessment in planning (Byrne and Sipe, 2010). Well-managed programs (e.g., classes, group activities, leagues etc.) can transform parks into active agents that bring communities of diverse backgrounds together while counteracting socioeconomic segregation, fostering social interactions, and promoting sustainable urban livelihoods (Gobster, 1998). Vulnerable groups such as people of colour, non-native English speakers, and lower income families may require extra effort in the development and delivery of urban park programs.

## 6.6 Conclusion

Urban park planning and management should account for local communities' distinct preferences for leisure settings and activities. Embracing the findings of this study would take urban planners out of the familiar realm of physical planning and into the realm of social analysis to identify the non-physical conditions that facilitate or limit the use of urban parks. Some of these conditions (e.g., the availability of leisure time) are likely to be perceived as beyond the domain of urban planning. And yet, planning that is not mindful of how social conditions influence perceived exclusion from park space may result in under-utilisation of urban parks leading to sub-optimal social outcomes such as reduced fitness and mental health.

We acknowledge that the response rate of our survey increases the potential for non-response bias, especially in the lower SES suburb. When the Salisbury data (lower SES suburb) were examined, we found discrepancies between our sample and the census data on some socio-demographic variables (e.g., resident status and one-parent households). We believe that the lower response rate may contribute to lower representativeness of the Salisbury sample. To provide an unbiased, cross-sectional sample, we adopted different strategies, including providing survey incentives and using multiple follow-ups with non-respondents. Although our survey targeted all households in the suburbs, the results showed that frequent park users and people of higher income were more likely to respond. Only 21% of respondents self-identified as non-park users or infrequent park users, compared with 56% identifying as frequent users (use local parks at least once a week). Future research should consider alternative strategies for more effective recruitment of people in lower income suburbs.

Although this study was focused on developing and empirically testing a model of urban park accessibility, the basic accessibility model could be applied to other urban services such as libraries, community centres, and social service facilities. Future research could apply the model to these services. Last, it would be beneficial to understand whether the accessibility model developed and tested in this study is applicable to different cultural settings such as those found in other countries. Future research could also determine whether the informational dimension, which was not significant in this study, should continue to be included in an integrated accessibility model.

# CHAPTER 7. FACTORS INFLUENCING PERCEIVED ACCESS TO URBAN PARKS: A COMPARATIVE STUDY OF BRISBANE (AUSTRALIA) AND ZHONGSHAN (CHINA)

Chapter 7 has been submitted as a journal article to *Habitat International* (in press). The related information presented in the previous chapters may be repeated in the introduction and method design sections of this chapter.

**ABSTRACT:** Previous research indicates that perceived access to urban parks is influenced by both physical and non-physical variables. However, research to date on park access has involved case studies conducted in Western countries that are not directly comparable to non-Western cases. The extent to which park access may be influenced by the larger social and cultural context of the urban setting is unknown. This study uses a comparative research design by applying the same multidimensional model of urban park access to community-level survey data collected in the cities of Brisbane (Australia) and Zhongshan (China). Our results indicate that lower income groups perceive significantly lower access to urban parks than higher income groups in both cities with Brisbane residents reporting greater overall park access compared to Zhongshan residents. The respondents from both cities reported preferences for sustainable transport modes (e.g., walking and cycling) to visit parks. The more frequently people visit a park by walking, the greater the self-reported park access. The results from both cities confirm that physical and locational features of parks (e.g., proximity and travel time) are the most important factors influencing perceived access. Our results indicate that both physical and socio-personal factors significantly contribute to self-reported park access in both urban contexts, supporting the hypothesis that the accessibility concept is a complex multi-dimensional construct that can be applied cross-culturally. We discuss the implications of our findings for park planning in urban areas.

**KEYWORDS:** park planning; accessibility; cross-cultural analysis; community survey; Australia; China

## 7.1 Introduction

Public parks and green spaces are an important environmental component of urban landscapes, providing the most common community features for leisure-time activities (Bedimo-Rung et al., 2005). Urban parks provide a variety of benefits by offering natural environments that reduce stress, facilitate recovery from mental and physical health issues, and encourage physical activity to combat increasingly sedentary lifestyles (Bedimo-Rung et al., 2005; Byrne and Wolch, 2009; Cohen et al., 2007; Ulrich and Addoms, 1981). Urban parks also offer places for social interactions to foster closer community ties, economic benefits from tourism, reduced health care expenses, and sustainable daily transport options (Bedimo-Rung et al., 2005;

Bolitzer and Netusil, 2000; Byrne and Sipe, 2010; Correll et al., 1978; Geoghegan, 2002). These benefits contribute to overall community well-being thus making park access and use a focus of study across multiple disciplines (Chiesura, 2004; Wolch et al., 2010).

Previous research has confirmed that park accessibility is one of the most important variables to explain park utilisation, thus providing a key indicator to measure the quality of urban life (Byrne et al., 2009; Wang et al., 2015a) and a key criterion to guide green space allocations in urban communities. However, conventional planning models rely heavily on objective quantitative standards (e.g., area and number of parks per capita, travel distance) to measure access to parks and green spaces (Maruani and Amit-Cohen, 2007; Wang et al., 2015a). These models do not adequately account for the complexity of the human decision-making process and the accessibility concept as a multidimensional construct. If planners are to respond to the diversified needs of urban parks, it is important to develop an adequate understanding of the accessibility concept, its dimensions, and its role in influencing the park use decision-making process.

The concept of accessibility is currently described as a multidimensional construct associated with both physical and non-physical factors (Brown, 2008; Gregory et al., 2009; Wang et al., 2015a). Distance and travel time are two conventional variables that measure accessibility as a function of geometric origin based on Location Theory and Central Place Theory (Hass, 2009; Marten and Gillespie, 1978), but the conceptualisation of accessibility has evolved beyond a spatial-physical dimension to include other important socio-personal factors such as information barriers, gender ideologies, and financial and cultural barriers (Aday and Andersen, 1974; Bisht et al., 2010; Ferreira and Batey, 2007; Gregory et al., 2009; Marten and Gillespie, 1978; Pirie, 1981). For example, Aday and Andersen (1974) posited the socio-organisational aspect of accessibility be distinguished from the geographic aspect of accessibility. They used the term ‘socio-organisational accessibility’ to represent the non-physical factors that constrain or enable the ability to obtain services. Similarly, other researchers proposed that social barriers and personal preferences be integrated with geographic factors to develop a more complete understanding of the accessibility concept (Bisht et al., 2010; Marten and Gillespie, 1978; Murray et al., 2003; Pirie, 1981). In particular, Pirie (1981) argued that accessibility is a synonym for reachability and convenience, suggesting that the accessibility concept be viewed as an ability to access services rather than merely as a physical measure of distance between origin and destination. Thus, accessibility was defined by Gregory et al. (2009) as *the ease with which people can reach desired activity sites* to account for the potential influence of socio-personal factors on the ability to access services.

Recent accessibility studies of urban parks have described the multidimensional nature of the accessibility concept. For example, Byrne and Wolch (2009) posited that perceptions of park accessibility are closely associated with both park user characteristics and park features while Wang et al. (2015a) empirically tested an integrated park accessibility model using survey data collected from two suburbs with comparable park features, but contrasting socioeconomic status (SES). A combination of spatial analysis and regression analysis was used to examine the effects of a variety of physical and non-physical variables on self-reported access to urban parks. The results confirmed the multidimensional nature of park accessibility, with both physical and non-physical dimensions significantly contributing to the construct.

Furthermore, people of colour and of lower income are vulnerable to inferior park access and substandard facilities, calling for research that targets specific group needs and preferences (Byrne et al., 2009; Estabrooks et al., 2003; Sister et al., 2010; Wolch et al., 2005). Wang et al. (2015a) found that income and language spoken at home (as an alternative measure of racial/ethnic group) were socioeconomic variables significantly associated with perceived park access, consistent with other research indicating that population groups from different cultural backgrounds and/or economic conditions perceive and use parks differently (Byrne and Wolch, 2009; Gobster, 1998; Hutchinson, 1987). These studies suggest that people of different socioeconomic background may respond differently to perceived park access. However, most of these studies were conducted in the context of western cities, with few validated in cities comprising alternative socio-cultural backgrounds. This indicates a need for research into the associations between socioeconomic variables and park accessibility in different urban settings.

Public parks also contribute to our understanding of the economics of urban structure, because park access contributes to the liveability of the urban environment (Longley et al., 1992; McCann and Ewing, 2003). A variety of strategies have been implemented (e.g., reuse of remnant urban land and obsolete transport infrastructure) to increase the supply of parks in cities throughout the world, especially in park-poor areas such as inner-cities (Byrne and Sipe, 2010; Wolch et al., 2014). Despite being a relatively new concept introduced from the West and Japan, public parks and green space are seen as a vital part of urban development in modern China (Shi, 1998). China is currently undergoing unprecedented internal rural-urban migration with explosive rates of urban growth. However, park planning has lagged behind the development of other urban infrastructure such as real estate and transport infrastructure (Wolch et al., 2014). In 2014, China had an average community greenspace ratio of 12 $m^2$ per capita, compared to an average of 154 $m^2$ per capita in South East Queensland (SEQ), Australia, and a national median of 50.2 $m^2$ per capita in the U.S. (BNFA, 2014; Queensland Government, 2011; Wang, 2009; Wolch et al., 2014). In this paper, we extend research on urban parks to include an empirical, cross-cultural validation of a multi-dimensional model of park accessibility. The different level of park development in Australian and Chinese cities, in addition to the well-documented cultural differences between the West and East, offers an important contrast in urban settings to examine the formation and cross-cultural validity of the park accessibility construct.

### *7.1.1.* Model and research questions

This study aims to empirically examine the cross-cultural validity of a park accessibility model (Figure 7-1) using neighbourhood-level survey data collected in two cities, Brisbane (Australia) and Zhongshan (China). The park accessibility model consists of five hypothetical dimensions and their associated variables: physical, transport, knowledge, social, and personal. The identification of multiple accessibility variables in the model provides an opportunity to empirically investigate their contributions to the overall accessibility construct.

We seek answers to the following research questions by comparing results between the two study cities: 1) Does perceived accessibility to parks differ between high and low income groups within each city? 2) Is perceived accessibility associated with commonly used transport modes to visit parks? 3) Which dimensions of accessibility (physical or socio-personal) most significantly influence perceived access to urban parks? 4) Which accessibility variable(s) contributes most strongly to perceived urban park access?

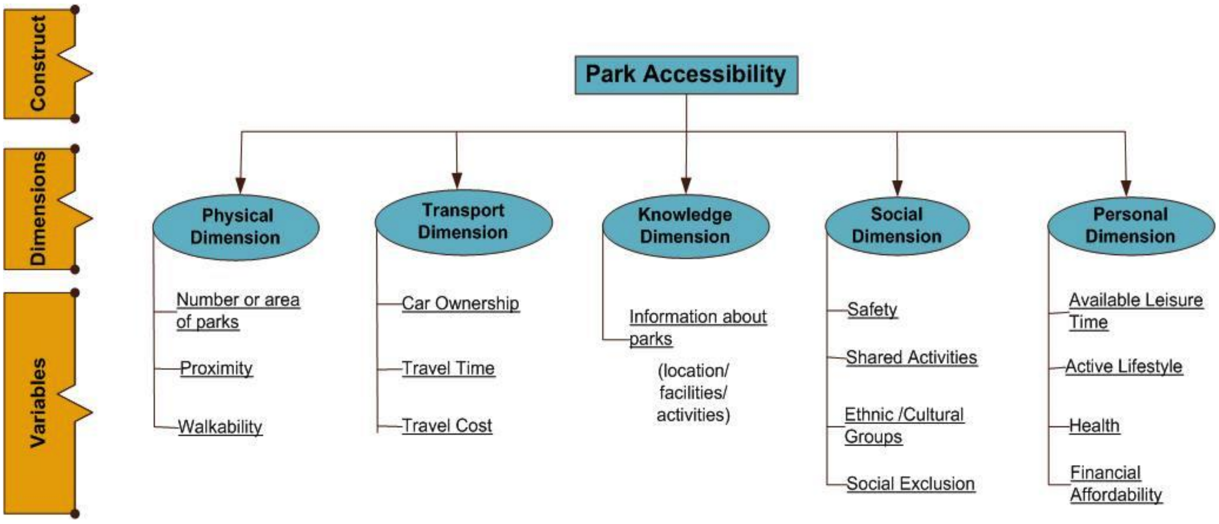


Figure 7-1 An integrated model of park accessibility

## 7.2 Methods

### *7.2.1.* Background of study cities

We collected primary neighbourhood-level survey data in the two cities of Brisbane, Australia, and Zhongshan, China (Figure 7-2). The two cities were purposively selected for their contrasting socio-cultural context, but similarity in size, climate, and topography.

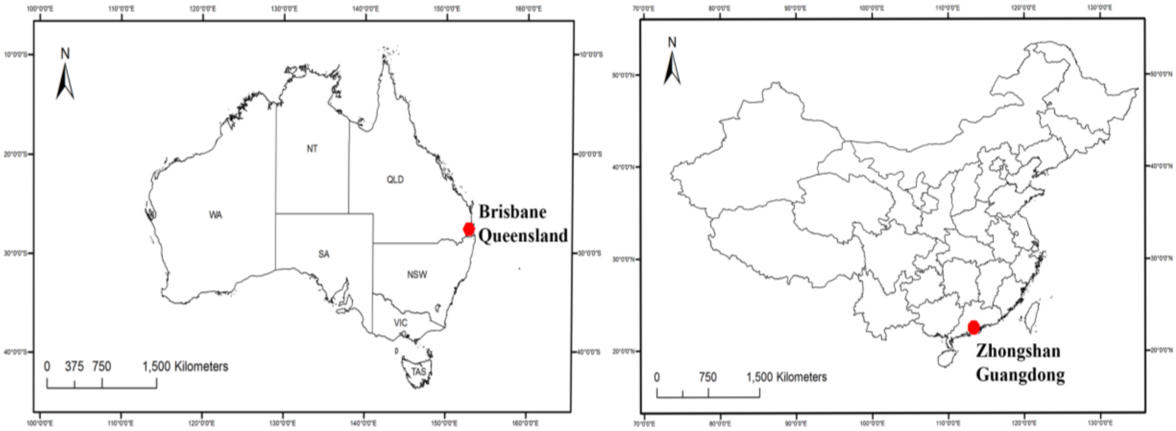


Figure 7-2 Locations of the two study cities in Australia (left) and China (right)

Brisbane is the capital and largest city in the State of Queensland, Australia. It is located in South East Queensland (SEQ) and accounts for approximately two-thirds of the total population in the state. The SEQ region has been the fastest growing metropolitan area in Australia since 1990 (DSDIP, 2009). As of 2013, the region had a population of 3.3 million with a projected population of 5.5 million in 2041(OESR, 2012). Brisbane is the most densely populated area in the SEQ region with a population density of 777 people per square kilometre, compared to the state average of less than 3 people (ABS, 2011a). Geographically, Brisbane sits on a hilly floodplain along the reaches of the Brisbane River. It has a humid, subtropical climate with an average annual temperature around 25°C.

Zhongshan, China is a prefecture-level city, located in the south of the Pearl River Delta (PRD) of Guangdong Province. Guangdong Province has been in the forefront of Chinese economic reform since China’s open door policy of 1979. In particular, the emergence of Guangdong as “the world’s factory” in the second half of the 1990s made the PRD one of the most sought-after destinations for inter-provincial migration within China, leading to massive population growth and unprecedented rapid urban development (Chan, 2013). According to the National Bureau of Statistics of China, 83.8% of the population in the PRD region lived in urban areas in 2013, compared to 47.2% in 1998, and only 27.4% in 1980 (GSB, 2013; Shen et al., 2002; Sit and Yang, 1997). Zhongshan is one of the primary migrant-receiving areas of the PRD region in the large-scale, rural-to-urban migration (Sit and Yang, 1997). For example, the population of Zhongshan increased at an average annual rate of 10.2% over the two decades from 1990 to 2010. According to the Chinese Population Census, Zhongshan had a total population of 2.74 million in 2010 with 1.4 million permanent residents in the household registration system (ZSB, 2011). Thus, about half of the population consists of temporary residents that are not legally entitled to live permanently in the city. Similar to the physical setting of Brisbane, Zhongshan is located on a hilly alluvial plain to the west of the mouth of the Pearl River, with a warm and humid climate and an average annual temperature of 22 °C.

