Examining Children's Perceptions and Use of Their Neighbourhood Built Environments: A Novel Participatory Mapping Approach

Stephen Fitzpatrick, The University of Western Ontario

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A thesis submitted in partial fulfillment of the requirements for the Master of Arts degree in Geography

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EXAMINING CHILDREN’S PERCEPTIONS AND USE OF THEIR NEIGHBOURHOOD BUILT ENVIRONMENTS: A NOVEL PARTICIPATORY MAPPING APPROACH

(Thesis format: Monograph)

By:

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Graduate Program in Geography

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts

The School of Graduate and Postdoctoral Studies
Western University
London, Ontario, Canada

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Abstract

This thesis uses a mixed methods approach to contribute towards a more complete understanding of the relationship between the built environment and children’s active school travel. It is argued that active travel – human powered transportation – to and from school provides regular physical activity that can help reverse rising rates of overweight or obese Canadian children. The built environment of a child’s school neighbourhood has been shown to influence travel decisions. To achieve higher rates of children’s active travel, a comprehensive understanding of the built environment is required.

This study uses child-led perceptual mapping (CLPM) and GIS analysis in a case study with children from three elementary schools in London, Ontario to determine how perception and use of their school neighbourhood varies according to the built environment. The typology for the perceptual mapping activities was inspired by that of urban theorist Kevin Lynch, with children identifying destinations, zones, and routes. A high degree of participation is attained according to Roger Hart’s Ladder of Participation.

It is observed that children perceive of their neighbourhood in unique and complex ways. Children did not perceive land uses by the designated function, nor did they define land uses in singular ways. Prominent features were also not confined to the proximity around their school. Layering the child directed methods as an effective tool in understanding issues facing children’s active travel. It is concluded that active travel must be a priority cemented in policy, and that stakeholders should engage in participatory research across disciplines if rates of active travel are to increase. CLPM is a novel approach that should be used by researchers who aim to understand children’s perception and use of the built environment. Children deserve a major stakeholder role in the school travel planning process, and further research on the impact of the built environment on children’s active travel is needed.

Keywords:
Children, Active Travel, Urban Planning, Built Environment, School Travel Planning, Mixed Methods, Perception Mapping, Participatory Methods, Qualitative GIS, GIS, School Environments
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My brilliant niece Amy, who wants more than anything to walk to school when she is older, and who I want more than anything to help walk to school. And to my extraordinary little niece Cara, I hope you follow in your big sisters footsteps.

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Chapter 1  Introduction

1.1 Research Context

Regular participation in active travel, such as walking, biking, and other non-motorized forms of travel, has been shown to be effective against physical inactivity and childhood obesity (Andersen, 2007; Ogilvie et al. 2007). Active travel (AT) offers children an easy opportunity for achieving moderate-to-vigorous physical activity that may help develop a physically active profile over the longer term (Panter, 2010). The built environment, including the types of land uses in neighbourhood, has been shown to affect how and where children choose to travel actively (Ding et al. 2011; McMillan, 2007). In order to encourage greater levels of AT, it is therefore essential that we gain a better understanding of what elements of the built environment act as barriers or supports to children’s participation in AT. This thesis aims to contribute to a relatively new but rapidly expanding body of research on active travel and the built environment to provide policy makers and stakeholders with the necessary evidence and baseline conditions to make informed decisions to effect change in children’s AT behaviour.

1.2 Research Objectives and Questions

The broader objective of this research is to contribute to the body of knowledge aimed at improving the health and physical activity of Canadian children. From a practical standpoint, the ultimate objective of this study is to have the findings adopted by local decision makers, school boards and city planners in their planning for healthy environments for children and youth. This research aims to move the discussion about planning healthy environments for children towards a participatory framework, and
advocates for a greater adoption of methods that are informed and directed by children. To meet these objectives, this research seeks to answer the following research question:

1. How do children's perceptions and use of their school neighbourhood vary according to the built environment?

This study aims to answer the research question by gaining a deeper understanding of the barriers and encouraging factors in children’s active use of their neighbourhood built environments. To achieve this aim, this study adopts an innovative participatory methodology, which directly involves children and stakeholders within the school travel planning process.

1.3 Statement of Intent

This research intends to contribute towards a greater understanding of how children perceive their built environment, and how this may affect active travel. Further understanding of the built environment is needed if policy- and decision-makers are to make interventions to increase rates of active travel. The subsequent chapters will accomplish this broad research objective in the following ways. Chapter 2 summarizes key evidence on the relationship between built environment characteristics and children’s active travel. This summary includes a systematic review to justify the need for further research, and to identify gaps in the current body of knowledge. Chapter 3 describes the mixed method approach taken for this research. The chapter outlines the innovative child-led perception mapping method used in this research to collect the required data, as well as the data management and data analysis procedures that were undertaken in a geographic information system (GIS). Chapter 3 also identifies the relational theoretical framework and participatory action philosophy that guided this study. Chapter 4 presents
findings from the spatial and statistical analyses of data gathered through the child-led mapping activities. These findings will connect perceptions of children’s school neighbourhood to different land use features. Results are presented primarily in the form of maps and charts, and further elaborated on using comments from the study participants. Subsequently, Chapter 5 discusses the key themes identified in the results. It connects the findings to content reviewed in Chapter 2, and presents the broader implications of this research. This chapter considers how the research at hand corroborates or changes the current body of knowledge. Lastly, Chapter 6 concludes the thesis by discussing targets for future research, and how the findings of research may be used to enact positive change moving forward.

The research for this thesis was undertaken as part of a larger project focused on nurturing healthy behaviours in children and the creation of healthy environments throughout South Western Ontario. The Spatial Temporal Environment and Activity Monitoring (STEAM) project began in the spring of 2011 and will conclude in the fall of 2014, with each year representing one phase of the research process. Ethics approval from the Non-Medical Research Ethics Board of Western University was obtained in the spring of 2011 (See Appendix A), and ethics approval from all of the respective school boards for the study was acquired thereafter. The three elementary schools examined in this thesis took part in the larger STEAM research project.

1.4 Study Area

The case study elementary schools under examination are located in London, Ontario. The three schools examined here represent a variety of built environment types.
and socio-demographic conditions that are representative of the socio-demographic and built environment of London as a whole.

*Table 1* presents socio-demographic contextual information from Statistics Canada. Neighbourhoods in the city of London are characterized by a variety of built form types, including: older, dense urban environments; older grid-style suburban environments; and newer, sprawling green field suburbs.

**Table 1: Overview of London**

<table>
<thead>
<tr>
<th>Population (Census Subdivision)</th>
<th>366,151</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Total Family Income ($)</td>
<td>68,648.00</td>
</tr>
<tr>
<td>Average Individual Income ($)</td>
<td>36,549.00</td>
</tr>
<tr>
<td>Total Private Dwellings</td>
<td>168,175</td>
</tr>
<tr>
<td>Land Area (Km²)</td>
<td>420.57</td>
</tr>
<tr>
<td>Population Density (Ppl/Km²)</td>
<td>870.6</td>
</tr>
<tr>
<td>Total Families in Private Households</td>
<td>100,185</td>
</tr>
<tr>
<td>Average Number of Children</td>
<td>1.10</td>
</tr>
<tr>
<td>Unemployment Rate (%)</td>
<td>9.3%</td>
</tr>
</tbody>
</table>

Source: Data from Statistics Canada, Census of Canada 2011

*Table 2* summarizes key socio-demographic characteristics of each case study school. The characteristics of the case study schools are broadly representative of different types of schools in London as a whole, as they adequately represent the distribution of socio-demographic qualities across a similar geographic scale (urban and suburban). School A is located in a higher density urban area, with a generally lower income population; whereas, School B is located in a lower density suburban area with a high-income population. Meanwhile, School C is suburban, but higher density, and generally inhabited by a middle income population.
### Table 2: Socio-Demographics of Case Study Schools

<table>
<thead>
<tr>
<th></th>
<th>School A</th>
<th>School B</th>
<th>School C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Count in Catchment</td>
<td>26,563</td>
<td>19,874</td>
<td>27,349</td>
</tr>
<tr>
<td>Population Density (per Km²)</td>
<td>2341.31</td>
<td>575.00</td>
<td>1496.30</td>
</tr>
<tr>
<td>Dwelling Count</td>
<td>11,810</td>
<td>7,160</td>
<td>10,920</td>
</tr>
<tr>
<td>Dwelling Density (per Km²)</td>
<td>1040.96</td>
<td>207.15</td>
<td>597.45</td>
</tr>
<tr>
<td>Median Household Income ($)</td>
<td>42,622.41</td>
<td>88,922.85</td>
<td>49,652.88</td>
</tr>
<tr>
<td>Average Household Income ($)</td>
<td>47,451.11</td>
<td>103,027.27</td>
<td>55,820.27</td>
</tr>
<tr>
<td>Neighbourhood Type</td>
<td>Urban</td>
<td>Suburban</td>
<td>Suburban</td>
</tr>
</tbody>
</table>


### 1.5 Thesis Format

This thesis is written in the monograph format. The research is broken down into the subsequent chapters: Literature Review, Methods, Results, Discussion, and Conclusion.
Chapter 2   Literature Review

Chapter 2 will summarize relevant literature on the significance and state of active travel of children, and the impact that the built environment has on children’s mode of travel. The systematic review identifies key built environment factors that influence AT, but also to demonstrates the need for further research aimed at understanding links between built environment factors, and children’s perceptions and use of the built environment. This chapter will conclude by presenting the relational approach and participatory action research framework that guided this research.

2.1 Why Travel Actively?

Childhood health is on the decline in Canada and other developed nations. Reports prepared using the data from the Canadian Health Measures Survey (CHMS) provide a statistically verified snapshot of the health of Canadian children. In their comparative study of 2,087 child participants in the CHMS to 5,116 child participants in the Canadian Fitness Survey conducted in 1981, Tremblay and colleagues found that physical activity levels - any body movement that works muscles using more than resting energy (Lipnowski & LeBlanc, 2012) - of Canadian children and youth aged 6 to 19 have declined significantly since 1981. The CHMS and subsequent publications using its data confirmed rising obesity rates in Canadian youth, demonstrating that between 1981 and 2009 the percentage of young respondents with an overweight or obese body mass index (BMI) significantly increased from 14% to 31%, and 14% to 25% for boys and girls respectively (Tremblay et al. 2010: 8). Additionally reported are the doubling of rates of
overweight or obese children from 13% to 26% between 1978 and 2004 (Healthy Canadians, 2011).