Table 7-1 compares the two study areas against multiple criteria used in the selection process. It shows that the two cities are comparable in terms of total area, population, general climatic conditions, and geographic characteristics, but differ in their official language and socio-cultural background.

Table 7-1 Selection criteria for study areas

| Criteria | Brisbane, Australia | Zhongshan, China |
|---|---|---|
| *Culture* | Western culture | Oriental culture |
| *Population* | Multi-cultural society (About 33.4% of residents were not born in Australia and 14% of households speak a language other than English at home) | Han Chinese-dominance society (98% of the total population) with a large proportion of temporary residents (52% of the total population) due to internal migration in China |
| *Official Language* | English | Chinese Mandarin |
| *Coordinates* | 27°28′S 153°01′E | 22°32′N 113°21′E |
| *River city* | Brisbane River | Shiqi River |
| *Urban area* | 1340.3 km² | 1800.14km² |
| *Population Density* | 778 people/ km² | 828 people/ km² (permanent residents only)<br>1734 people/ km² (including temporary residents) |
| *Climate* | Subtropical humid climate | Subtropical humid monsoon climate |
| *Geography* | Hilly floodplain | Hilly alluvial plain |
| *Economic background* | Capital city and primary activity centre in Queensland state | The city's discretionary income per capita is among the highest in China |
| *Urban agglomeration* | South East Queensland (SEQ) | Pearl River Delta (PRD) |

### *7.2.2.* Sampling design

Neighbourhood-level surveys were conducted in Brisbane and Zhongshan to collect primary data. The study areas within each city were purposively selected to recruit respondents with different income levels, but otherwise comparable on the quantitative variables of population density and ratio of green space per person.

The survey in Brisbane was implemented in two suburbs with contrasting socioeconomic status (SES), namely Salisbury (lower SES) and Graceville (higher SES). Three criteria were used to select the suburbs within the greater Brisbane area: they should have (1) dominant residential land use; (2) contrasting SES (i.e., one relatively high and one relatively low); and (3) comparable provision of urban parks (i.e., green space ratio per person). The SES was operationalised using the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD), one of the four Socio-Economic Indexes for Areas (SEIFA) compiled by the Australian Bureau of Statistics (ABS) to capture comprehensive socioeconomic characteristics across census statistical areas. According to the 2011 Australian Census, Graceville is a residential suburb with an area of 143.5 hectares with no industrial land. The suburb is situated in one of the most affluent areas of Brisbane. Salisbury has an area of 380.1 hectares with dominant residential land use, but lower SES. Graceville is at the top of the SES scale (96/100) among all Brisbane suburbs compared to Salisbury (57/100). The average population density in the study areas is 19 persons per hectare. The two suburbs have comparable park systems, with seven parks and 79.2 $m^2$ of park area per person in Graceville compared to eleven parks and 91.6 $m^2$ of park area per person in Salisbury. All the parks in the study areas are free for public use.

The survey in Zhongshan was conducted in the inner city of Zhongshan. The inner city of Zhongshan has a population density of 20.98 people per hectare with a green space ratio (i.e., green space relative to other land uses) of 39% in the built-up area, one of the highest among Chinese cities. There are six public parks for free public use with a total area of 179 hectares. Our survey was delivered in a residential area of approximately 200 hectares located in the south-central part of the city, bounded by Zhongshan Si Road, Xingwen Road, Xingzhong Avenue and Qiwan Avenue. This area was selected because it is one of the primary residential neighbourhoods with a diversity of dwellings types. In the absence of a comprehensive SES index at the neighbourhood level such as SEIFA in Brisbane, residential dwellings with different median prices were sampled to recruit respondents with contrasting socioeconomic backgrounds.

### *7.2.3.* Survey design and response rate

We selected three different parks within each study area to query survey participants about park access. These parks provided a representation of local parks given the limited number of public parks in each study area. The criteria used to select the parks included: (1) the parks should be free for public use; (2) the parks should represent different sizes; and (3) the parks should have a variety of facilities.

The response rates in Brisbane and Zhongshan were 24.5% and 82% respectively. The large difference in response rate was because we used self-administered, mail surveys in Brisbane and household interview surveys in Zhongshan. In Brisbane, participants were asked to return their completed questionnaires by mail using a postage-paid envelope. To mitigate the typically low response rate in mail survey, a combination of techniques recommended by Fox et al. (1988) were adopted in this study to reduce the potential for non-response bias, such as the use of a cover letter, follow-up survey, stamped return postage, incentives, and sponsorship by local government (Dillman et al., 2014; Kotrlik and Higgins, 2001; Salkind and Rainwater, 2003).

However, the response rate in Salisbury (lower SES) was lower than Graceville (higher SES) despite the use of the above techniques. The finding is consistent with previous literature reporting that people with lower incomes are more reluctant to participate in survey research (Goyder, 1987; Groves et al., 1992; Groves and Peytcheva, 2008; Van Loon et al., 2003). The low response rate in Brisbane was largely due to the low response rate in the lower SES suburb (20% in Salisbury) and limited resources that were available for this research. It is acknowledged that external validity (generalisation) is necessarily weak in this type of study given the available resources for sampling effort. Nevertheless, the sampling response represents 11.3% of total local households in Graceville and 7.6% in Salisbury, thus providing reasonable representation of the local population.

The Zhongshan data collection was implemented after the Brisbane survey. To increase study response and sample representativeness in Zhongshan, a door-to-door interview technique was used. Participants were provided with a questionnaire and asked to complete the questionnaire independently and return it to the interviewers. The change in survey recruitment method was effective in significantly increasing the response rate.

### *7.2.4.* Measurement design and scale reliability

The variables in the multi-dimension model were operationalised using psychometric scaling and 5-point Likert scales (i.e., from 1= ‘strongly disagree’ to 5= ‘strongly agree’). The survey instrument included both newly developed questions and existing questions from other studies. Survey questions from existing studies were adopted because they had been tested for reliability and validity. For example, we measured *perceived accessibility* using questions and scales (1= ‘very easy’ to 5= ‘very difficult’) from survey research in Bristol, UK (Jones et al., 2009). But, because previous park studies have largely focused on geographic measures such as road distance and service availability to operationalise access, we developed new survey scales and questions to measure the non-physical variables such as *safety*, *social exclusion*, and *information* (see Table 7-2).

We asked the same survey questions in both cities for the purpose of accessibility model comparison. Survey questionnaires were developed using the sequential development model (Harkness et al., 2003). The questions were first developed in English and then translated into Chinese with minor changes in the scales to fit the context of Zhongshan (e.g., annual household income). The survey questions were pilot-tested in each language respectively with participants that included local residents, planners, and academics with survey research expertise. We evaluated multi-item scales in the questionnaire using reliability analysis where a larger Cronbach’s alpha (α) indicates a higher level of internal consistency (Field, 2009). The results showed that the scales were reliable in both urban contexts with α scores above 0.8, with the exception of the *safety* construct for Zhongshan with α= 0.68 compared to α= 0.85 for Brisbane. Although the reliability analysis indicated that removal of one item for the safety construct would increase the overall α to 0.74, we retained all items on this scale for measurement consistency between the cities. Table 7-2 lists the survey questions used in this study with mean scores from each city.

Table 7-2 Comparison between Brisbane and Zhongshan on variables used to analyse perceived park accessibility

| **Variable** | **Measures** | **Mean** | | **Test for difference or relationship** |
|---|---|---|---|---|
| | | **Brisbane** | **Zhongshan** | |
| Perceived Accessibility | | | | |
| *Perceived Accessibility* | How would you rate your overall ease of access to this park? | 1.92 | 2.30 | -8.01** |
| *Perceived Physical Accessibility* | How easy is it for you to physically get to this park? | 1.81 | 2.31 | -11.16** |
| *Perceived Socio-personal Accessibility* | Are there any socio-personal issues (e.g., perceived safety issues or antisocial behaviour, etc.) that make you avoid visiting this park? | 1.29 | 1.95 | -18.52** |
| Physical dimension | | | | |
| *Number or Area of parks* | There are a sufficient number of parks in my neighbourhood. | 4.0 | 3.22 | 15.79** |
| | There are sufficient areas of parks in my neighbourhood. | 3.92 | 3.2 | 14.67** |
| *Proximity* | This park is close to where I live. | 3.98 | 3.22 | 13.99** |
| *Walkability* | I can easily walk to this park. | 3.86 | 3.1 | 12.99** |
| | The walk to this park is a pleasant experience. | 3.73 | 3.16 | 10.56** |
| Transport dimension | | | | |
| *Car Ownership* | Do you own a private vehicle? (% of answer ‘Yes’) | 92% | 60.6% | 269.5($\chi^2$)** |
| *Travel Time* | How long would you estimate it would take you (in minutes) to get to each park using your common method? | 10.76 | 17.63 | -9.08** |
| *Travel Cost* | How much money would you estimate it would cost you (in AUD/RMB) to get to each park using your most likely method to go there? | AUD 0 | RMB 4.97 | - |

| | | | | |
|---|---|---|---|---|
| Knowledge dimension | | | | |
| *Information* | I am aware of parks and park facilities in my neighbourhood. | 4.39 | 3.13 | 34.25** |
| | I know where the parks are located in my neighbourhood and how to get there. | 4.47 | 3.84 | 18.07** |
| | I have good knowledge on public parks in my neighbourhood. | 3.43 | 2.78 | 14.88** |
| | I am aware of the activities and programs held in the parks. | 2.96 | 2.65 | 7.367** |
| | I know how to attend park activities in my neighbourhood. | 3.18 | 2.76 | 9.24** |
| | I have good knowledge on changes to activities and programs held in the parks. | 2.77 | 2.61 | 2.75** |
| Social dimension | | | | |
| *Safety* | I am concerned with my personal safety when I travel to this park. | 2.17 | 3.76 | -32.91** |
| | I feel unsafe when visiting this park. | 2.02 | 2.72 | -15.04** |
| | There are people participating in illegal activities (e.g. selling drugs) around this park. | 2.17 | 2.51 | -7.76** |
| | This park is regularly patrolled by police. | 2.51 | 3.16 | -15.20** |
| | This park is a place with high crime at night. | 2.45 | 2.96 | -12.50** |
| | Homeless or vagrant people are frequent in this park. | 2.31 | 3.03 | -17.53** |
| *Shared Activities* | This park is attractive to me because I can do my favourite activities with other people of shared interest (e.g. soccer, football etc.). | 3.25 | 3.09 | 3.24** |
| *Ethnic/Cultural Groups* | This park is attractive to me if there are people from my ethnic or cultural background. | 2.91 | 3.06 | -3.49** |
| *Social Exclusion* | Most people in my neighbourhood are friendly. | 4.06 | 3.58 | 13.84** |
| | Most people in my neighbourhood are trustworthy. | 3.82 | 3.34 | 14.13** |
| | Residents in my neighbourhoods share similar interest. | 3.33 | 3.02 | 9.05** |
| | Residents in my neighbourhoods help each other. | 3.73 | 3.45 | 8.33** |
| | I feel a strong connection with the neighbourhood. | 3.7 | 3.38 | 7.97** |
| Personal dimension | | | | |
| *Available Leisure Time* | I have a good work-life balance. | 3.7 | 3.27 | 5.79** |
| | I have enough leisure time to visit parks if I want. | 3.77 | 3.51 | 11.64** |
| *Active lifestyle* | I prefer outdoor climate to staying indoors. | 3.87 | 3.82 | ND[a] |
| | Outdoor exercise is an important part of my life. | 3.85 | 3.89 | ND[a] |
| *Health Status* | How would you say your health is in general? | 2.58 | 2.79 | 9.4** |
| *Financial Affordability* | Visiting and using public parks in my neighbourhood is an affordable activity. | 4.5 | 3.84 | 17.17** |

*Note*: [a] ND refers to no significant difference.
*$p < 0.05$.
**$p < 0.01$.

## 7.3 Analyses

### *7.3.1.* Study participants and perceived access by income groups

We ran descriptive statistical analyses to report the socio-demographic profiles of survey participants. To answer the first research question about whether perceived accessibility differs by income group, respondents from each city were categorised into two groups of higher and lower income. We used AUD 31,200 (annual household income) as the break-point for lower income households in Brisbane based on the low income threshold and income intervals published in Australia Census of Population and Housing (ABS, 2011a), and RMB 40,000 in Zhongshan according to Guangdong Statistical Bureau (GSB, 2013). Socio-demographic variables (e.g., sex, age and birth place) were compared between higher and lower income groups within each city.

Survey participants were asked about their perceived access to each of the three parks in the neighbourhood. We examined the difference in perceived park accessibility between income groups within and between each city using the combined results for the three parks.

### *7.3.2.* Relationship between perceived accessibility and travel mode to parks

To answer the second research question about the association between travel mode and perceived access to parks, the study participants were asked to select their most commonly used and most preferred travel mode to parks respectively. Responses from the two questions were compared for differences between the actual choice and mode preference using cross-tabulations and Chi-square ($\chi^2$) statistics for each city.

### *7.3.3.* Assessing the importance of physical vs. socio-personal dimension of accessibility

A two-factor regression model was constructed to investigate which accessibility dimension (physical or socio-personal) provides a more important predictor of perceived park access. Responses to the general question of perceived accessibility were used as the dependent variable in the model with the physical and socio-personal dimensions of accessibility as independent variables. We evaluated three separate regression models for each city, one model for each income group and a combined model for all respondents. The results were then compared between cities.

### *7.3.4.* Full regression model

Three types of regression models were constructed using ordinary least squares method to answer the last research question about which variables provide the strongest predictors of perceived accessibility: a full regression model for the general perceived accessibility question and a regression model for each hypothesised accessibility dimension (physical and socio-personal).

In the full regression model, the general perceived accessibility question was regressed against all 15 independent, exploratory variables of park accessibility (hereafter called the ‘general accessibility model’). We ran three separate general accessibility models using data from each city: one for each income group and one for all respondents combined. Further, two additional regression models were constructed for each hypothesised accessibility dimension (physical and socio-personal). The 15 variables were grouped into two categories, physical and socio-personal. The six items in the physical and transport dimensions are classified as physical variables while the nine items in the other three dimensions were classified as socio-personal variables. The first regression model (hereafter called the ‘physical accessibility model’) used perceived physical accessibility as the dependent variable, regressing against the six physical items as independent variables. The second model (hereafter called the ‘socio-personal accessibility model’) used socio-personal accessibility as the dependent variable, regressing against the nine socio-personal items. These models were run for each city respectively and the results were compared between the two cities.

## 7.4 Results

### *7.4.1.* Survey respondent characteristics

We examined the representativeness of the study samples by comparing (1) the socio-demographic characteristics of respondents with the census data for each city; and (2) the socio-demographic characteristics of the lower and higher income groups within each city. Table 7-3 provides the demographic profile of survey respondents. The results indicate general consistency with local population characteristics in both cities. In Brisbane, the sample showed minimal discrepancy with the ABS census data on most demographic variables including family composition, birthplace, home ownership, and language spoken at home. However, the Brisbane sample had more females and older respondents compared to the census data.

The same socio-demographic questions were asked in Zhongshan for consistency. The results showed similar demographic characteristics as those reported in the 2010 Chinese census. For example, both sexes were about equally represented in the sample (male 51.6% of the sample vs. 53.1% in the census). About 50.9% of respondents reported that they speak the local language at home (i.e., Cantonese) and 58.1% reported that they were born locally. These results compare favourably with local census data indicating that about 43.9% of the population are temporary residents without legal entitlements to live in the city permanently (ZSB, 2011). We were unable to conduct the same comparative census analyses as Brisbane due to the unavailability of some socio-demographic variables (e.g., home ownership and language spoken at home).

When the two income groups from each city were compared, there was a high degree of similarity on most demographic variables, e.g., *birth place* and *language spoken at home*, within each city (Table 7-3). But there were some significant differences in demographic variables between income groups, e.g., *sex* in Zhongshan and *age* in Brisbane. To evaluate the potential influence of these variables on self-reported park access, we ran correlation analysis between *perceived accessibility* and the two variables of *age* and *length of residence,* and a Chi-square test for association between *sex* and *perceived accessibility*. There were no significant relationships found between these variables. As expected, variables related to respondent socio-economic characteristics showed significant differences between income groups in both cities. For example, in both cities, significantly fewer respondents with lower income reported car ownership than their higher income counterparts. A similar result was also found for the *home ownership* variable in both cities, with significant differences between lower and higher income groups. When city averages were compared, Brisbane respondents reported a significantly higher average percentage of car ownership than Zhongshan respondents (92.5% Brisbane vs. 60.6% Zhongshan), but there were similar average home ownership rates (82.6% Brisbane vs. 83% Zhongshan).