These trends are a cause for concern on numerous fronts. Various studies have suggested that if these trends are allowed to continue, Canadian children will experience the consequences of insulin resistance, type 2 diabetes, dyslipidemia, hypertension, obstructive sleep apnoea, poor self-esteem and a lower health-related quality of life as they grow older (Fennoy, 2010; Daniel, 2009). As these health consequences mount, the costs to both the individual and to the Canadian healthcare system become monumental. A recent study reported that physical inactivity is directly associated with $1.6 billion in annual Canadian health care costs, along with a $3.7 billion loss in economic productivity due increased cardiovascular disease, stroke, hypertension, multiple cancers, type II diabetes, and other physical and mental health issues (Katzmarzyk & Janssen, 2004). If the population afflicted with these conditions increases in size, then the costs will rise accordingly. These are not problems isolated within childhood, but rather as behaviours and attitudes towards physical activity and health that are established in during childhood development. Without meaningful research and intervention, the adults who these children will grow into will be less likely to be physically active and societally productive.

In recent years, research has focused on the active travel (AT) of school-aged children. Active travel to and from school has the potential to reduce increasing rates of overweight or obese children by providing them with the chance to engage in affordable, routine physical activity through active modes of transportation such as walking or biking (Tudor-Locke et al. 2001). An active journey by foot, bike, skateboard or other human-
powered means has been shown to improve the health of children by helping them meet recommended levels of daily exercise or moderate-to-vigorous physical activity (MVPA) (Ogilvie et al. 2007). The Canadian Physical Activity Guidelines (Canadian Society for Exercise Physiology [CSEP], 2012) and the World Health Organization (2012) recommend that children aged 6-17 engage in a minimum of 60 minutes a day of MVPA. The formal definition of MVPA for children as given by these organizations and widely used in academia is “… physical activity that is performed at…4.0 – 6.9 times the intensity of rest.” (Canadian Society for Exercise Physiology, 2013). Common examples include biking, hiking, rollerblading and walking (CSEP, 2013).

Children are particularly well positioned to engage in AT. The majority of children travel to and from school 5 days a week for a total of 10 trips, and do this for a 10-month school year. These journeys add up to a significant opportunity to engage in regular physical activity, one that can potentially improve childhood health in the present and the future. In addition to the journey to school, engaging in active travel as a whole increases and improves the overall physical activity level of children (Panter et al. 2010; Andersen, 2007). Children who engage in AT can see benefits that are “… reflected in a more physically active profile” (Cooper et al. 2003: 276). A study of 219 Grade Five students in South Carolina found that those who walk to school average 24 additional minutes of MVPA per day compared to non-walkers, thus satisfying nearly half of the recommended 60 minutes of MVPA per day (Sirard et al. 2005).
2.2 The State of Active Travel

Despite growing awareness and research on the benefits of AT, rates of children’s AT, particularly to and from school, continue to fall as children increasingly rely on being driven to destinations or receiving school bus services (McMillan, 2007). Nationwide household transportation studies in the United States have revealed that the proportion of US children who travelled actively to school dropped from 42% in 1969 to 16% in 2001 (Centers for Disease Control and Prevention, 2008). Within a metropolitan Canadian context, an analysis of historical survey data in the Greater Toronto Area revealed that rates of active transportation to and from school in the GTA have declined from 53.0% to 42.5% for 11–13 year olds, and 38.6% to 30.7% for 14–15 year olds between 1986 and 2006 (Buliung et al. 2009). These declining rates are not necessarily accompanied by a lack of desire to travel actively to school. When asked how they travel to school, nearly two-thirds (64%) of 614 children surveyed in London, Ontario who lived within walking distance (1.6 km) of their school reported that they travel actively (Larsen et al. 2011). Although this is an encouraging rate, 76% of these children reported they would prefer to travel actively, thus indicating existing barriers to their mobility (Larsen et al. 2011).

Declining rates of active travel to school make it critical to identify the causes and factors associated with the decline and to possibly identify those that may be modified to increase active travel. There are many factors that can influence the ability or decision of a child to engage in active travel. Cooper and colleagues (2003) stressed the need for additional research to explore potential determinants of children engaging in active travel.
Since then, several studies have established the impact of socio-demographic factors, as well as both child and parental perceptions of safety along travel routes through the use of surveys and questionnaires (Carver et al. 2010; Willis et al. 2004). The scope of research on this topic must be narrowed further for planning effective and manageable action.

2.3 Influence of Built Environment on Children’s Active Travel

A growing body of research, particularly in the fields of planning and public health, indicates that specific elements of the built environment can directly influence whether or not a child travels actively to and from school (Larsen et al. 2011; 2009; van Loon & Frank, 2011; Giles-Corti et al. 2009; McMillan, 2007). In their extensive review, van Loon and Frank (2011) examine broad relationships between built urban environments and youth physical activity, and in doing so create an ecological classification of correlates of children’s physical activity and active transportation (Figure 1). In this framework van Loon and Frank illustrate the broad nature of physical activity research, but also the importance of the built environment physical components (i.e. street dimensions, sidewalk continuity, and intersection design) of neighbourhood environments within this research.
The authors find that in the context of the model, urban form is the most suitable starting point for interventions, as changes in urban form “…may be a prerequisite for the success of other joint interventions targeting behaviour change…” (van Loon & Frank, 2011: 295). The authors also suggest in their classification that there is substantial necessary work at both small and large extents of child environment – be it by street,
neighbourhood, planning district, or city wide – to gain the prerequisite knowledge of urban form.

In the research on the relationship between the built environment and children’s active travel, land use is frequently identified as a significant factor affecting active travel decisions of children. Land use refers to the designation of parcels of land based on their use, function or purpose (Girling & Kellett, 2005). Understanding the relationship between land use and children’s active travel is viewed as fundamental for subsequent research on built environment and potential interventions (van Loon & Frank, 2011). However findings have been mixed. In their examination of 4,338 subjects in 10 Californian communities, Su and colleagues found that schools situated in areas with greater density of residential land use were more likely to have higher rates of active travel to and from school (2013). Larsen and colleagues support this finding in their research of 614 youth in London Ontario, finding that residential density and the presence of street trees were associated with higher rates of active travel to school (2011). Both studies found that a mix of land uses around home and school environments was associated with lower rates of active travel to and from school (Su et al. 2013; Larsen et al. 2011).

Conversely, other studies have found results that support the case for a greater mix of land uses contributing to a higher rate of youth active travel. Lovasi and colleagues (2011) found that greater land use mix was significantly associated with higher physical activity levels of children aged 2 to 5. McMillan arrived at a similar conclusion concerning active travel in her analysis of urban form variables impacting a child’s travel mode (2007). In her spatial analysis of 16 schools in California (number of
participants unspecified), it was found that mixed land use was strongly connected to the
decision of children to travel actively within their school neighbourhoods (McMillan,
2007). McMillan concludes by stating that “…creating safe environments by improving
urban design may influence children’s commuting behaviour.” (McMillan, 2007: 276). In
their systematic review of 103 research papers, Ding and colleagues (2011) found that a
mix of land uses was among the most supported correlates of active travel and physical
activity for children and youth aged 3-18 years within the large body of research
examined. Although results vary among the studies reviewed above, they all
acknowledge that more research is needed on land use within the built environment to
effectively plan for children’s active travel.

2.4 Changing the Built Environment using Urban Planning
and Urban Design

Research has established that specific elements of the built environment can
directly influence children’s decisions to travel actively within their community and
thereby to engage in physical activity (Van Loon & Frank, 2011; Panter et al. 2010;
Giles-Corti et al. 2009; Larsen et al. 2009; McMillan, 2007). Often discussed as the tools
most suitable to change the built environment, urban planning and urban design target
specific areas or components of urban form that affect its functionality and effectiveness.
These modifications, if properly done, can alter the built environment and influence the
decision of travel mode for children (Boarnet et al. 2008). These modifications are
referred to as interventions; deliberate actions taken to improve the current state of a
previously identified phenomenon.
Tremblay recommended that research be conducted to “…assess future interventions designed to improve the fitness of the nation…” (Tremblay et al. 2010: 12), asserting that directed action must be taken. van Loon and Frank examine the broad nature of physical activity research, and also stress the importance of infrastructure components (i.e. street dimensions, sidewalk continuity, and intersection design) of built neighbourhood environments (van Loon & Frank, 2011). Their review asserts that there is significant “…potential for urban form interventions to influence youth physical activity.” (van Loon & Frank: 295). Research has identified a wide spectrum of targets suitable for urban design interventions. These include sidewalks, intersections, and parks (Larsen et al. 2009; Boarnet et al. 2008). The built environment category is divided into two fundamental components, access and design, which must be targeted simultaneously for actions or interventions to be effective (van Loon & Frank, 2011).

Other studies move beyond recommendations and have conducted an experiment by physically implementing an alteration in the built environment and measuring behaviour before and after implementation. For example, Burke (2009) evaluated how community design interventions in Somerville, Massachusetts had an impact on the physical activity levels of the residents. Following the installation of walking and biking infrastructure and increasing access for walkers and cyclists to community institutions, the researchers noted a statistically significant increase in physical activity and interest in active transportation (Burke, 2009). Boarnet (2005 A) arrived at a similar result, but with a more quantifiable measure of success. Boarnet and colleagues measured conditions before and after the renovation of sidewalks and the installation of traffic signals and crosswalks that affected 1,778 children aged 8-11 in California over a period of three
years (Boarnet et al. 2005 A). Analysis from survey data following the intervention showed a significant increase of 30%, 70%, and 28% of children travelling actively at three different sites, demonstrating that urban design modifications can be an effective way to increase rates of active travel (Boarnet et al. 2005 A).

If a consistent trend among successful interventions, whether in design or scale, can be identified, then the need for further geographic examination of the built environment in children’s communities is reduced; as this would provide a valuable baseline to urban planners and designers for determining siting of future built environment interventions. A systematic review was conducted to establish a baseline of the scale and type of urban planning and design interventions that have taken place, and their effectiveness. This literature review will consider the geographic question of where interventions are located, and where they are most effective. The objective is not to determine what type of intervention is most effective, as experts with the required skill and expertise make that decision within localized context and conditions. Rather, this review seeks to identify gaps in the literature and to solidify the place of this research in the broader knowledge base.