Table 7-3 Survey respondents’ socio-demographic characteristics: Zhongshan and Brisbane

| **Brisbane, Australia** | | | | **Zhongshan, China** | | | |
|---|---|---|---|---|---|---|---|
| *Variable (%)* | Overall (*N*=319) | Lower income (*N*=49) | Higher income (*N*=231) | *Variable (%)* | Overall (*N*=323) | Lower income (*N*=131) | Higher income (*N*=187) |
| ***Sex*** | | | | | | | |
| Male | 35.8 | 36.7 | 34.2 | Male | 51.6 | 42.0 | 58.3** |
| Female | 64.2 | 63.3 | 65.8 | Female | 48.4 | 58.0 | 41.7 |
| ***Age*** | | | | | | | |
| Mean | | 59 | 45** | Mean | | 35.2 | 35.5 |
| Below 30 | 10.2 | | | Under 30 | 39.8 | | |
| 31-50 | 51.1 | | | 31-50 | 52.7 | | |
| 50 or older | 38.6 | | | 50 or older | 7.5 | | |
| ***Length of residence*** | | | | | | | |
| Mean | | 24 | 11** | Mean | | 7.7 | 8.8 |
| Less than 1 year | 13.6 | | | Less than 1 year | 14.0 | | |
| 1-5 years | 26.5 | | | 1-5 years | 40.2 | | |
| 5 years and longer | 59.9 | | | 5-15 years | 32.0 | | |
| ***Language spoken at home*** | | | | | | | |
| English only | 89.6 | 83.7 | 91.8 | Cantonese (incl. Zhongshan dialect) | 50.9 | 53.9 | 47.8 |
| Other languages | 10.4 | 16.3 | 8.2 | Mandarin and others | 49.1 | 46.1 | 52.2 |
| ***Birth Place*** | | | | | | | |
| Australia | 77.4 | 73.5 | 77.5 | Zhongshan and cities within the province | 58.1 | 60.7 | 55.4 |
| Overseas | 22.6 | 26.5 | 22.5 | Other cities | 41.9 | 39.2 | 44.6 |
| ***Car Ownership*** | | | | | | | |
| Yes | 92.5 | 81.6 | 96.1** | Yes | 60.6 | 49.2 | 68.3** |
| No | 7.5 | 18.4 | 3.9 | No | 39.4 | 50.2 | 31.7 |
| ***Homeowner*** | | | | | | | |
| Rent | 17.4 | 24.5 | 16.9** | Rent | 17.0 | 20.6 | 14.4** |
| Own | 82.6 | 75.5 | 83.1 | Own | 83.0 | 79.4 | 85.6 |
| ***Household Annual Income*** | | | | | | | |
| Below AU$31,199 | 17.5 | | | Below RMB39,999 | 41.2 | | |
| AU$31,200-$103,999 | 42.5 | | | RMB40,000-79,999 | 38.4 | | |
| Above AU$104,000 | 40.0 | | | Above RMB80,000 | 20.5 | | |

*Note:* there were 37 missing values on the *income* variable in the Brisbane sample.

**there were significant associations (for categorical variables) or differences (for continuous variables) between the variable and income groups within the city at alpha level of 0.05.

### *7.4.2.* Perceived accessibility by cities

We compared self-reported access to parks between respondents from the two study cities. About 58.5% of Zhongshan respondents reported ‘very easy’ or ‘easy’ access to local parks, compared to 75.6% of Brisbane residents (see Table 7-4). As a precaution, perceived accessibility responses were statistically analysed as both an interval and categorical variable. A Chi-square test indicated a significant difference in perceived accessibility between the two cities ($\chi^2$ (4) = 87.1, $p$ < 0.01), with Brisbane respondents reporting easier park access on average ($\overline{x} = 1.9$ Brisbane vs. $\overline{x} = 2.3$ Zhongshan). When standardised residuals were examined (Table 7-4), respondents reporting ‘very easy’ or ‘neutral’ park access contributed most to differences between the cities.

Perceived park access between higher and lower income groups was also compared in each city. The analyses showed consistent results where lower income groups reported significantly more difficult access. For example, in Zhongshan, 14.5% of lower income respondents reported difficult access to local parks, compared to 11% of higher income people. Similarly, 39.5% of lower income respondents from Brisbane reported that park access was ‘not easy’, compared to 25% of higher income respondents living in the same neighbourhoods.

Table 7-4 Perceived accessibility to parks by income groups in Zhongshan and Brisbane

| | | Group Mean | Very Easy | Easy | Neither Easy or Difficult | Difficult | Very Difficult |
|---|---|---|---|---|---|---|---|
| Zhongshan[a] | Lower income | 2.4 | 21.8% | 34.6% | 29.1% | 10.5% | 4.0% |
| | Higher income | 2.2 | 29.8% | 30.1% | 29.1% | 9.8% | 1.2% |
| | All respondents | 2.3 | 26.5% | 31.9% | 29.1% | 10.1% | 2.4% |
| | Std. residual | | 4.5 | 0 | -4.7 | -1.2 | -0.8 |
| Brisbane[b] | Lower income | 2.3 | 34.0% | 26.5% | 23.1% | 11.6% | 4.8% |
| | Higher income | 1.9 | 44.6% | 30.4% | 13.4% | 10.7% | 0.9% |
| | All respondents | 1.9 | 44.0% | 32.0% | 14.6% | 7.8% | 1.6% |
| | Std. residual | | **-4.4** | 0 | **4.6** | 1.2 | 0.7 |

*Note:* respondents were asked to choose from ‘very easy’ (1) to ‘very difficult’ (5) access.

[a.] Mean difference between two income groups is statistically significant at the 0.01 level (t= -2.61, p< 0.01)

[b.] Mean difference between two income groups is statistically significant at the 0.01 level (t= -4.02, $p$< 0.01)

### *7.4.3.* Actual versus preferred travel mode to parks

Actual versus preferred travel mode to parks was compared between the two cities (see Table 7-5). There was a significant difference in actual travel mode for respondents ($\chi^2$(4) = 353.55, p< 0.001), with Brisbane respondents more likely to visit parks by walking (78.4%) and

Zhongshan residents more likely to drive (47.1%). In addition, 7.6% of Zhongshan respondents used public transport compared to only 0.9% in Brisbane.

When we compared actual with preferred travel mode for each city, similar results were reported in both cities. For example, sustainable travel modes (i.e., public transport, walking and cycling) were more preferred by respondents in both cities. In Zhongshan, 46% of people chose walking as the most preferred travel mode, compared to only 36.9% who reported walking as their most common travel mode. In both cities, fewer respondents reported automobiles as their preferred transport mode compared to actual travel to parks (Zhongshan: 38.3% preferred vs. 47.1% actual; Brisbane: 11.3% vs. 15%).

The Chi-square test (Table 7-5) was used to examine the relationships between actual travel mode and perceived access to parks. Both cities reported statistically significant associations between the two variables, with travel mode having a stronger association with perceived accessibility in Brisbane ($\chi^2$ (3) =20.42, $p < 0.001$).

Table 7-5 Most commonly used and preferred travel modes to parks in Zhongshan and Brisbane

| | Brisbane, Australia (*N*=319) | | | | Zhongshan, China (*N*=323) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Perceived accessibility [a] | | | | Perceived accessibility [b] | |
| Travel mode (%) | Preferred mode | Actual mode | Easy | Not Easy | Preferred mode | Actual mode | Easy | Not Easy |
| Car/motorcycle | 11.3 | 15 | 68.1 | 31.9 | 38.3 | 47.1 | 59.6 | 40.4 |
| Public transport | 1.6 | 0.9 | 22.2 | 77.8 | 11.3 | 7.6 | 56.9 | 43.1 |
| Walk | 81.1 | 78.4 | 77.6 | 22.4 | 46.0 | 36.9 | 60.6 | 39.4 |
| Bike | 6.5 | 4.7 | 80 | 20 | 13.3 | 7 | 42.4 | 57.6 |

[a] There was a significant difference in actual travel mode for respondents between the two cities: $\chi^2$ (4) = 353.55, $p < 0.001$.

[b] There was a significant association between actual travel mode and perceived accessibility in both cities: Brisbane $\chi^2$ (3) = 20.42, $p < 0.001$; Zhongshan $\chi^2$ (3) = 7.95, $p = 0.047$

### *7.4.4.* Influence of physical and socio-personal dimensions on perceived access

Results from the two-factor regression analyses are reported in Table 7-6. All six regression models (three for each city) were statistically significant ($p < 0.01$). When the individual dimensions of access were examined, results from the two cities showed a high degree of similarity. In the regression models for all respondents and the higher income group, both accessibility dimensions were statistically significant predictors of perceived access, with the physical dimension a much stronger predictor than the socio-personal dimension. In the model for the lower income group, the physical dimension was the only significant predictor that influenced perceived access to parks (0.87 Brisbane vs. 0.81 Zhongshan). Overall, the results indicate that the physical dimension is a more important predictor in explaining the variance of perceived access to local parks in both cities, with people of lower income more vulnerable to changes in physical park access.

Table 7-6 Regression models of two accessibility dimensions to perceived access to parks in Zhongshan and Brisbane

| | | Perceived Physical Accessibility | Perceived Socio-personal Accessibility | R | Adjusted $R^2$ | F |
|---|---|---|---|---|---|---|
| Zhongshan | Lower income | 0.81** | 0.04 | 0.81 | 0.65 | 412.70** |
| | Higher income | 0.77** | 0.09** | 0.83 | 0.68 | 513.91** |
| | All respondents | 0.79** | 0.07** | 0.82 | 0.67 | 951.16** |
| Brisbane | Lower income | 0.87** | 0.08 | 0.86 | 0.74 | 204.15** |
| | Higher income | 0.68** | 0.23** | 0.78 | 0.62 | 545.05** |
| | All respondents | 0.73** | 0.16** | 0.79 | 0.63 | 787.78** |

** $p< 0.01$ (2-tailed)

### *7.4.5.* Influence of physical and non-physical variables on perceived access

Results from the multivariate regression analyses are reported in Table 7-7. Five regression models were run for each city: three general accessibility models with one for each income group and one for all respondents (column 1); a physical accessibility model for all respondents (column 2) and a socio-personal accessibility model all respondents (column 3).

All regression models were statistically significant ($p < 0.01$) but the Brisbane models were generally stronger, explaining more overall variance in perceived accessibility ($R^2$ = 49%) compared to Zhongshan ($R^2$ = 29%). Generally, the park accessibility model fits better in the Brisbane context than Zhongshan. When the significance of individual variables was examined, physical variables explained more of the difference in $R^2$ values between the two models in different urban settings. For example, the *proximity* variable was a significant predictor in both settings, but much stronger in the general Brisbane model (0.432) compared to Zhongshan (0.189), based on the magnitude of the standardised coefficients. In contrast, the *travel time* (Brisbane: 0.093 vs. Zhongshan: 0.236) and *pleasant walk* (Brisbane: 0.181 vs. Zhongshan: 0.252) variables were more important in the Chinese model. This indicates the strength of predictor variables may vary depending on the settings of the case study cities including socio-cultural context, urban form and structure, and resident behavioural patterns. When the different models are compared, the physical accessibility models (Zhongshan: 31%

and Brisbane: 51%) were generally stronger than the non-physical models (Zhongshan: 12% and Brisbane: 15%).

The general accessibility models indicate that variables from both the physical and non-physical dimensions significantly influence overall perceived access to parks. The strongest predictor variables were from the physical dimension: *pleasant walk*, *travel time* and *proximity* in the Zhongshan model compared to *proximity*, *sufficient parks*, and *pleasant walk* in the Brisbane model. The physical dimension was more important in explaining perceived park access in both cities, although the strength of individual variables differed, with *pleasant walk* the strongest predictor variable (std. coefficient= 0.252) in the Zhongshan model and *proximity* (std. coefficient= 0.432) in Brisbane. The fourth most influential variables in both cities were from the non-physical dimension: *cultural groups* in Zhongshan and *leisure time* in Brisbane. When the models for different income groups were compared, the results for the higher income group were similar to the results for all respondents. However, the regression models for the lower income group revealed additional socio-personal variables that account for some changes in perceived park access. For example, *car ownership* was a significant predictor variable in lower income models for both cities and *affordability* and self-reported *health status* were significant predictors of park access for the lower income group in Zhongshan.

In the physical accessibility models, *proximity, estimated travel time*, and *pleasant walk* were the most important explanatory variables in both cities based on standardised coefficients. The *sufficient parks* variable was also a statistically significant predictor in Brisbane, but not in Zhongshan. In Zhongshan, the strongest predictor was estimated *travel time* (0.28) compared to the *proximity* variable (0.39) in Brisbane. In the socio-personal accessibility models, the *safety* variable was the most influential factor in both cities. *Available leisure time* and *culture group* variables were also statistically significant in Brisbane while *social exclusion* and *shared activities* were more important in Zhongshan.

In summary, the results indicate that both physical and non-physical factors significantly contribute to perceived park access, with physical variables more important in explaining the variance in park access. The physical models were the strongest and most consistent for groups from different cultural or socioeconomic backgrounds. Nevertheless, the significance of non-physical variables differed between groups (cities and income levels). In particular, self-reported *safety* and whether parks were used by people from similar cultural backgrounds were important socio-personal variables for groups from different backgrounds.

Table 7-7 Regression models for three measures of perceived accessibility

| | ***Column 1:*** ***General Perceived Accessibility Against All Variables*** | | | | | | ***Column 2:*** ***Physical Accessibility Against Physical Variables*** | | ***Column 3:*** ***Socio-personal Accessibility Against Non-physical Variables*** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Zhongshan, China** | | | **Brisbane, Australia** | | | **Zhongshan** | **Brisbane** | **Zhongshan** | **Brisbane** |
| **Variables** | Higher Income | Lower Income | All Respondents | Higher Income | Lower Income | All Respondents | All Respondents | All Respondents | All Respondents | All Respondents |
| Sufficient parks in neighbourhood | 0.009 | 0.043 | 0.007 | 0.124** | 0.029 | 0.116** | 0.016 | 0.066* | | |
| Proximity | 0.209** | 0.191** | 0.189** | 0.424** | 0.732** | 0.432** | 0.232** | 0.390** | | |
| Estimated travel time | 0.072** | 0.061** | 0.236** | 0.018 | 0.042 | 0.093** | 0.282** | 0.178** | | |
| Estimated travel cost | 0.219 | 0.249 | 0.044 | 0.005 | 0.178 | 0.005 | 0.044 | 0.056 | | |
| Pleasant walk | 0.231** | 0.236** | 0.252** | 0.253** | 0.109 | 0.181** | 0.238** | 0.257** | | |
| Car ownership | 0.014 | 0.114* | 0.061 | 0.021 | 0.309* | 0.005 | 0.034 | 0.036 | | |
| Information | 0.060 | 0.080 | 0.028 | 0.002 | 0.073 | 0.026 | | | 0.009 | 0.018 |
| Social exclusions | 0.022 | 0.111 | 0.045 | 0.022 | 0.054 | 0.016 | | | 0.141** | 0.030 |
| Leisure time available | 0.012 | 0.04 | 0.005 | 0.097* | 0.121 | 0.111** | | | 0.034 | 0.107** |
| Active lifestyle | 0.021 | 0.094 | 0.020 | 0.042 | 0.045 | 0.004 | | | 0.012 | 0.087 |
| Health | 0.063 | 0.139* | 0.031 | 0.027 | 0.092 | 0.015 | | | 0.038 | 0.050 |
| Afford | 0.058 | 0.150** | 0.010 | 0.071 | 0.068 | 0.031 | | | 0.044 | 0.020 |
| Safety | 0.100* | 0.054 | 0.047 | 0.069 | 0.129 | 0.023 | | | 0.296** | 0.288** |
| Shared activities | 0.141* | 0.051 | 0.090* | 0.021 | 0.136 | 0.018 | | | 0.092* | 0.038 |
| Culture Groups | 0.14* | 0.006 | 0.107** | 0.092* | 0.123 | 0.083* | | | 0.065 | 0.195** |
| R | 0.55 | 0.62 | 0.55 | 0.73 | 0.73 | 0.71 | 0.57 | 0.71 | 0.37 | 0.40 |
| Adjusted $R^2$ | 0.28 | 0.35 | 0.29 | 0.51 | 0.42 | 0.49 | 0.32 | 0.51 | 0.13 | 0.15 |
| F | 13.16** | 11.32** | 21.63** | 31.73** | 4.53** | 38.23** | 79.50** | 127.46** | 14.65** | 18.82** |

*Note:* see Table 7-2 for explanation for variables.