2.4.1 Review Strategy

To accomplish this objective, five databases with different foci were selected and searched systematically. These databases were Scopus, PubMed, GEOBASE, Web of Science, and Active Living Research; they were searched from May 1, 2012 to June 1, 2012, and then again from March 1, 2013 to March 21, 2013. The search strategy employed is as follows:
“urban design” OR "urban form" OR "urban planning" OR "built environment*"

AND “active transport*” OR “active travel*” OR "physical activit*" OR biking OR cycling OR walking

AND child* OR youth

Although often considered separately, this review included both active travel and physical activity in the search strategy. The reason for this is that a search strategy too specific in its terminology might exclude meaningful sources. As physical activity is a by-product of active travel, the two phenomena are not exclusive.

Four conditions were imposed on study selection in order to achieve results relevant to the objective of this paper:

1. Research had to occur within an urban/suburban environment;
2. The study was published between 2002-2013;
3. The study was written in English;
4. The study had measured conditions before and after an intervention/ natural experiment.

The fourth criterion was not included in the search strategy because it was found to expand search results to a wide field of undesirable studies, as thousands of research papers include recommendations to conduct interventions/experiments in their keywords or abstract. Instead, this condition was applied manually to papers returned from the first three conditions. For a visualization of the full process leading to final article selection, consult Figure 2 on the next page.
Once relevant articles (13) had been selected, their reference lists were examined to include any additional articles, bringing the total to 14 studies. These studies were then subject to a validity assessment to determine their extensiveness and rigour. In keeping
with common practice in systematic reviews in social science, a validity score was assigned to each study. This assessment, contained in Appendix B, tabulates specific attributes of each article to ensure it was thorough enough to be considered in this review. Individual scores assigned to each study are not used in the results or the discussion sections to leverage studies over each other, but rather to ensure that as a collective sample, the studies chosen were of high quality. Studies had to report an objective measure of physical activity or active transportation at baseline and follow-up, and although self-reported measures were not excluded, studies using self-report or subjective data were graded accordingly in the validity assessment. Similar assessments are common practice in systematic reviews, and within similar lines of inquiry (Pont et al. 2009; Ogilvie et al. 2007). Any study scoring 2 or lower was not to be included, although all 14 studies scored 3 or higher.

Once the selection process and validity assessment were complete, data extraction began. For data extraction, the focus was on the characteristics of the intervention or natural experiment (description, level, target users, follow-up logistics), the study population (age of children, sample size \([n]\), location), and the results of intervention (descriptive effects, significance). These study characteristics revealed what precisely the intervention consisted of, and also supplied a measure of its effectiveness. Some studies focused on a broader population than children; and in this case only the findings for children were considered in analysis. A full summary of each review study can be found in Table 3.
### Table 3: Article Summary from Data Extraction

<table>
<thead>
<tr>
<th>Study</th>
<th>Description of Intervention</th>
<th>Site of Intervention</th>
<th>Study Population</th>
<th>Ages</th>
<th>Location</th>
<th>Sample Size</th>
<th>Follow-up</th>
<th>Reported net effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farley, 2007</td>
<td>Play structure with impact absorbent surface, large paved sport areas, sport field</td>
<td>Schoolyard</td>
<td>Children in Grades 2-8</td>
<td>6-13</td>
<td>New Orleans, Louisiana</td>
<td>N/A</td>
<td>9-10 Random days, every 3 months from April 2003 to May 2005</td>
<td>Increase not significant. Number of children physically active was 84% higher than comparison neighbourhood.</td>
</tr>
<tr>
<td>Fitzhugh, 2010</td>
<td>Installation of Multiuse Pathways</td>
<td>Neighbourhood</td>
<td>School level users</td>
<td>Not specified</td>
<td>Knoxville, Tennessee</td>
<td>N/A</td>
<td>14 Months following trail construction – March 2007. 2 Weekdays during school travel times.</td>
<td>No significant increase in active travel to or from school.</td>
</tr>
<tr>
<td>Veitch, 2012</td>
<td>Neighbourhood park refurbishment</td>
<td>Public Park</td>
<td>Park users (Including Children)</td>
<td>2 -4 (65). 5-18 (359)</td>
<td>Victoria, AUS</td>
<td>424</td>
<td>27 Observation periods, 12 months following</td>
<td>Increase in park use, more walkers and vigorous activity. ***</td>
</tr>
<tr>
<td>Study (Year)</td>
<td>Intervention Description</td>
<td>Location</td>
<td>Sample Size</td>
<td>Data Collection Period</td>
<td>Findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
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<td>------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tester and Baker, 2009</td>
<td>Sport field turf replacement, installation of fencing, lighting, landscaping, picnic benches, walkways</td>
<td>San Francisco, CA</td>
<td>460</td>
<td>Entire days, for 1 complete week in June 2006 and June 2007</td>
<td>Significant playfield use increase for children, significant increases in use in overall park usage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carver, A., 2010</td>
<td>Road safety improvements – speed bumps, lit crossings, road shoulder redesign</td>
<td>Melbourne, AUS</td>
<td>446</td>
<td>2 Sessions - 2004 and 2006, questionnaire and accelerometry done between July and December.</td>
<td>Significant increases in AT for children aged 8-9, For adolescents, intersection density and pathways are significant.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brink, 2010</td>
<td>Renovated schoolyards - trees and green space, shade, sport fields [paved and grassed], landscaping and furniture</td>
<td>Denver, COL</td>
<td>3,688</td>
<td>2005 and 2006. Each school observed for 4 days.</td>
<td>Student traffic increased, PA levels higher at intervention sites. Mean active - Energy Expenditure **</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anthamatten, 2011</td>
<td>Renovated schoolyards - trees and green space, shade, sport fields [paved and grassed], landscaping and furniture</td>
<td>Denver, COL</td>
<td>3,688</td>
<td>2005 and 2006. Each school observed for 4 days.</td>
<td>Renovated schoolyards used significantly more than control schools. ** In observed users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Intervention Details</td>
<td>Setting</td>
<td>Participants</td>
<td>Location</td>
<td>Duration</td>
<td>Findings</td>
<td>Significance</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Ridgers, 2010</td>
<td>Installed equipment (soccer posts, courts) and new ground painting)</td>
<td>Schoolyard</td>
<td>Elementary School children</td>
<td>Not specified</td>
<td>NW region of the UK</td>
<td>6 and 12 months post intervention (March to July)</td>
<td>Positive but non-significant increases in MVPA and VPA.</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Cohen, 2012</td>
<td>Installation of fitness zones: outdoor exercise equipment</td>
<td>Public Park</td>
<td>Park users (including children)</td>
<td>Not specified</td>
<td>Los Angeles, CA</td>
<td>Two periods: 12 and 14 months following installation. Each consisted of 3 times a day, for two week and weekend days</td>
<td>Use of park increased, children made up 22.2% of equipment users.</td>
<td>None</td>
</tr>
<tr>
<td>Cohen, 2009</td>
<td>Renovating and tripling size of skate park</td>
<td>Public Park</td>
<td>Skate park users</td>
<td>Not specified</td>
<td>Los Angeles, CAL</td>
<td>1-3 months following completion. 2 observation periods; each 7 days, with multiple observations.</td>
<td>510% increase in skate park usage (6-fold).</td>
<td>***</td>
</tr>
</tbody>
</table>

**Legend:**
- **MVPA:** Moderate to Vigorous Physical Activity
- **VPA:** Vigorous Physical Activity
- **CAL:** California
<table>
<thead>
<tr>
<th>Study</th>
<th>Project Details</th>
<th>Location</th>
<th>Participants</th>
<th>Measurements</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boarnet, 2005 A</td>
<td>Installation/renovation of bicycle lanes, crosswalks, sidewalks</td>
<td>School Neighbourhood</td>
<td>Parents of children (age unspecified)</td>
<td>California, US</td>
<td>1,244 parents</td>
</tr>
<tr>
<td>Boarnet, 2005 B</td>
<td>Traffic improvement projects: sidewalks, bicycle paths, traffic control devices</td>
<td>School Neighbourhood</td>
<td>Parents of children in grades 3 to 5. (age unspecified)</td>
<td>California, US</td>
<td>1,243 parents</td>
</tr>
<tr>
<td>Hinckson, 2011</td>
<td>Sidewalk improvements, crosswalk and speed bump installation</td>
<td>School Neighbourhood</td>
<td>Children, grades 0(1)-5</td>
<td>Auckland, New Zealand</td>
<td>7,281</td>
</tr>
<tr>
<td>Day, 2007</td>
<td>Urban revitalization - traffic control, landscaping, new facades, street furniture, lighting.</td>
<td>Neighbourhood Citizens (including children)</td>
<td>15 and under</td>
<td>Santa Ann, CAL</td>
<td>N/A</td>
</tr>
</tbody>
</table>
2.5 Findings

The studies were categorized in two ways: by site of intervention and by the target of intervention. Interventions were found to occur at four different types of site; neighbourhood, school neighbourhood, public parks, and schoolyards. Both public park and schoolyard sites had four intervention studies each, while the neighbourhood and school neighbourhood sites had three studies respectively. Figure 3 shows the percentage of findings for each level that were found to be significantly associated with negative AT/PA levels, showed no significance, or were associated with positive changes in AT/PA.

Figure 3: Significant Impact by Site of Intervention
The sites with the most frequent occurrence of significant positive increase in the AT and PA of children were urban design interventions in public parks (75%) and school neighbourhoods (60%). Schoolyard improvements were considerably effective (50%). Urban design interventions at the neighbourhood level were the least likely to see a significant rise in AT or PA, with an equal chance of positive and negative effects (33.3%). The largest site of intervention - neighbourhood wide - was least likely to result in any significant increases in AT or PA. Interventions at a more focused scale with defined boundaries (park edges) and landmarks (a school) had a higher likelihood of success.