*$p< 0.05$ (2-tailed).

**$p< 0.01$(2-tailed).

## 7.5 Discussion

This study supports the validity of an integrated park accessibility model consisting of both physical and non-physical factors. The model was empirically examined in two cities with different socio-cultural contexts. Our results indicate that both physical and socio-personal factors significantly contribute to self-reported park access in both urban settings, supporting the hypothesis that the accessibility concept is a complex, multi-dimensional construct. Four of the five hypothesised dimensions in the model were supported, but there was no empirical evidence available for the presence of the information dimension. Further, the physical dimension provides the most important component of the accessibility construct in both cultural settings, with *proximity* and *pleasant walking* to parks providing the strongest predictor variables. The socio-personal dimensions of access are much weaker than physical variables, with self-reported *safety* and whether parks are used by people from similar *cultural groups* being the most important predictor variables.

Brisbane residents perceive higher levels of park access compared to Zhongshan residents and walking to parks is more popular in Brisbane than Zhongshan. Results from both cities indicate that the more frequently people visit a park by walking, the greater the perceived access. This may partially explain the lower perceived access reported by Zhongshan respondents since they drive to parks more often than Brisbane residents. Residents of both cities reported stronger preferences for sustainable travel modes (including public transport, walking, and cycling) than they actually used.

With respect to income and access, lower income groups are more likely to report lower levels of park access and appear more vulnerable to changes in physical settings (e.g., reduced greenspace area, increased distance to parks) due to fewer resources (e.g., money, private vehicles). In both cities, the *car ownership* variable was an important predictor variable in the lower income models but not in the higher income models.

This paper provides support for treating access to urban parks and green spaces as an environmental justice issue. Many cities have an uneven distribution of green spaces in urban areas, with lower income neighbourhoods and communities of colour more subject to poorer park access and degraded facilities (Oh and Jeong, 2007; Sister et al., 2010; Tsou et al., 2005; Wolch et al., 2014). Our findings support these previous studies with respondents with lower income reporting significantly less access to parks than their higher income counterparts. However, simply increasing the supply of parkland will not necessarily result in increased park access (Wang et al., 2015a). Perceived park access is influenced by a combination of both physical and non-physical variables that differ by population group and the specific context of the urban setting, reinforcing the need for targeted social research that can identify diverse community needs for more efficient public service delivery at a local level. For example, having a *pleasant walking* option is very important in Zhongshan while *proximity* was considered most important in Brisbane.

Further, our results indicate that the environmental justice component of park access is broader than simple physical availability of urban parks and also includes level of affluence. *Affordability* was an important factor on whether to use (or not use) parks in the lower income model in Zhongshan, but not in the Brisbane model, or with the higher income group in Zhongshan. This outcome was not unexpected. Chinese cities, like many other cities around the world, allow for a range of commercial uses in their public parks (Byrne and Sipe, 2010). Even if park entry were free to all visitors, park users with lower incomes would likely consider their financial expenses associated with the park visit, especially when they are accompanied by small children and families. In contrast, there are limited commercial uses in Brisbane neighbourhood parks, and thus, affordability issues were only indicated by Chinese respondents.

Commercial uses (e.g., restaurants, cafés, equipment rental shops, and mini amusement parks for children) in public parks convert public green spaces into potential revenue sources for municipalities to fund expenses associated with ongoing park maintenance or facility upgrades. Allowing appropriate types of commercial uses may help foster positive attitudes towards parkland, increase park utilisation and promote a more active lifestyle (Byrne and Sipe, 2010), but families with lower incomes are likely to limit their park use without sufficient discretionary income. For example, in Zhongshan, park management was criticised for failing to adequately regulate privatisation that resulted in significant increases in the price of commercial services located within the parks. Although our model was unable to fully account for these additional costs of visiting local parks, our results indicated that lower income groups are most vulnerable to price changes, especially in cities that allow for extensive commercial activities in urban parks. Therefore, it is important for park management authorities to make decisions that foster equitable service delivery and to regulate privatisation options that account for community diversity and affordability.

The findings from both cities support preferences for sustainable transport modes (e.g., walking and cycling) to visit parks. However, the actual use of sustainable options by Chinese respondents was significantly less than Brisbane residents. The discrepancy between preferences for a pedestrian-friendly environment and actual use in Zhongshan indicates the important role of physical urban planning and design, especially in rapidly urbanising cities. In Brisbane, recreational needs are recognised at a strategic level in the regional plan (DSDIP, 2009) while Zhongshan has implemented a more standard approach with over-emphasis on park quantity (Wang, 2009). Previous studies suggest that green space policies have significant impacts on the form of urban settlement (Elson, 1986; Longley et al., 1992). The reliance on a quantitative standards approach that is embedded in the top-down park planning regime in Chinese cities can undervalue the important role and contribution that urban design of residential area plays in creating walkable and safe residential areas that meet community recreational demands. For example, Giles-Corti et al. (2013) found longitudinal evidence that both transport and recreational-walking were sensitive to the availability and diversity of local transport and recreational destinations, demonstrating the potential for local infrastructure to support health-promoting behaviours.

## 7.6 Conclusion

In this paper, cross-cultural evidence supports our claim that park accessibility is a complex, multi-dimensional construct. The Chinese case study suggests that over-emphasis on quantitative standards in urban planning may fail to achieve optimal social outcomes. This paper highlights the importance of moving beyond the realm of conventional planning with physical standards to address the socio-personal dimensions of park accessibility. Simply increasing the supply of urban parks does not necessarily correspond to an increase in park utilisation because perceived park access, an important predictor of future park use (Wang et al., 2015b), is likely to be influenced by the diversity of the social and cultural context of urban settings.

Possible policy interventions highlighted by this paper include: ensuring public parks are proximate to residential locations; providing quality footpath amenities to foster a walkable urban landscape and to support health-promoting behaviours; and regulating privatisation options that account for community diversity and affordability, particularly when commercial uses are available in public parks. However, the effectiveness of these interventions may vary according to the specific context of urban settings. Each city or community has unique characteristics that may influence personal evaluation of park access, and ultimately park use. Planners should have the capacity to understand the diversity of community characteristics (Ferreira and Batey, 2007; Longley, 2005) and how park access might be influenced by the physical and social context to ensure more efficient and equitable public service delivery at a local government level. Therefore, planners and policy makers will likely require additional community-based research to provide for enhanced social outcomes.

The multidimensional park accessibility model described herein provides a cross-cultural framework to help urban planners better understand the complexity of park access to identify pathways for increasing park use that promote healthy urban lifestyles. But, the accessibility model is a work in progress. Future research should determine whether the information dimension, which was insignificant in this study, applies to specific urban contexts. In addition, the increased spatial analytical capabilities offered by geographic information systems (GIS) enable the design and evaluation of more complex urban park use models that can incorporate greater heterogeneity in individual behaviour in alternative physical urban settings (Batty et al., 2003; Longley, 2003). Future accessibility research should incorporate the findings from this study to develop individual-based simulation models (e.g., agent-based models) that predict how changes in the design and structure of urban park systems, in combination with socio-personal variables, influence park use.

# CHAPTER 8. CONCLUSION AND CRITICAL REFLECTION

Urban parks and open spaces are recreational assets that help breathe life into our cities. This research investigated two key points: 1) the influence of park accessibility and past use on human behavioural intention towards urban park use and 2) the cross-sectional validity of the multi-dimensional model of park accessibility. This study significantly contributes to accessibility literature, expands on the theory of planned behaviour and environmental justice research of park access, and informs park planning practice. Chapter 8 summarises the main research findings to address the four objectives of this study, critically reflects on implications arising from this project for park management and planning, then discusses the key contributions of this research to scientific knowledge, and finally, provides suggestions for future research.

## 8.1 Summary of key research findings

This study has extended our understanding of urban park access and use by achieving the four research objectives:

1. Develop an integrated conceptual framework for urban park use.
2. Examine the impact of perceived accessibility and geographic accessibility on people's attitudes and behavioural intentions to visit parks.
3. Determine the factors that influence perceived accessibility for communities of contrasting social economic status.
4. Validate the proposed park accessibility model across different socio-cultural settings.

### *8.1.1.* Objective 1 – development of conceptual models

Through the critical review of relevant literature, this research was able to develop an integrated conceptual framework for urban park use. This objective has addressed a knowledge gap in the study of park use by showing the potential role of park accessibility, as a multidimensional construct, in influencing human behavioural intentions to use urban parks. Moreover, the analysis also indicated that existing park accessibility research is limited to the concept's physical and temporal dimensions, leaving other relevant factors such as social conditions and personal constraints, largely unexplored. Conceptual models were developed to address these research gaps within the current literature.

Outcome 1: A theoretical framework was developed to further our understanding about the concept of accessibility and its interactions with other variables associated with park use. The framework emphasises the role of accessibility as a potential predictor of park use behaviour. It also highlights the importance to understand self-reported accessibility as the outcome of an integrated evaluation of potential constraints associated with different dimensions of park accessibility.

Outcome 2: An expanded model of the theory of planned behaviour was developed to illustrate the relationship between park use and its potential predictor variables (e.g., perceived accessibility, attitude, past use behaviour, geographic proximity and norms). The model examines park use from an individual perspective that focuses on factors that may influence individual decision-making towards park use or non-use. The hypothetical relationships illustrated in the model can be operationalised to empirically investigate the significance of variables in predicting future human behaviour towards park use.

Outcome 3: The second model developed was the integrated model of park accessibility, as an expanded form of accessibility construct in an urban park context. The model contains both physical and non-physical dimensions of accessibility, with each dimension represented by its associated variables identified in the urban park context. This is an explorative model that can be operationalised and empirically tested.

### *8.1.2.* Objective 2 – the impact of perceived and geographic accessibility on park use intention

This study, via objective 2, has extended existing knowledge by demonstrating that park accessibility provides a reliable predictor of behavioural intention to use urban parks. To achieve this objective, the expanded theory of the planned behavioural model was empirically tested using primary community survey data collected from Brisbane suburbs. The expanded TPB model was compared with two other alternative behavioural models for their validity and model fits. Moreover, perceived and geographic accessibility were compared for their influence on the explanatory power of the expanded TPB model using structural equation modelling methods.

Outcome 1: The expanded TPB model (Figure 5-1) had the best model fit compared with two other alternative behavioural models, and thus enhanced the prediction of future park use.

Outcome 2: Attitude towards parks was found to have important mediating effects on future park use. Therefore, policy interventions that seek to increase positive perception towards urban park space are likely to increase park utilisation.

Outcome 3: Both perceived and geographic accessibility significantly contributed to the explanatory power of the expanded TPB model, but perceived accessibility provided a more important predictor of future park use.

### *8.1.3.* Objective 3 – factors influencing perceived accessibility for communities of contrasting SES

This objective has, in part, filled a knowledge gap in accessibility research by providing empirical evidence to support the hypothesis that both physical and non-physical variables are likely to influence self-reported park access. The integrated model of park accessibility (Figure 6-1) was empirically tested using primary survey data collected from the two Brisbane suburbs of different socioeconomic status.

Outcome 1: The analyses provided empirical support for the multi-dimensional nature of the accessibility construct, wherein both physical and socio-personal dimensions significantly influenced self-reported access to parks.

Outcome 2: The physical dimension of accessibility, especially the *proximity* variable, provided the most important explanatory variable of park accessibility. Socio-personal dimension was statistically significant but much weaker in explaining the variance of park accessibility.

Outcome 3: Self-reported park access was associated with community SES, with the lower SES community more likely to report a lower level of park access given the comparable levels of park supply in both suburbs.

### *8.1.4.* Objective 4 – the influence of the social and cultural context of an urban setting on park accessibility

In the last objective, the previous analyses were expanded to investigate the extent to which park access may be influenced by the larger social and cultural context of urban settings. The same multidimensional model of park accessibility was tested in the two cities of Brisbane

(Australia) and Zhongshan (China), using a comparative research design. The following findings were highlighted:

Outcome 1: Model testing in both city contexts reported similar results. Four of the five hypothesised dimensions (physical, transport, social, and personal dimensions) were empirically supported but there was no empirical evidence available for the presence of the *informational* dimension.

Outcome 2: The relative importance of accessibility variables appeared to vary in different cultural contexts and urban settings. For example, having a pleasant walking option was the most important predictor variable in Zhongshan while proximity to parks was considered the most important by Brisbane respondents. The *financial affordability* variable was a significant factor in the lower income model of Zhongshan, but not in any Brisbane models.

Outcome 3: Results indicated statistically significant associations between travel modes and perceived access to parks in both cities. The more frequently people visit a park by walking, the greater is the perceived access to parks. This finding may partially explain the lower level of park access reported by Zhongshan respondents since they have to drive more often than Brisbane residents.

Outcome 4: Both cities reported consistent findings in terms of differentiated park access between higher and lower income groups. Respondents with lower income were more likely to report less access to parks and appeared more vulnerable to the changes of physical settings (e.g., reduced greenspace area, increased distance to parks).

## 8.2 Conclusion of findings and critical reflections

This thesis examined a reconceptualisation of accessibility and TPB model. An expanded conceptual framework was applied to extend understanding of park access and use in different socio-cultural contexts of urban settings. The expanded TPB model provided strong supports for the *perceived accessibility* variable as a predictor of human behaviour related to urban park use, suggesting the need to identify potential factors that may influence self-reported park access (Chapter 5). The results from study areas of different socio-cultural backgrounds consistently supported the validity of the multidimensional model of park accessibility (Chapters 6 and 7). Further, this study provided a supporting rationale for treating access to urban parks and green space as an environmental justice issue, with respondents from lower

SES areas reporting significantly less access to parks than their higher SES counterparts (Chapter 6). Also, this study found that the importance of physical and non-physical accessibility variables does not apply to all population groups equally, but is influenced by the larger social and cultural context of urban settings (Chapter 7). In this light, the research objectives in this study have been achieved successfully and the following implications can be drawn from the outcomes of this research.

First, findings from this thesis suggested that simply increasing park supply will not necessarily correspond to an increase in park use. Conventional park planning that relies exclusively on quantitative standards tends to overlook the complexity of both the accessibility construct and the individual decision-making process. The outcomes of this thesis have successfully addressed these knowledge gaps in planning, through proposing and empirically testing the multidimensional park accessibility model from an individual perceptual perspective, thus providing a more complete understanding of accessibility in the urban park context. An understanding of the multidimensional nature of park accessibility is crucial in planning because it highlights the need for planners to go beyond the familiar realm of physical planning to embrace the important findings of social analysis. Findings from this study have indicated the importance of socio-personal factors in influencing self-reported park accessibility and, ultimately, park use. Therefore, the models proposed and tested in this thesis provide practical tools to enable planners to identify more efficient ways to encourage public park utilisation and to expand the public benefit derived from urban park use. The following key areas are recommended based on the findings of this study as examples of possible policy interventions in planning to increase park use: 1) ensure public parks are reasonably proximate to residential locations; 2) provide footpath amenities such as shade and lighting to encourage walking and cycling; 3) provide opportunities to develop and sustain an inclusive community culture; and 4) organise programs and events that capture local residents’ shared interests in activities.

Second, to encourage community livelihood through greater utilisation of urban parks, findings from this thesis recommend that park management should be mindful of the diversity of community characteristics for a more efficient public service delivery. This study emphasises the importance of perceived park accessibility in influencing future park use, advocating the need for an evidence-based planning approach that is able to recognise the differentiated preferences and recreational demands of local communities. The approaches used in this study (e.g., focused community analysis and cross-sectional comparison) provide useful methods to help planners conduct local research to understand the complexity of community characteristics.

Therefore, this thesis has contributed to park planning practice by providing methods 1) to identify important predictor variables in influencing perceived access to urban parks and 2) to develop insights into the complexity of individual decision-making process and community diversity. These new approaches will help planners develop more insightful knowledge about local community characteristics, their distinct needs and recreational preferences to improve the quality of urban life and social sustainability.