Eight categories of major interventions are listed on the vertical axis of Figure 4. Traffic control measures (controlled crossings, speed bumps, etc.), sidewalk installation and renovation, public park renovations (pathways, lighting, landscaping, furniture), greening (tree planting, shade provision), and sport field renovation have the highest likelihood of producing significant increases in PA or AT (each over 50%). Crosswalks were found to be ineffective 33.3% in this regard, while the installation of multiuse paths and play structures produced no significant increases in AT or PA. Interventions in neighbourhood parks and the environments immediately around schools had the highest probability of positively increasing active travel or physical activity compared to other options.
Figure 4: Significant Impact by Type of Intervention

The relationship between specific types of interventions and the likelihood of increasing AT/PA is stronger than that of the site of intervention. Installation of new multi-use paths and new play structures were found to have no significant results in any of the studies examined, while installing crosswalks was found to achieve significant results only 33.3% of the time. The three most successful interventions (each having a positive impact of 75% or greater) were the implementation of traffic control, sidewalk installation/renovation, and public park refurbishment. There is an opportunity for neighbourhood interventions to achieve significant positive impact on PA and AT, as research done on urban form predictors of physical activity or active transportation levels have suggested multiple correlates, such as distance to and from school, residential density, and street trees (Larsen et al. 2009; Tucker, 2009).


2.6 Recommendations

2.6.1 Urban Planning and Design

What this review reveals is that while there are specific types of interventions that have been deployed, there is a lack of consistency and clarity as to how the sites of these interventions were chosen. There is no discernible correlation between the site and type of intervention and the subsequent likelihood of success. There are scattered findings for effectiveness of scale, with mixed success being reported for interventions at both large and small-scale sites. There is no universally used, published strategy for determining where interventions should be initiated. The body of research on the built environment and AT or PA has not yet provided intervention planners with sufficient evidence to select strategic, effective intervention sites. The results indicate a need for additional research on the built environment to assist in developing context to allow for proper site selection that considers all geographic scales and land uses for built environment interventions aimed at increasing AT and PA. If the site of an intervention can be transparently chosen with consideration of properly collected baseline conditions and neighbourhood specific context, then focus can be turned towards designing the most effective interventions possible. This represents a gap in the current state of knowledge for planning interventions to increase the active travel of children.

2.6.2 School Travel Planning

Invested community stakeholder groups often spearhead intervention design and implementation. Active travel to and from school, a large component of children`s active transportation opportunities, is affected by the direction of school travel planning. School travel planning (STP) is the process of planning for children`s active travel to and from school through
the “mobilization of key community stakeholders (governments, parents, children, teachers, school administrators)” (Buliung et al. 2011). Across Canada, many organizations assume a leadership role in this process. These include public health units in Ontario and non-governmental organization such as the Hub for Active School Travel (HASTe) in British Columbia (Hub for Active School Travel, 2013). STP is often the umbrella process under which AT and PA interventions are planned. While different organizations may take charge of the process, their methods are largely uniform and often based on resources available from the Active and Safe Routes to School website, run by Canada Walks, a division of Green Communities Canada (Green Communities Canada, 2013). The goal is a living document that contains direction for policy, built environment, and education based on conditions specific for each school. These resources suggest the procedure shown in Figure 5 in developing a school travel plan. A full cycle of participation takes roughly two full school years, and is dependent on recruiting a committee of invested stakeholders in each school to participate.

Figure 5: School Travel Planning Procedure (Green Communities Canada, 2013)
Successful participation in STP is based on establishing accurate baseline conditions that represent how and where children are moving through the built environment (Buliung et al. 2011). There is a large degree of variation within the methods used in the baseline data collection phase, but often it consists of classroom hands-up surveys, parent surveys, traffic observation and walkabouts done with an assortment of community stakeholders including teachers, Block Parents, principals, city planners and officials, and researchers (Buliung et al. 2011).

There is a fundamental shortcoming within the baseline data collection phase that hinders the overall likelihood of success. Students are typically not co-researchers in this process, but rather the subjects of research. The role of the student in this process, as described in the facilitator guide, is that they “…may partake in a walkabout and traffic observation…” (Green Communities Canada, 2012: 6), to implement the action plan. Students may also take part in a classroom survey, and for older students, potentially be included on the steering committee (Green Communities Canada, 2012). The recommended survey is a tally conducted by the teacher, wherein the students raise their hands to answer two questions – how did they travel to school that day, and how will they travel from school that day (Green Communities Canada, 2012). Of all the roles of various stakeholders, the role of the students is the last to be described. STP activities often fail to generate a high level of child participation. Examining the STP process and relating it to Roger Hart’s Ladder of Youth Participation (1992) reveals that children meet the fourth level – being consulted – at best, and could very well drop to the lower realms of non-participation when students are present only as decoration (Hart, 1992). If STP researchers conduct baseline assessment without a higher standard of student engagement, the entire process loses effectiveness and credibility. There is a need to develop methods that focus on more contextually specific issues that can affect the active travel of children. Methods that prioritize
depth rather than breadth for baseline data collection can accurately portray the environments and perceptions of the children for whom active travel is being planned. Child directed research has been shown to be effective using participatory methods (Loebach & Gilliland, 2010). The standard version of STP reaffirms results of the review: there is no agreed upon or proven method to determine where to locate built environment interventions.