Further, to achieve a more efficient and equitable service delivery, it is necessary to provide policy interventions that more specifically address the needs of communities of lower SES. Given the comparable levels of park supply in their neighbourhoods, communities of lower SES generally reported lower access to local parks than their higher SES counterpart, indicating the need for extra policy attentions on addressing the potential barriers that may constrain their park access and use. Findings of the environmental justice literature suggested that communities of lower income and people of colour are more subject to inferior access to urban parks and degraded facilities (Byrne et al., 2009; Estabrooks et al., 2003; Sister et al., 2010; Wolch et al., 2005). This study empirically supported and further expanded the literature by arguing that the environmental justice issues of park access not only associate with the availability and location of parks, but also with socioeconomic concerns such as vehicle ownership and financial affordability. For example, in the Zhongshan case study, park users with lower incomes were more likely to consider the potential financial expense associated with park visit, constraining their intention to use parks. Therefore, the study results have shown that perceived park access is not equal among all residents, but varies according to their socioeconomic backgrounds.

Last, this study highlights the important role of physical urban design in supporting health-promoting behaviours, especially in rapidly urbanising cities. While respondents from both Western and non-Western countries supported the community preference for a pedestrian-friendly environment, there was a significant discrepancy between the preferences for sustainable transport modes (walking and cycling) to visit parks and the actual use of these modes. Previous research found that walking is sensitive to the availability and physical design of local transport infrastructure and recreational destinations (Giles-Corti et al., 2005; Giles-Corti et al., 2013; Goličnik and Ward Thompson, 2010). However, the over-emphasis on park quantity in planning regimes is likely to undervalue the important role and contribution of pedestrian-friendly urban design (e.g., quality footpath connections and other pedestrian infrastructure that contribute to a pleasant walking experience) in encouraging health-promoting behaviours and active use of park spaces. This is especially the case in cities with continuing urbanisation. This study has found cross-cultural supports for the community preference for a walkable urban environment. Therefore, it is important for planners to meet such preferences and needs to build ‘liveable cities’, given that pedestrian-friendly urban design can contribute to neighbourhood safety, encourage more active lifestyles, promote better health outcomes and contribute to overall community well-being.

## 8.3 Major contributions to knowledge

This research contributes to knowledge in five major ways:

Theoretically, this thesis makes an original contribution to the theory and practice of park planning to address the need to understand park use and access from an individual perspective. The theoretical framework developed in this study illustrates the interactions between park accessibility, human behaviour and park use, as well as their associated factors. The framework provides comprehensive insights into the human evaluation process towards the park use or non-use decision, highlighting the salient factors that may lead to the development of more effective policy interventions to increase urban park use.

As a pioneering work to investigate future park use, it has extended on earlier studies that relied exclusively on observed measures (e.g., use frequency) to examine urban park use. This thesis has demonstrated that the theory of planned behaviour provides a useful approach to understand the interrelationships between park accessibility and use, as well as the role of potential factors in influencing individual decision-making towards future park use. The inclusion of cross-disciplinary variables in the proposed conceptual models makes this study the first attempt to empirically illustrate the interactive relationships amongst these variables.

Methodologically, the use of structural equation modelling estimation provides unique insights into the causal relationships between variables, thus making it possible to compare the relevant importance of geographic and perceived accessibility for their contributions to park use intention. It also enables the comparison of different theoretical models for their predictive ability for park use. The measurement models were examined for their reliability and validity, thus making the research easily replicable and generalisable by future studies.

Conceptually, this thesis advanced the accessibility research by providing a more complete representation of the multidimensional construct of accessibility in the urban park context. The integrated accessibility model addresses the research gap between the evolution of the accessibility concept and the development of its measures. The model components can be operationalised and analysed for their importance in influencing the overall park accessibility construct. And thus, the model can be empirically analysed and generalised to other non-park facilities and services with minor changes. Therefore, this thesis provides a useful tool for park management through the identification of dimensions and influential factors in relation to accessibility in the urban park context.

Analytically, the conceptual models in this study were analysed and compared at different analytical scales: suburbs of different socioeconomic status, people of different income and cities of different socio-cultural settings. The cross-sectional approach used in this study confirmed that these conceptual models have the ability to be generalised to a greater diversity of urban settings.

## 8.4 Limitations and future research

A major challenge encountered in this study was the low response rate of the mail survey in the lower SES suburb of Brisbane (Salisbury). The overall response rate in Salisbury survey was 20%. Though adequate for statistical analysis, it tended to raise concerns of underrepresentation of the target population. To provide an unbiased, cross-sectional sample, different strategies were adopted in the survey following the recommendation from previous literature, including seeking sponsorship from local governments, providing incentives, and using multiple follow-ups with non-respondents. The low response rate is also likely to increase the potential of non-response bias. The results show that only 21% of respondents reported as non-users (never use local parks) and seldom-users (use local parks not every month but at least once a year), in comparison with 55.8% classified as frequent users (use local parks at least once a week). Although the study targeted both current park users and non-users, frequent park users were likely to be more motivated to respond. Future research should consider alternative strategies for more effective recruitment of people in lower SES suburbs.

There was a limitation with respect to the inability to test some of the hypothetical variables in the integrated park accessibility model such as car-ownership and travel cost. The Brisbane survey showed a high level of homogeneity in responses towards these questions. It was not a surprising result considering that the case study was conducted in a metropolitan area of Australia. The limitation was partly mitigated when the case study area changed to a less-developed city in China. However, it is still unknown whether the findings can be generalised to other cities of similar socio-cultural settings. It is also acknowledged that there is a possible bias arising from the use of different delivery methods in primary data collection between the two cities. The mail survey method in Brisbane was changed to face-to-face delivery when the survey was implemented in the Chinese city, in order to minimise the non-response bias in the mail survey and to ensure that the data collection was completed within the time frame. To mitigate the interviewer bias, the interviewers were asked to only manage the questionnaire delivery and collection. This was to ensure that the questionnaire was completed by the respondents independently with no influence from the presence of the interviewers. Future studies may incorporate further considerations to cope with such issues.

Furthermore, this study used urban parks as the context to develop and empirically test the conceptual models. The conceptual models are open to modifications wherein the base paths and dimensions can be changed to fit specific research contexts. Future research can build upon the results presented in this study and apply the models to other urban services such as libraries, community centres, and social service facilities. Data analysis in this study was affected by the difficulties in acquiring secondary data in the less-developed city. For example, it was unable to test the expanded TPB model in the Chinese city (Zhongshan) due to the lack of spatial datasets (e.g., road network) for the local areas. Future studies may determine the applicability of the behavioural model to a larger social and cultural context of urban settings.

Finally, the increased spatial analytical capabilities offered by geographic information systems (GIS) also enable the design and evaluation of more complex urban models that incorporate greater heterogeneity in individual behaviour with alternative physical urban settings (Batty et al., 2003; Longley, 2003). Findings from this study can be incorporated into the development of individual-based simulation models (e.g., agent-based models). Future studies may investigate how changes in the design and structure of urban systems, in combination with socio-personal variables, may influence park use.

In conclusion, contemporary geographic research on parks has called for a more integrated research agenda to provide urban socio-spatial explanations on how and why people use urban parks (Byrne and Wolch, 2009). The thesis presented here has addressed this research need through challenging existing theories and practice related to the socio-spatial dimension of urban park management from multiple disciplinary perspectives. The outcome of this thesis has extended our understanding about the formation of human behaviour towards park use through empirically comparing the importance of perceived and geographic accessibility in influencing human decisions-making processes. Further to this, this study has addressed the multi-dimensional nature of the accessibility concept and provided extensive analyses into potential physical and non-physical factors shaping park accessibility, as well as their importance in predicting human behavioural intentions towards urban park use.

In this light, this thesis has made an original contribution to the understanding about the interactive relationships amongst accessibility, park use and human behavioural decision-making, and about how these relationships vary across communities of different sociocultural backgrounds. It has provided insights into the complexity in the formation of human decisions towards park use and non-use. This study encourages planners and urban management to incorporate the important findings of social research to promote changes towards healthy lifestyle in communities. Therefore, this thesis was able to contribute in sharpening theoretical insights into nature-society relations, broadening our understanding of socio-spatial explanations for environmental injustice issues of park access and opening wide national and international policy debates in the field.

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# APPENDICES

Appendix I: Survey booklet

# COMMUNITY SURVEY

## Your access and use of parks in your neighbourhood

**Bonus Available**

**Please provide the name of your street here:**

No: ________________________

Street:________________________

Suburb:________________________

THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

**School of Geography, Planning and Environmental Management**

Dear Sir/Madam

A research team in the School of Geography, Planning and Environmental Management at the University of Queensland is undertaking a study about urban parks in your neighbourhood. This survey asks about your everyday use and perceptions of parks in your neighbourhood. The information you provide will help us learn about how people use community parks to better manage them.

We invite you to participate by completing the enclosed questionnaire and returning it to us **by post** (a self-addressed ***postage-paid*** **envelope** is provided with the questionnaire).

If you or someone else in your household has already completed the survey, please accept our sincere thanks. If you have not completed the survey, please do so as soon as possible.

We will send you **one Brisbane City Council Free Plant Voucher** (for two free native plants for your garden) as a ***thank-you gift*** for returning the **completed** questionnaire to us by 30th May 2013. If you are interested in receiving a thank-you gift, please provide your **contact details** in **the consent form** on the back of this questionnaire.

Even if you are not familiar with any of the parks in your neighbourhood, please complete as much of the survey as you can. If you have any questions about the study, please email us at d.wang7@uq.edu.au

Thank you!

25-04-2013

## Tell us about parks in your neighbourhood

(A **map** of the urban parks in your neighbourhood is available on the **BACK PAGE**)

**Q-1.** What is your **most common way** to travel to parks in your neighbourhood?

(*Please tick one response*) →

☐ Car /Motorcycle
☐ Public transport
☐ Walk
☐ Bike
☐ Other--- please specify________

**Q-2.** How **frequently do you use** public parks in your neighbourhood? →

(*Please tick one response*)

☐ Never
☐ Seldom (Not every month but at least once a year)
☐ Occasionally (Every month but not every week)
☐ Frequently (At least one time a week)
☐ Always (More than 3 times a week)

On average, about **how many times** do you visit public parks in your neighbourhood each month? →

____ **TIMES PER MONTH**

**Q-3.** Would you please rank the following methods from **Most Preferred (1) to Least Preferred (4)** as a method to travel to parks in your neighbourhood?

(*Please rank from 1 to 4*) →

___ Car /Motorcycle

___ Public transport

___ Walk

___ Bike

## **Q-4**. Do you **AGREE or DISAGREE** with the following statements?

**Example**: (***Please Circle One Response***)

| Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 2 | 3 | ④ | 5 |

| | Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| **There are a sufficient number of parks in my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |
| **There is sufficient area of parks in my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |
| **I am aware of parks and park facilities in my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |
| **I know how to get to the parks located in my neighbourhood** | 1 | 2 | 3 | 4 | 5 |
| **I have good knowledge of any changes made to park facilities in my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |
| **I am aware of the activities and programs held in the parks.** | 1 | 2 | 3 | 4 | 5 |
| **I know how to attend park activities in my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |
| **I have good knowledge of any changes to activities and programs held in the parks.** | 1 | 2 | 3 | 4 | 5 |
| **Most people in my neighbourhood are friendly.** | 1 | 2 | 3 | 4 | 5 |
| **Most people in my neighbourhood are trustworthy.** | 1 | 2 | 3 | 4 | 5 |
| **Residents in my neighbourhood share similar interests.** | 1 | 2 | 3 | 4 | 5 |
| **Residents in my neighbourhood help each other.** | 1 | 2 | 3 | 4 | 5 |
| **I feel a strong personal connection to my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |

Note: The responses range from "Strongly Disagree (**1**)" to "Strongly Agree (**5**)", please select one that best describe your circumstance.

**Q-5**. Do you **AGREE or DISAGREE** with the following statements?

**Example**: (***Please Circle One Response***)

| Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 2 | 3 | ④ | 5 |

| | Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| **My family and relatives would choose neighbourhood parks as a place to spend free time.** | 1 | 2 | 3 | 4 | 5 |
| **My friends would choose neighbourhood parks as a place to spend free time.** | 1 | 2 | 3 | 4 | 5 |
| **People who are important to me would encourage my use of neighbourhood parks.** | 1 | 2 | 3 | 4 | 5 |
| **I have a good work-life balance** | 1 | 2 | 3 | 4 | 5 |
| **I can find enough leisure time to visit parks if I want.** | 1 | 2 | 3 | 4 | 5 |
| **I have a physically active lifestyle.** | 1 | 2 | 3 | 4 | 5 |
| **I prefer an outdoor climate to staying indoors.** | 1 | 2 | 3 | 4 | 5 |
| **Outdoor exercise is an important part of my life** | 1 | 2 | 3 | 4 | 5 |

**Q-6.** How would you **RATE** the **SIGNIFICANCE** of the following hypothetical barriers in your decision whether or not to visit a particular park?

The responses range from Extremely Insignificant (EI)" to "Extremely Significant (ES)" (*Please circle one response per item*) **Example:**

| | | | | |
|---|---|---|---|---|
| EI | I | N | Ⓢ | ES |

| | Extremely Insignificant | Insignificant | Neutral | Significant | Extremely Significant |
|---|---|---|---|---|---|
| **Crossing a highway** | EI | I | N | S | ES |
| **Crossing a busy street or intersections** | EI | I | N | S | ES |
| **Crossing train tracks** | EI | I | N | S | ES |
| **Must pass through unsafe area** | EI | I | N | S | ES |
| **Other Barriers________** | EI | I | N | S | ES |

**Q-7**. Do you **AGREE or DISAGREE** with the following statements?

**Example:** (***Please Circle One Response***)

| **Strongly Disagree** | **Disagree** | **Neither Agree or Disagree** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|
| 1 | 2 | 3 | ④ | 5 |

| | Strongly Disagree ↓ | Disagree ↓ | Neither Agree or Disagree ↓ | Agree ↓ | Strongly Agree ↓ |
|---|---|---|---|---|---|
| **Travelling to parks is expensive.** | 1 | 2 | 3 | 4 | 5 |
| **The cost of travelling to parks influences my decision to visit parks.** | 1 | 2 | 3 | 4 | 5 |
| **Visiting parks requires available leisure time.** | 1 | 2 | 3 | 4 | 5 |
| **My available leisure time influences my decision to visit parks.** | 1 | 2 | 3 | 4 | 5 |
| **Visiting parks require a large personal effort.** | 1 | 2 | 3 | 4 | 5 |
| **The effort needed to visit parks influences my decision to visit parks.** | 1 | 2 | 3 | 4 | 5 |
| **I feel better when I see other people in parks doing the same activities that I like to do.** | 1 | 2 | 3 | 4 | 5 |
| **I feel better when I see people from the same ethnic or cultural background as me when I visit parks.** | 1 | 2 | 3 | 4 | 5 |
| **My physical and mental health is good enough to visit parks in my neighbourhood.** | 1 | 2 | 3 | 4 | 5 |
| **My use of parks is determined more by other family member needs (e.g. children or partner) than my own needs.** | 1 | 2 | 3 | 4 | 5 |
| **Visiting and using parks in my neighbourhood is an affordable activity.** | 1 | 2 | 3 | 4 | 5 |

Note: The responses range from "Strongly Disagree (**1**)" to "Strongly Agree (**5**)", please select one that best describe your circumstance.

**In this section, we would like to ask you about three SPECIFIC PARKS in your neighbourhood: Toohey Forest Park, Salisbury Recreation Reserve, Rosebank Square Park.**

( You can see their name and location on the map on the **BACK PAGE** of this survey booklet.)

**Q-1.** How would you rate your overall **EASE OF ACCESS** to each park listed below? *(Please* *<u>circle</u>* *one response for each park.)*

| | | | | | |
|---|---|---|---|---|---|
| **Toohey Forest Park** | Very easy | Easy | Neither easy or difficult | Difficult | Very difficult |
| **Salisbury Recreation Reserve** | Very easy | Easy | Neither easy or difficult | Difficult | Very difficult |
| **Rosebank Square Park** | Very easy | Easy | Neither easy or difficult | Difficult | Very difficult |

**Q-2.** How **EASY** is it for you to **PHYSICALLY** get to each Park listed below? *(Please* *<u>circle</u>* *one response for each park.)*

| | | | | | |
|---|---|---|---|---|---|
| **Toohey Forest Park** | Very easy | Easy | Neither easy or difficult | Difficult | Very difficult |
| **Salisbury Recreation Reserve** | Very easy | Easy | Neither easy or difficult | Difficult | Very difficult |
| **Rosebank Square Park** | Very easy | Easy | Neither easy or difficult | Difficult | Very difficult |

**Q-3.** Are there any **SOCIO-PERSONAL ISSUES** (e.g. perceived safety or antisocial behaviour) that make you avoid visiting each park below?

*(Please* *<u>circle</u>* *one response for each park.)*

| | | | | | |
|---|---|---|---|---|---|
| **Toohey Forest Park** | No concerns at all | A few concerns | Some concerns | Many concerns | Very high concerns |
| **Salisbury Recreation Reserve** | No concerns at all | A few concerns | Some concerns | Many concerns | Very high social concerns |
| **Rosebank Square Park** | No concerns at all | A few concerns | Some concerns | Many concerns | Very high concerns |

**Q-4.** Do you **Agree or Disagree** with the statements below for each park listed below? (The responses range from "Strongly Disagree" to "Strongly Agree". *Please circle one response for each park.*)

| Example: | Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | ④ | 5 |

| | **Toohey Forest Park** | **Salisbury Recreation Reserve** | **Rosebank Square Park** |
|---|---|---|---|
| **I intend to visit this park in the near future** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **It is highly likely that I will visit this park in the near future.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

**Q-5**: **A)** What is your **ESTIMATE** of the ***distance***, ***time***, and ***cost*** to reach each park listed below? (*Please enter your estimates below.* Don't worry about the accuracy of your estimates.)

| | **Toohey Forest Park** | **Salisbury Recreation Reserve** | **Rosebank Square Park** |
|---|---|---|---|
| **How far would you estimate the travel distance (in meters) is from your house to each park?** | ____metres | ____metres | ____metres |
| **How long would you estimate it would take you (in minutes) to get to each park using your common method?** | ____mins | ____mins | ____mins |

**B)** Do you **Agree or Disagree** with the statements below for each park listed below? (*Please circle one response for each park.* The responses range from "Strongly Disagree" to "Strongly Agree". *)*

| | **Toohey Forest Park** | **Salisbury Recreation Reserve** | **Rosebank Square Park** |
|---|---|---|---|
| **This park is close to where I live.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **Travel time to this park is acceptable.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **Travel cost to this park is acceptable.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

**Q-6.** Tell us your **experiences** with each park below. Do you **Agree or Disagree** with the following statements for each park? (The responses range from "Strongly Disagree" to "Strongly Agree".)

| **Example:** | **Strongly Disagree** | **Disagree** | **Neither Agree or Disagree** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | ④ | 5 |

| *(Please circle one response for each park.)* | **Toohey Forest Park** | **Salisbury Recreation Reserve** | **Rosebank Square Park** |
|---|---|---|---|
| **Visiting this park is enjoyable.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **Visiting this park is a positive experience** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **Visiting this park is fun.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **I can easily walk to this park** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **The walk to this park is a pleasant experience.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park is attractive to me because there are other people from my ethnic or cultural background at the park.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park is attractive to me because I can do my favourite activities with other people that share my interests (e.g. soccer, football, playground)** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **I am concerned with my personal safety when I travel to this park.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **I feel unsafe when visiting this park.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **There are people participating in illegal activities (e.g., selling drugs) around this park.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park is regularly patrolled by police.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park is a place with high crime at night.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **Homeless or vagrant people use this park.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

**Q-7.** In this question, we would like to know the level of importance of "the three parks" qualities to you. Do you **Agree or Disagree** with the following statements for each park? (The responses range from "Strongly Disagree" to "Strongly Agree")

| | | | | | |
|---|---|---|---|---|---|
| **Example:** | **Strongly Disagree** | **Disagree** | **Neither Agree or Disagree** | **Agree** | **Strongly Agree** |
| | 1 | 2 | 3 | ④ | 5 |

| *(Please circle one response for each park.)* | **Toohey Forest Park** | **Salisbury Recreation Reserve** | **Rosebank Square Park** |
|---|---|---|---|
| **This park provides attractive scenery.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park provides a place to learn about nature.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **The park provides places of cultural or historical importance.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park provides future development sites for homes, businesses, schools, shopping, and other facilities** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park helps produce and preserve clean air, soil, and water for the city.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park is important for future generations to experience our city as it is now.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **The park provides a place to enjoy natural landscapes such as forests, wetlands, streams, or lakes.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park is a good place to have fun with family, friends, and others.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park provides valuable habitat for plants and animals to live.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park provides a place for physical activities and exercise.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park provides a change or contrast from being indoors.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| **This park provides a place to escape personal or social pressures.** | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

## Please tell us a little about yourself

**Q-1.** What is your gender? ☐ Male ; ☐ Female

**Q-2.** What is your age? _______Years

**Q-3.** Where were you born? ☐Australia; ☐ Overseas

**Q-4.** Do you rent or own your home? ☐ Rent; ☐ Own

**Q-5.** How long have you lived in this neighbourhood? _______Years

**Q-6.** Do you own a private vehicle? ☐ Yes; ☐ No

**Q-7.** Do you speak a language other than English at home? (tick one only)

☐ No, English only
☐ Yes, Arabic
☐ Yes, Mandarin
☐ Yes, Italian
☐ Yes, Greek
☐ Yes, Vietnamese
☐ Yes, other language. Which?

**Q-8.** Which life cycle stage best describes you? (tick one only)

☐ Single, no children
☐ Single, youngest child under six
☐ Single, youngest child six or older
☐ Couple, no children
☐ Couple, youngest child under six
☐ Couple, youngest child six or older

**Q-9.** What is the highest level of formal education you have completed? (tick one only)

☐ Secondary school
☐ High school diploma or certificate
☐ University graduate (Bachelor degree)
☐ Postgraduate diploma/certificate or Bachelor Honours
☐ Master degree
☐ Doctorate

**Q-10**. What is your total before-tax household income per year? (tick one only)

☐ $1—$10,399
☐ $10,400—$15,599
☐ $15,600—$20,799
☐ $20,800—$31,199
☐ $31,200—$41,599
☐ $41,600—$51,599
☐ $52,000—$64,999
☐ $65,000—$77,999
☐ $78,000—$103,999
☐ $104,000 or more

**Q-11.** How would you rate your general health and fitness? (tick one only).

☐ Excellent
☐ Very Good
☐ Good
☐ Fair
☐ Poor

## Other Comments?

**Is there anything else you would like to tell us about your use of parks?**

*Thank you very much for contributing to this research project.*

Please **sign on the consent form** and **return** the completed survey in the self-addressed envelope provided in the next page.

If you need any assistance in filling out this survey, please contact us at the University of Queensland on (07) 3365 6534 or email d.wang7@uq.du.au.

## Participant Consent Form

Dear Participant:

If you participate in this study, the information will not be linked back to you as an individual. The information will be stored in a secure environment and access to the data will be made available only to the members of the research team. Your comments will be kept confidential and any information provided will only be used for the purposes of this research.

As a participant in this research, your acceptance is required as confirmation of your informed consent to participate in this study. Your Participation is voluntary and you may withdraw at any time.

This study adheres to the Guidelines of the ethical review process of The University of Queensland. Whilst you are free to discuss your participation in this study with investigator Dong Wang (contactable on (07)3365 6534), if you would like to speak to an officer of the University not involved in the study, you may contact Dr Annie Ross, the Ethics Officer on 3365 1450; or 3365 6084; or annie.ross@uq.edu.au.

### Declaration:

I hereby agree to be involved in the above research project as a participant. I have read the research information sheet pertaining to this research project and understand the nature of the research and my role in it.

I understand that I and my position will not be identified in the project. Potential identifying information will be used ONLY for the purpose of providing you with a summary of results. All responses will be coded and will contribute to the pooled data of the research team, so no individual responses will be made available.

I understand that none of the information that I provide will be described or portrayed in any way that will be identify me in any report on the study.

Would you like to receive a copy of the survey results?

☐ YES. PLEASE SEND ME THE SURVEY RESULTS AND MY EMAIL IS..................................

Would you like to receive one BCC Free Plant Voucher as SURVEY GIFT?

☐ YES, PLEASE SEND ME ONE AND **MY CONTACT DETAILS ARE**:

Name of recipient_________________ House/Unit No. __________________

Street address:________________ Suburb :______________________

Postcode:______________

(Sorry, we can't send to a PO Box)

**Signature** .................................. **Date** …….......................

***Return Envelope here***

*PLEASE RETAIN THIS PAGE FOR YOUR INFORMATION*

# Participant Information sheet

**Project title:** How accessibility contributes to urban park use and values

### *What is the study all about?*

This survey asks you about how you access, use and value your community parks. The aim is to identify key factors that influence people's access to and use of urban parks. The information you provide will help us develop better ways to manage and provide access to community parks.

### *Who is carrying out the study?*

This study is initiated and conducted by a research team in the school of Geography, Planning and Environmental Management, University of Queensland. You are welcome to discuss your participation in this study with the investigator Dong Wang on (07) 3365 6534; or email: d.wang7@uq.edu.au

### *How much time will the study take?*

We would greatly appreciate your participation in the study. We estimate about 15 minutes to complete the questionnaire.

### *Can I withdraw from the study?*

Your participation in this study is voluntary and you may withdraw at any time.

### *Will the information I provide be kept confidential?*

The information you provide will not be linked back to you as an individual. Only aggregated results will be reported. The information will be stored in a secure environment and access to the data will be made available only to the members of the research team. Your comments will be kept confidential and any information provided will only be used for the purposes of this research.

### *What if I require further information?*

If you would like to receive a copy of the survey results, please provide your email address at the end of the consent form. If you need any assistance in filling out the survey, please contact us at University of Queensland on (07) 3365 6534.

This study adheres to the Guidelines of the ethical review process of The University of Queensland. Whilst you are free to discuss your participation in this study with investigator Dong Wang, if you would like to speak to an officer of the University not involved in the study, you may contact Dr Annie Ross, the Ethics Officer on 3365 1450; or 3365 6084; or annie.ross@uq.edu.au

Investigator: Dong Wang

Tel. (07) 3365 6534 Email: d.wang7@uq.edu.au

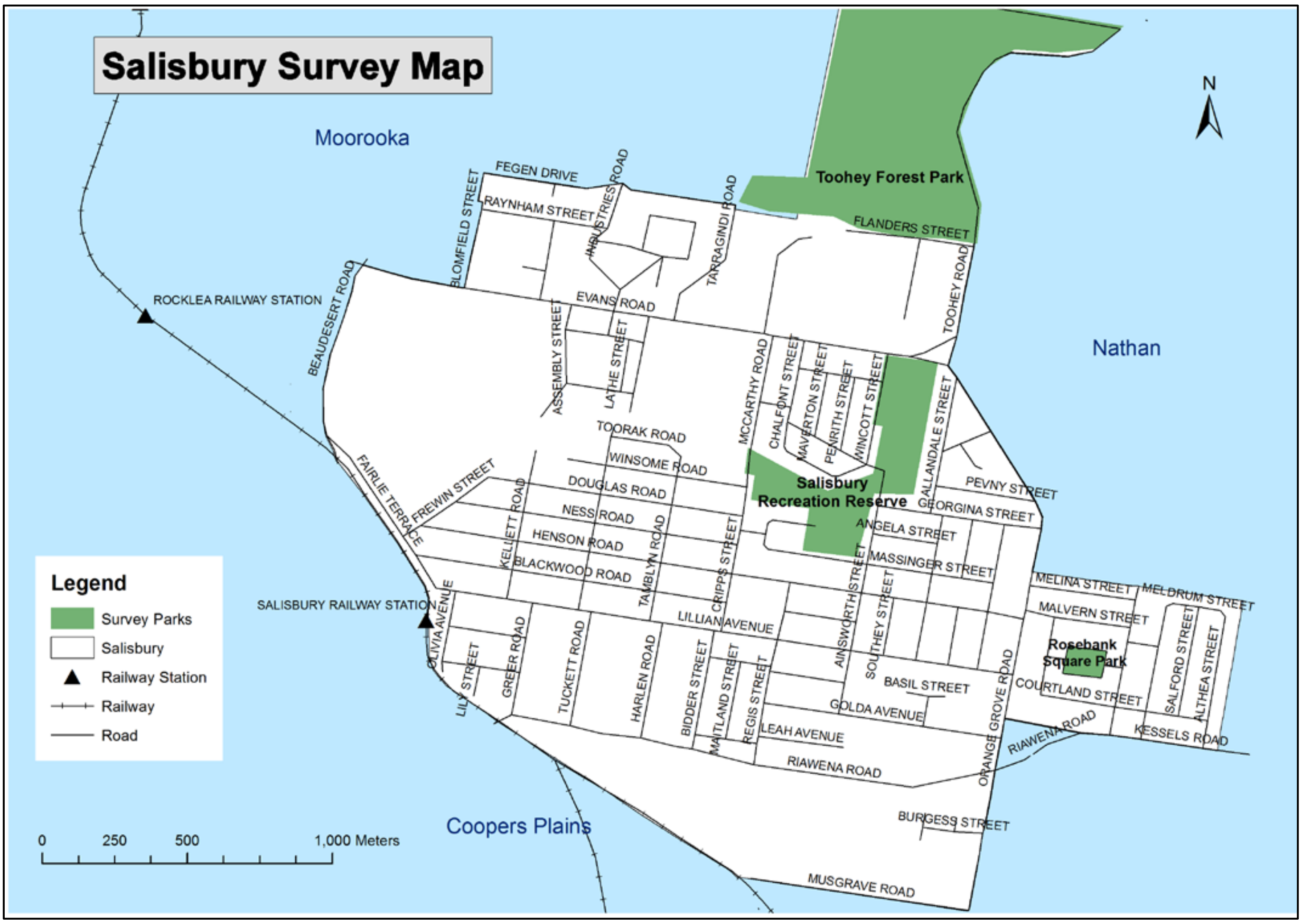
Advisor:

| | |
|---|---|
| Associate Professor Greg Brown | Email: g.brown2@uq.edu.au |
| Dr. Derlie Mateo-Babiano | Email: i.mateobabiano@uq.edu.au |

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

# Location of parks

⇩



Please return your completed questionnaire to:

Dong Wang
Level 4, Chamberlain Building (35),
School of Geography, Planning and Environmental Management,
University of Queensland Brisbane, Qld, 4072 Australia
Phone: (07) 3365 6534
Email: d.wang7@uq.edu.au

# Appendix II: Ethical clearance approval

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

**School of Geography Planning and
Environmental Management**

24 July 2012

TO: Dong Wang
FROM: Annie Ross, GPEM Ethics Officer
CC: Greg Brown

RE: Application for Ethics Approval

PROPOSAL TITLE: [GPEM number 20120018] *How accessibility contributes to urban park use : a cross-cultural study*

In my capacity as the School of GPEM Ethics Officer, I have reviewed the above research proposal for compliance with University and School regulations governing human subjects research.

The proposed research is not subject to higher level review by the University Behavioural and Social Sciences Ethical Review Committee (BSSERC) for the following reasons: 1) the research does not directly involve human subjects from vulnerable or special populations, 2) the research does not involve any risk above "everyday living", 3) the research is not intrusive, and 4) informed consent will be obtained before data collection, participation is voluntary, and participants may withdraw at any time. The research is thus classified as low risk and School level ethics approval is appropriate.

The research proposal, as presented, complies with the National Statement on Ethical Conduct in Human Research and the associated university regulations. You may conduct the research subject to the following conditions. 1) the interviews should be conducted as described in the research protocol, 2) participants should not be personally identifiable in the results without explicit permission of the participant, 3) the data collected is to be kept in a secure location. Should any of the above conditions change, you must refer the amended research protocol back to the GPEM Ethics officer.

If you have questions about the ethics review process, please contact me.

Annie Ross

Dr. Annie Ross (annie.ross@uq.edu.au)
Ethics Officer
School of Geography, Planning, and Environmental Management

School of
Geography Planning and
Environmental Management

The University of Queensland
Brisbane QLD 4072 Australia

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http://www.gpem.uq.edu.au/

THE UNIVERSITY
OF QUEENSLAND

| **CLEARANCE Nº**<br>(office use only) |
|---|
| |

# SCHOOL OF GEOGRAPHY, PLANNING AND ENVIRONMENTAL MANAGEMENT

## Application Form for Ethical Clearance for Research Involving Human Participants

## For review School of GPEM Ethics Officer

### For Undergraduate and Postgraduate Student Research up to and including PhD

## Instructions

As part of the design process of any research involving human subjects, all researchers must pay careful consideration to their ethical obligation to conduct research that protects the welfare and the rights of all human participants. This requires researchers to familiarise themselves with the national codes of ethical research as outlined by the National Health and Medical Research Council (NHMRC) and to subject all research involving humans to ethical review by an appropriate ethics committee.

The University of Queensland operates a peak ethical review committee, the Human Experimentation Ethics Review Committee (HEERC), and two ethics sub-committees, the Behavioural and Social Sciences Ethical Review Committee (BSSERC), and the Medical Research Ethics Committee (MREC). Most, but not all, social science applications are considered by the BSSERC. These three institutional ethics committees are duly constituted under the Australian Human Ethics Committee (AHEC) which is a committee of the NHMRC.

In order to expedite the process of ethical review for students up to the level of, and including, PhD, the School of Geography, Planning and Environmental Management has been designated under the AHEC to review ethical protocols for research that does not constitute a risk to human subjects beyond the normal risk of everyday living, and that does not involve groups considered especially vulnerable. School committees are not constituted under, or registered with, the Australian Human Ethics Committee to approve ethical procedures that involve a risk above the risk of everyday living. Protocols involving a higher risk will properly fall within the jurisdiction of the BSSERC. These *may* include research involving:

- Vulnerable groups, such as people with an intellectual or mental impairment
- Children and young people under the age of 18 (in addition, a Blue Card is required)
- Persons who are highly dependent upon medical care
- Persons in dependent or unequal relationships (such as patients and health care experts, teachers and pupils, employees and their employers or supervisors)
- People who may be involved in illegal activities
- Aboriginal and Torres Strait Islander peoples, as well as other distinct ethnic and cultural groups
- People in other countries
- Socially isolated or marginalised groups.

If the school committee considers the risk to be above the prescribed level, or considers it prudent in the circumstances for an institutional ethics committee to review the protocol (for example, because the research is of a particularly sensitive nature or the study population is a particularly vulnerable group), then the application may be referred to the appropriate institutional committee (such as the BSSERC). Alternatively, the school committee may require the protocol to be amended in order to reduce the risk to within the threshold level.

## Application Process

Students seeking ethical clearance for their research proposals should undertake the following procedures:

- Consult their academic advisors in preparing their ethics application and ask their supervisor to complete and sign the declarations.
- Familiarise themselves with the NHMRC's national statement on ethical conduct in research involving humans (http://www.nhmrc.gov.au/_files_nhmrc/file/publications/synopses/e72-jul09.pdf) and the UQ Guidelines / Interpretation of the National Statement (http://www.uq.edu.au/research/rrtd/files/human/uq_interpretations_national_statement.rtf).
- Download an ethical review application form from the School website and, working with their advisor, provide a detailed response to each question
- Prepare the necessary ancillary material including, where necessary, written consent forms, research information sheets, questionnaires and letters to relevant gatekeepers. Ensure the relevant University of Queensland ethical paragraph is included on all information sheets and other documents provided to research participants
- Submit an *electronic application form*, along with a fieldwork plan and risk assessment form, to your Principal Supervisor for final review, who will in turn submit it to the School Ethics Officer at annie.ross@uq.edu.au.
- In cases where ethics applications are submitted directly to BSSERC, you are required lodge a copy of your application with the School and provide us with a copy of your ethical clearance certificate once approval has been granted
- Any changes to the originally approved research protocol, including amendments to participants, recruitment techniques and methods, need to be resubmitted for approval on an Amendment to Approved Proposals form from Dr Annie Ross annie.ross@uq.edu.au

Your application will then be forwarded to the School of Geography, Planning and Environmental Management Ethics Officer (Dr Annie Ross), for approval. In cases where the risk for research participants is considered to be above the prescribed level, you will be asked to either resubmit your application to the BSSERC or to consider revising your project in order to reduce the risk to within the threshold level.

## Timeframe

Please note that a full review through BSSERC can take a minimum of eight weeks while expedited reviews undertaken by the School can take a minimum of two weeks. It is possible that the School Ethics Officer may request that students revise and resubmit their applications to address a particular issue of concern. Data collection from human participants cannot commence until ethical approval has been granted.

Students should also be advised that, due to staff research activities and absences, any ethics applications submitted during non-teaching periods are likely to take longer to review.

## Further information

The National Health and Medical Research Council has prepared a *National Statement on Ethical Conduct in Research Involving Humans* (2007), setting out national standards for the ethical design, review and conduct of human research. The statement is available at: http://www.nhmrc.gov.au/_files_nhmrc/file/publications/synopses/e72-jul09.pdf.

To speak to an ethics officer, please contact the following:

Dr Annie Ross
School Ethics Officer
School of GPEM
The University of Queensland
Tel: 3365 1450/3365 6084
Email:annie.ross@uq.edu.au

Michael Tse
Human Ethics Officer
Research and Research Training Division
The University of Queensland
Tel: 3365 3924
Email: humanethics@research.uq.edu.au

## SUPERVISOR DECLARATION

**(To be completed and signed by principal supervisor once all sections of the ethics application form and associated documents have been completed and read by the supervisor)**

I confirm that I have read and approved all sections of this ethics application and associated documents.

I confirm that this application has been submitted to the Ethics Officer **at least 4 weeks prior to commencement of fieldwork.**

I confirm that I am not aware of any additional ethical issues associated with this research other than those detailed in this form and associated documents.

I confirm that I have procedures in place to closely monitor the research process and will be in regular contact with the student throughout all stages of the research.

Name Greg Brown  Signed Greg Brown  Date 17/7/12
(Principal Supervisor)

**CLEARANCE Nº**
(office use only)

THE UNIVERSITY OF QUEENSLAND

SCHOOL OF GEOGRAPHY PLANNING AND ENVIRONMENTAL MANGEMENT

## Application Form for Ethical Clearance for Research Involving Human Participants

## For review by School of Geography, Planning and Environmental Management Ethics Officer

### For Undergraduate and Postgraduate Student Research up to and including PhD

**Project Title:**
How accessibility contributes to urban park use : a cross-cultural study

| | |
|---|---|
| **Student Name:** | Dong Wang |
| **Student Number :** | 41559060 |
| **Co-investigators (where applicable)** | |

| | |
|---|---|
| **Project Supervisor/s** | Associate professor Greg Brown<br>Dr. Derlie Mateo-Babiano |
| **Other relevant authority (ie industry partner, project sponsor)** | |

| | **Telephone** | **Fax** | **Email** |
|---|---|---|---|
| **Contact details of principal investigator** | **0430606681** | | **d.wang7@uq.edu.au** |
| **Contact details of supervisor** | **7-3365-6654** | | **g.brown2@uq.edu.au** |
| **Contact details of supervisor** | **7-3365-3916** | | **i.mateobabiano@uq.edu.au** |

| | |
|---|---|
| **Degree enrolled:** | PHD |
| **If project funded, name of funding body:** | GPEM |

| | | | |
|---|---|---|---|
| **Project location** | Brisbane, Australia and Guangzhou, China | **Project duration** | 3 years |

**A. Is this submission identical or very similar to a previously approved protocol?** **YES / [✓ NO]** (circle)

If **YES**, please provide clearance nº **and** indicate whether identical or very similar:

**B. Does this submission hold other ethical clearance? If yes, please provide details.** **YES / [✓ NO]** (circle)

**Note:** Copies from other **AHEC** fully registered ethics committees must be attached.

**PLEASE ANSWER ALL OF THE FOLLOWING QUESTIONS**
Please refer to the NHMRC National Guidelines when completing this form
http://www.nhmrc.gov.au/publications/synopses/_files/e72.pdf

**In every day or lay language, please provide a summary of the project – including aims and benefit**

Defining and measuring accessibility is crucial in public resource allocation. To achieve equitable facility distribution requires an adequate understanding about the concept of accessibility, its influential factors and improving accessibility of various groups. However, the existing knowledge on accessibility to public facilities is incomplete, especially at the individual perceptual level, its role in influencing people's use behaviour and its perceived values. Previous works illustrate that while accessibility has been developed as a multi-dimensional construct, its measurement has been limited to its physical and temporal dimensions, leaving other relevant factors such as social conditions and personal constraints, including perceptions, largely unexplored. This study proposes to fill these knowledge gaps.

Urban public parks play an important role in contributing to the quality of urban life. Thus, urban parks as the specific public facility will be the contextual focus in this research. The study introduces an alternative integrative model to define and measure park accessibility. It aims to empirically validate and examine this integrative model on the extent to which accessibility variables, both in spatial and non-spatial dimensions, contribute to people's perception of park accessibility. Furthermore, the integrated park accessibility model is incorporated into an extended behavioural framework, which is developed based on the theory of planned behaviour (TPB) and the theory of urban park geography (TUPG), to investigate the significance of accessibility in contributing to behavioural change and value change, relative to other subjective components (e.g. attitudes, subjective norms, etc.).

This study will contribute to the academic field by providing an integrated construct of park accessibility; an expanded behavioural framework describing the relationship between park accessibility, perceived park value and self-reported use behaviour; an empirical test investigating the significance of accessibility variables in affecting park use behaviour and perceived park value; a cross-cultural validation of the proposed models.

**1) Using everyday language, please give details of the research plan**
Note: The committee needs sufficient information to put into context the ethical considerations listed in later questions.

**Research design:** This research will use a survey-based quantitative research design. Three major study steps are designed in order to answer the proposed research questions. They are model development, model validation and cross-cultural model validation. Model development involves a process of conducting an explorative desktop review to identify knowledge gaps and an inductive reasoning approach to develop the theoretical framework used in this research. The next step is to empirically examine the proposed models with empirical data collected from neighbourhood level survey data. This step aims to identify associations between the variables in the framework and validate the models. The last step involves a cross-cultural validation of the model with data collected from two different cultural settings. It is a similar deductive inference approach as adopted in the second step, but will incorporate a comparative analysis to identify the cultural influence on the models.

**Data collection:** This research selects the city of Brisbane in Australia and the inner city of Guangzhou in China as its sample cities to enable the comparative study. The selection of sample cities is based on their similarities according to the selection criteria with the exception of culture. Survey data collected from these two cities will contribute to the pooled data for quantitative data analysis.

This research will adopt a two-stage sampling design for data collection in each sample city.

The first sampling stage will select two neighbourhoods of contrasting socio-economic status (SES). A socially-disadvantaged neighbourhood and a socially-advantaged neighbourhood. These two selected neighbourhood will provide contrast in SES level while provide providing comparable attributes in terms of public parks distribution.

This section provides the sampling process using the city of Brisbane as an example. Firstly, all Brisbane suburbs are sorted according to their respective SEIFA decile ranking within the state of Queensland. Then, resident population and park features (no. of parks and area of parks) are compared between suburbs. Based on these criteria, two suburbs were determined as study areas for Brisbane. One is Coopers Plains, which has a lower SES level (SEIFA Decile Ranking of 5 within the state) and the other is Graceville with the highest SES level in Queensland. Both these suburbs are surrounded by suburbs with similar social economic conditions.

The second sampling stage will randomly draw a representative sample from local population of each neighbourhood for conducting neighbourhood level survey. Systematic random sampling method is used to reduce the likelihood of bias.

**Pre-test**: The draft survey document will be pre-tested before implementation. Pilot survey will be conducted in the University of Queensland St Lucia campus. The aim of the pilot survey is to ensure the questionnaire is well-presented and easy to understand. Pilot survey participants will be selected by using mixed sampling methods: three professionals will be purposively selected from who have good knowledge in urban parks, public facilities delivery and urban planning; three domestic and three international students from China will be chose by using convenience sampling methods.

**Survey Implementation:** A mail survey will be adopted as the primary data collection strategy in Brisbane. Survey questionnaires will be distributed to participants' residential address. To increase the expected low response rate a follow-up household survey will be conducted from the third week after the initial mail-out. In addition, internet survey is considered as an effective supplement according to the availability of data and resources.

**2) Who are the participants or informants and how will they be recruited?**

Note: Details of approximate number, age range, and male/female ratios are required.

(Please note that the School cannot approve research involving people under the age of 18 years)

This survey aims to recruit approximately 150-200 survey participants from each sample neighbourhood. Only those 18 years old and above will be invited to participate in this study. Due to the nature of the target population and the process of selection, there may be a wide range of age groupings but, to the extent possible, this study aims for a representative sample of male/ female participants. The target survey sample is to the demographic characteristics for each neighbourhood based on ABS census data.

**3) Participation by vulnerable groups**

The NHMRC has identified certain social groups as vulnerable and requires all researchers to take special care to protect the interests of these groups if they are in any way involved in the project. Those groups include: children; people with an intellectual disability; people highly dependent on medical care; people in dependent relationships; people in other countries; and collectivities with their own social structures linked by a common identity and or common customs. Separate guidelines have been developed for Aboriginal and Torres Strait Islander Peoples.

Identity whether participation of any vulnerable groups is likely:

| | | |
|---|---|---|
| no participation likely | some participation likely | a focus of the research |
| ☑ | ☐ | ☐ |

Note: If participation of vulnerable groups is likely to take place, the protocol may not qualify for School review and a separate application will need to be submitted to the BSSERC.

Vulnerable groups are not the target of this study. Their participation is voluntary and is unlikely to take place without their willingness. Similar survey will be conducted in a Chinese city

**4) Participation by Aboriginal and Torres Strait Islander peoples**

The involvement of Aboriginal and Torres Strait Islander peoples in the research carries additional ethical responsibilities, which are outlined in the NHMRC statement. Any research where there is a chance that participants will be of Aboriginal and Torres Strait Islander background must adhere to these guidelines. In cases where Aboriginal and Torres Strait Islander people and their culture are the *focus* of the research, the protocol must be reviewed by the BSSERC. Please note below what, if any, additional measures will be put in place for participants of Aboriginal and Torres Strait Islander background.

Aboriginal and Torres Strait Islander people are not the target of this study. If selected in the random sampling process, their participation is voluntary.

**5) How will informed consent be obtained from participants or informants?**

A letter of consent will be posted in the same package with the survey questionnaire to participants' residential address. The participants will be asked to sign the letter before proceeding with the survey.

**6) Provide details of procedures for establishing confidentiality and protecting privacy of participants or informants**

The identity of participants will neither appear on the survey, nor link to the survey documents.

The questionnaire will be posted to an address rather than a name.
These survey documents will be collected both anonymously and confidentially.

**7) Provide details of data security and storage**
Refer to Section 4.20.2.2 of the Handbook of University Policies and Procedures for advice on retention of data (available at http://www.uq.edu.au/hupp/index.html?page=25156&pid=25154).

The survey documents obtained from participants will be stored in a secured office in the University of Queensland. A secured computer will be used to store and analyse the survey data and data sharing will be limited within the research team.

**8) Provide details of ethical issues likely to be encountered as part of your research**
For example. Are there issues of gender that need to be considered? Are there matters that will cause distress to your informants? Are you wishing to acquire personal information about people's financial situations or lifestyle preferences? Please list any and all issues that could occur as a result of your research.

Few ethical issues would likely be encountered as part of this research.

There is low risk in the implementation of the survey that would potentially cause distress to survey participants given that the survey will focus on the general attitudes and use of public urban facilities such as parks. Personal information about people's financial status and their attitudes towards parks are required, however such information will not be linked to the identity of respondents and only aggregated result will be reported.

The questions devised for the questionnaires will be carefully piloted to preclude items that may be considered offensive, culturally inappropriate, intrusive , misleading , biased , inconsiderate, impertinent or abstruse.

**9) Provide details of how you will address each of the ethical concerns listed in Question 8.**

As there is only limited ethical concerns in this research, I will reassure the survey participants in *participant information sheet* that the information obtained from them will be treated confidentially and only be used for academic purpose

**10) In what form will the data be collected**
Note: Tick the most appropriate box:

(i) Identified ☐ (ii) Potentially Identifiable ☑ (iii) De-Identified ☐

The survey will be distributed by residential address, not by names

**11) In what form will the data be stored and/or accessed:**
Note: Tick the most appropriate box:

(i) Identified ☐ (ii) Potentially Identifiable ☐ (iii) De-Identified ☑

**12) Give details of how feedback will be available to participants or informants**
In particular, how will you ensure that you have permission to quote data collected via qualitative research methods?

Survey participant will authorize the use of data by signing the letter of consent. The outcome of the survey is available and the link of published article will be sent to the participants who express their interest of feedback by providing their email address.

13) **Does the project involve any of the following possibilities? If YES, provide details and explain how risks will be minimised (Please attach a Risk Assessment Form to this application and discuss below any potential risks identified):**

**a) The possibility of physical stress/distress, or discomfort**

*1. to the participants:*

*No risk*

*2. to the researchers/data collectors:*

*No risk*

**b) The possibility of psychological/mental stress/distress, or discomfort**

*1. to the participants:*

*No risk*

*2. to the researchers/data collectors:*

*No risk*

**c) The possibility of the researcher being harmed in any way from engaging in the research activity**

Low

**d) Deception of, or withholding information from, participants at ANY stage of the project**

No

**e) Access to data held by a Commonwealth Department or Agency**

No

**f) Access to data by bodies or people other than the investigators (eg, medical records)**

No

**14) Please indicate what you think is the level of risk for prospective participants against the scale below**

Tick the most appropriate box. (Refer to the UQ Guidelines)

☐ **Extreme Risk**
☐ **High Risk**
☐ **Some Risk**
☐ **Minimal Risk**
☒ **No Foreseeable Added Risk Above the Risks of Everyday Living**

**15) How has the possibility of withdrawal from the project been addressed?**
Note: Ensure that details and effects of withdrawal without prejudice at any time have been considered and explained.

Participants may withdraw from the project at any time during the research with prior notice.

**16) Please note that this section must be completed for funded research or the application will not be processed.**

a) Is this project receiving financial support to conduct the research? [✓ YES]/NO

b) If Yes, from what source(s)?
GPEM

c) Provide details of any other "in kind" support for the project or direct or indirect payment to any investigator

The investigator will seek collaboration with local academic institutions when the survey is implemented in China.

d) Please provide details of participant reimbursement for their involvement in the project, if any
Note: This could be cash payment, food vouchers, free services, or movie passes, etc.

Small thank-you gifts (e.g. pen, bookmarks, etc.)

**17) In undertaking this research do any "conflict of interest" issues arise?**
If YES, please provide details.
Note: Conflict of Interest may arise, for example, because a researcher, or someone close to the researcher, stands to benefit financially from the research or the carrying out of the project or because inconsistent or incompatible obligations exist. Refer to Chapter 5.4 of the NHMRC National Statement.

No. Random sampling is used in neighbourhood survey to select survey participants

**ATTACHMENTS:**

**1) Participant Consent Form** **[✓ Yes]/No**
**Note:** for examples of what should be included in a consent form, please consult page 12 of the UQ Guidelines for Ethical Review of Research Involving Humans. Also refer to "Checklist" below.

**2) Participant Information Sheet** **[✓ Yes]/No**
**Note:** for External Use, forms should be released on letterhead and contain University Ethical Paragraph.
Refer to UQ Guidelines and Ethics website, and "Checklist" below.

**3) Questionnaire** (if applicable) **[✓ Yes]/No**

**4) Survey instrument** (if applicable) **Yes/No**

**5) Gatekeepers or Permission-Givers** (if applicable) **Yes/No**
**Note:** A 'gatekeeper' or 'permission-giver' is a person authorised to write a letter of authority and recognition from an organisation of any type involved with the research, which gives permission to the researcher for access to the population under the gatekeeper's or 'permission-giver's' authority.

**5) Fieldwork Plan and Risk Assessment Form** **Yes/No**

**6) Other - please specify __________________________________________** **Yes/No**

## DECLARATION

We/I, the undersigned researcher(s) have read the University of Queensland's Guidelines for Ethical Review of Research Involving Humans - 2000 and agree to abide by them in the conduct of this research. It is understood that this includes the reporting and monitoring roles associated with the approval by the University of Queensland.

**Signature of Principal Investigator:** DONG WANG
**Date: 16 / 07 / 2012**

**Signature of Supervisor** (if applicable)**:_____** Greg Brown
________________________________________

**Date: 16 / 07 / 12**

---

**Applications should be submitted electronically to:**

**Dr Annie Ross**
**Ethics Officer**
**School of Geography, Planning and Environmental Management**
**Email:** annie.ross@uq.edu.au

## Submission of Research Protocols for Human Ethical Clearance

### APPLICATION CHECKLIST

This checklist is supplied for use as an additional means of ensuring all aspects of the proposed study have been considered and adequately detailed before submission to the Ethics Officer. A copy may be attached to the original application form for the reviewing Committee to support your submission.

**Project Title:**
**Principal Investigator:**

**Participant Information Sheet**

| | YES | NO | IF NO, WHY? |
|---|---|---|---|
| 1. Version for each participant group (if applicable) | | X | Not applicable |
| 2. On letter-headed paper | X | | |
| 3. Full title of project | X | | |
| *4.* Lay title of project (if applicable) | | X | Not applicable |
| 5. Names, positions and affiliations of all investigators (including supervisor) | X | | |
| 6. Clear purpose of study | X | | |
| 7. Non-technical language | X | | |
| 8. Details of participation / procedures | X | | |
| 9. Duration of participation | X | | |
| 10. Location for participation | X | | |
| 11. Risks outlined and how managed | X | | |
| 12. Expected outcomes of research / direct benefits to participants | X | | |
| 13. What support if something goes wrong | X | | |
| 14. Freedom to withdraw without penalty | X | | |
| 15. Assurance of confidentiality | X | | |
| 16. Access to results | X | | |
| 17. Debriefing | X | | |
| 18. Reimbursement to participants | X | | |
| 19. Need for Witnesses (if applicable) | | X | Not applicable |
| 20. Contact details for further questions | X | | |
| 21. Ethical clearance statement | X | | |

**Participant Consent Form**

| | YES | NO | IF NO, WHY? |
|---|---|---|---|
| 1. Version for each participant group (if applicable) | | X | Not applicable |
| 2. Full title of project | X | | |
| 3. Lay title of project (if applicable) | | X | Not applicable |
| 4. Names, positions and affiliations of all investigators | X | | |
| 5. Provision of space for full name of participant | X | | |
| 6. Written declaration of informed consent, eg, "I have read/"I understand…" | X | | |
| 7. Freedom to withdraw without penalty | X | | |
| 8. Assurance of confidentiality | X | | |
| 9. No benefit for participation | X | | |
| 10. Provision for signature of participant | X | | |
| 11. Provision for signature of guardian, relationship to participant and date | X | | |

## University of Queensland Ethical Paragraphs

### *Expedited review*

The following paragraph is to be incorporated into all information sheets and questionnaires given to participants involved in human research projects which have received or are applying for expedited review by the School of Geography, Planning and Environmental Management Ethics Officer at The University of Queensland:

> This study adheres to the Guidelines of the ethical review process of The University of Queensland. Whilst you are free to discuss your participation in this study with project staff (contactable on ......................), if you would like to speak to an officer of the University not involved in the study, you may contact Dr Annie Ross, the Ethics Officer on 3365 1450; or 3365 6084; or annie.ross@uq.edu.au.

## Sample Declaration for Informed Consent Form

The following paragraph, or similar, should be included on the informed consent sheet as part of the participant's declaration that informed consent has been granted:

> I hereby agree to be involved in the above research project as a participant. I have read the research information sheet pertaining to this research project and understand the nature of the research and my role in it.

# Appendix III: Supply of digital data agreement with Brisbane City Council

*Dedicated to a better Brisbane*

**Brisbane City Council**

**Corporate Services**
**Spatial Information Services**
Level 2, 505 St Pauls Terrace
Fortitide Valley, QLD 4006

Contact Adrian Sturk
Telephone + 61 7 340 36863
Facsimile + 61 7 3334 0069

**BCC REF : BM85243**

## SUPPLY OF DIGITAL DATA
## CONSULTANTS AGREEMENT

This agreement dated this 20th day of February, 2012 is made between the Brisbane City Council (the licensor) and School of Geography, Planning and Environmental Management, University of Queensland of Level 5, Chamberlain Building (35), Campbell Road St. Lucia 4072 (the licensee).

### 1.0 TERMS AND CONDITIONS FOR THE SUPPLY OF DIGITAL DATA TO CONSULTANTS

The Licensor agrees to supply to the Licensee the licensed data specified in 'Schedule A', and the Licensee agrees to only use such data for the permitted use and subject conditions and restrictions specified in 'Schedule A', and the Licensee agrees to pay the Licensor the fee specified in 'Schedule A'.

### 2.0 DEFINITIONS

(a) **Cadastral** means relating to titles or registered interests over land or water, or to the alienation, leasing or occupation of State lands or mining areas or roads, and includes reference to the boundaries of the land, area or road.

(b) **Consultant** means any consultant, contractor or business partner of the Licensor engaged for a specific project for the Licensor.

(c) **Brisbane City Council Data** means any data owned by the Brisbane City Council. It includes data that has been reformatted or converted on to a different media or translated into another format.

(d) **Copyright Owners** means any relevant copyright owner referred to in section 8 of this agreement.

(e) **Intellectual Property Rights** means all copyright, patent application rights, patent rights, design rights, database rights, trade mark rights (whether registered or unregistered), trade secrets and confidential information, all know-how, and all other rights of intellectual property.

(f) **Licence** means the non-exclusive, non-transferable licence granted by the Licensor to the Licensee pursuant to this agreement.

(g) **Licensor** means the Brisbane City Council.

(h) **Licensee** means any corporation, organisation or person who is granted access for payment or otherwise Licensed Data or Licensed Data Products by the Licensor.

(i) **Licensed Data** means all data which is identified in section 5 of 'Schedule A' of this agreement (Licensed Data Specification). It represents data that is currently available to the Brisbane City Council at the date of issue. It includes data that has been reformatted or converted on to a different media or translated into another format.

(j) **Licensed Data Product** means any value added product derived from or based on the Licensed Data or any Licensed Data Product.

(k) **DERM Digital Cadastral Data** means that information relating to the Cadastral land parcels of the State which is extracted from the DCDB and supplied to the Brisbane City Council under license agreement. It includes data that has been reformatted or converted on to a different media or translated into another format.

*LICENSEE DELEGATE SIGNATURE*

Under this agreement, you (the licensee) undertake to comply with the following conditions.

## 3.0 PERMITTED USE AND RESTRICTIONS

3.1 The Consultants use of the Licensed Data or Licensed Data Product shall be limited solely to its own personal use, and use by licensed subcontractors, and shall include specific permitted use and restrictions as specified in section 8.0 of 'Schedule A'. Unless specified to the contrary in section 8.0 of 'Schedule A', the data shall not be made available to third parties (including any corporation, institution, organisation or person in any manner associated with the recipient), on-sell or distribute the data for reward to any other third party.

3.2 The Consultant shall ensure that any subcontractor(s) used on the specified project shall sign a license agreement which includes the terms outlined in this agreement.

3.3 The Consultant shall not purport to or grant rights to the Licensed Data or Licensed Data Product, in either hardcopy or electronic format to any other person or organisation.

3.4 The Consultant shall not use the Licensed Data or Licensed Data Products with the intention of encroaching on the privacy of an individual or company or other organisation.

3.5 The Consultant shall not change the coordinates of the Licensed Data.

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4.3 The Consultant also acknowledges that it has no rights of ownership in any of the copyright digital data referred to as being owned by any relevant copyright owner referred to in this agreement.

## 5.0 LIABILITY

5.1 The Consultant shall indemnify the Licensor, its employees and agents from all liability and the Licensor, its employees and agents shall not be liable to the Licensee for any loss or damage suffered or incurred by the Licensee or any other party arising from or in relation to any error or inaccuracy to the Licensed Data or Licensed Data Products howsoever caused and whether by negligence or otherwise in or arising from or in relation to the performance or use of the Licensed Data or Licensed Data Products.

5.2 The Consultant acknowledges that the Brisbane City Council, nor any of the relevant copyright owners, do not guarantee the accuracy or completeness of the Licensed Data, and does not make any warranty about the licensed data.

5.3 The Consultant agrees that the Brisbane City Council and other relevant copyright owners referred to in this licence, are not under any liability to the Licensee for any loss or damage (including consequential loss or damage) from any use of the Licensed Data.

5.4 The terms of this agreement may be pleaded as a bar to any claim or action brought by the Licensee against the Licensor.

*LICENSEE DELEGATE SIGNATURE* ______________________

## 6.0 CONFIDENTIALITY

6.1 The Consultant agrees that the Licensed Data is valuable commercial information of the Brisbane City Council, and The State of Queensland (through the Department of Environment & Resource Management).

6.2 The Consultant agrees to disclose Licensed Data or Licensed Data Products only to such of its employees and servants who need to know it for the purpose of the Consultant exercising its obligations under this agreement.

6.3 The Consultant shall take all reasonable steps to maintain and safeguard the confidentiality of the Licensed Data or Licensed Data Product and to ensure that its employees and servants maintain the confidentiality of the Licensed Data or Licensed Data Product and use the Data solely for the purposes permitted under Section 3.0 of this agreement.

## 7.0 DISCLAIMER

The Licensee acknowledges that while every endeavour has been made to ensure that the material here produced is accurate in what it conveys, the Licensor takes no responsibility for any errors or omissions therein or for any acts that may occur due to its use and the Licensee specifically acknowledges and accepts such condition.

Brisbane City Council does not warrant the correctness or completeness of the Licensed Data. It is the responsibility of the Licensee at all times to ensure that such parts of the Licensed Data used by it are correct by means of independent verification before any reliance is placed on it, with reference to City Plan Classifications, by application to the Brisbane City Council for Planning and Development Certificates.

## 8.0 LICENCEE TO INCLUDE DISCLAIMER

The Licensee shall include the following disclaimer on all copies of all Licensed Data and Licensed Data Products transacted by the Licensee :

© Brisbane City Council [2010].
In consideration of Council, and the copyright owners listed below, permitting the use of this data, you acknowledge and agree that Council, and the copyright owners, give no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage), relating to any use of this data.

Data must not be used for direct marketing or be used in breach of the privacy laws.

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2009 Brisway © 2009 Melway Publishing

*LICENSEE DELEGATE SIGNATURE* ______________________

## SCHEDULE A

| | |
|---|---|
| **1.0 AGREEMENT DATE** | 20th day of February, 2013 |
| 1.1 BCC Reference Number | BM85243 |
| **2.0 LICENSOR DETAILS** | |
| 2.1 Company Name | Brisbane City Council |
| 2.2 Physical Address | Level 2, 505 St Pauls Terrace, Fortitude Valley QLD 4006 |
| 2.3 Company Delegate | Spatial Information Operations Manager |
| 2.4 Company Delegate Name | Adrian Sturk |
| 2.5 Contact Name | Adrian Sturk |
| **3.0 SPONSOR DETAILS** | |
| 3.1 BCC Sponsor Unit | Natural Environment, Water and Sustainability Branch, City Planning & Sustainability |
| 3.2 Sponsor's Position | Program Delivery Manager |
| 3.3 Sponsor's Name | Lyndal Plant |
| **4.0 LICENSEE DETAILS** | |
| 4.1 Company Name (in Full) | School of Geography, Planning and Environmental Management, University of Queensland |
| 4.2 Physical Address | Level 5, Chamberlain Building (35), Campbell Road, St. Lucia 4072 |
| 4.3 Company Delegate Name | Dong Wang |
| **5.0 LICENSED DATA SPECIFICATION** | |
| 5.1 Brisbane City Council Data | 5.1.1 Park<br>5.1.2 Park Classification |
| 5.2 Non - BCC Data | N/A |
| 5.3 DERM Data | 5.3.1 Digital Cadastral Database Corridor Parcels |
| **6.0 GEOGRAPHIC LOCATION OR EXTENTS OF LICENSED DATA** | Brisbane Local Government Area |
| **7.0 DIGITAL DATA FORMAT** | ESRI Shape |
| **8.0 SPECIFIC PERMITTED USE AND RESTRICTIONS** | Study on How Accessibility Contributes to Urban Park Use and Values |
| **9.0 FEES PAYABLE** (Please note this is not an invoice) | $ nil (inclusive of GST) |

|  |  |  |  |
|---|---|---|---|
| **10.0 SIGNATORIES** |  |  |  |
| **LICENSOR** |  |  |  |
| **10.1 Licensor Name** | ADRIAN STURK<br>(on behalf of the **Brisbane City Council**) ABN 72 002 765 795 |  |  |
| **10.2 Licensor Signature** |  | Date | 20/02/13 |
| **10.3 Licensor Witness Name** | (Please print) JUDITH CAMPBELL |  |  |
| **10.4 Licensor Witness Signature** |  | Date | 20/02/13. |
| **LICENSEE** |  |  |  |
| **10.5 Licensee Delegate Name** | DONG WANG<br>(on behalf of **School of Geography, Planning and Environmental Management, University of Queensland**) |  |  |
| **10.6 Licensee Delegate Signature** |  | Date | 27/02/13 |
| **10.7 Licensee Witness Name** | (Please print) IDERLINA MATEO-BABIANO |  |  |
| **10.8 Licensee Witness Signature** |  | Date | 27/02/2013 |