2.7 Research Approach and Framework

2.7.1 Relational Approach

This thesis adopted a relational approach as the overarching research perspective. In recent years, relational concepts of place have emerged in theoretical discussions within geography (Graham & Healey, 1999; Cummins et al. 2007). While initially focused on economic geography (Bathell & Glucker, 2005; Yeung, 2005), taking a relational approach has gained popularity in research on interactions and relationships between individuals and place. A relational perspective views place as a dynamic and fluid phenomenon constructed socially and culturally by people who are regularly mobile through it (Cummins et al. 2007). Place, a relational researcher would argue, is constructed differently for each person, and descriptions of contextual features vary greatly depending on the individual experiencing them (Graham & Healey, 1999). This contextual component is fundamental to a relational perspective; that is to “…elaborate and extend traditional notions of proximity and distance as defining the separation of people and places” (Cummins et al. 2007: 1827).

Relational geographers assert that places are produced and managed by the interaction and perceptions of various ‘actors’, be it individuals or a large group (Conradson, 2005). This is significant when considering the extensive research done on how the perception of the built
environment impacts active travel or physical activity of an individual or a group (Larsen et al. 2011; Giles-Corti et al. 2009; Larsen et al. 2009). Cummins and colleagues support this theory in their widely cited article on relational geographies and health, stating that instead of focusing on the differences between places, research should “… concentrate on the processes and interactions occurring between people and time… which may be important for health.” (2007: 1828). The emphasis of the dynamism of place and the importance of mitigating the separation of person from place makes a relational approach compatible with and complementary to the mixed methods approach used in this research. This research recognizes that the “…tight interrelationships between individuals and contexts, are not easy to capture…” (Mitchell, 2001). There is a need for multiple research methods and methodologies in order to accurately portray the relationship between children, their neighbourhood, and their diverse and complex movement through it (Veitch et al. 2008).

2.7.2 Participatory Action Research Framework

In order to meet their needs and obtain a degree of authenticity, decisions and action concerning children’s active travel are best founded on research done with children (James, 2007). In addition to being guided by a relational approach, the research in this thesis was conducted within the framework of participatory action research (PAR). PAR is an inquiry that is self-reflective, and conducted with a population with which researcher has a strong social relationship with (Berg, 2009). In doing so, research guided by a PAR framework is a “…highly collaborative, reflective, experiential, and participatory mode of research in which all individuals involved in the study…are deliberate and contributing actors…” (Stringer & Dwyer, 2005: 32). Bartlett and colleagues structured their research on vulnerable populations within a PAR
framework, and found it to be effective in their exploration of the lived experience of Aboriginal participants (2007).

The PAR framework informed the research done for this thesis by expanding the realm of the researcher to include non-traditional collaborators - children. Through this framework, children were empowered to take an interest in how their neighbourhood or community places are shaped and managed by city planners, engineers, and other adult stakeholders. In doing so, this research became increasingly effective in the exploration and understanding of childhood places. Like most other research participants, children provide better quality responses when they are engaged in the topic, working with researchers who share their interest (Agar, 1996). In the application of the methods, participants were empowered. Instead of extracting data from children and ending the working relationship, the results obtained using Child-Led Perception Mapping (CLPM) were arrived at collaboratively through the direction of the child. The discussion of perceptions led by children guided the accompanying quantitative research, and clarified potential misguided interpretations of place made by the researcher, and can also inform them of inequalities or disparities that they may have otherwise been unaware of (Foster-Fishman et al. 2005).

The complementary relationship between PAR and CLPM is not one-way. Rather it is reciprocal, as CLPM is a method that is naturally aligned with the ontological and epistemological assumptions of a PAR framework. While PAR stresses the importance of having a social relationship with participants, CLPM offered a method that did much in the way of attaining this relationship. Situating the researcher within a place significant to the child and having a discussion directed by the children themselves works to deconstruct research hierarchies as the researcher shows an openness and physical investment in the place with the
student. In doing so, the likelihood of developing a collaborative relationship with the participants increases.

### 2.7.3 Youth Participation

The mixed methods approach of this research, fully described in Chapter 3, takes into consideration the complexities of youth participation, specifically within Roger Hart’s theory on children’s participation (1992). Often children are omitted from decision processes, as they are perceived by adults to “…not have the decision-making power of adults…” and “…should be protected from undue involvement and responsibility in the problems of society” (Hart, 1992: 5). Hart also notes that children need to be substantially and genuinely involved in projects concerning them in order to achieve meaningful, representative results. Moreover, Hart argues that simply having children involved in a decision making process is insufficient to achieve participation. According to Hart’s *Ladder of Participation* (1992), there are eight rungs of participation, as seen in *Figure 6*. The ranking of research on this ladder, Hart argues, corresponds to the likelihood of successful, representative projects (Hart, 1992).
When considered within this theory, the standard STP paradigm described in Chapter 2 does not achieve a successful and representative level of student participation. The current STP process assigns youth to the fourth rung in the ladder – assigned but informed (Hart, 1992). At this level, students are given a role and go along with the activities planned by adults. While this step does achieve participation, there is the risk that if the optional student involvement suggested in this process is ignored, then STP can fall between the third and first rung, into the
category of nonparticipation. *Manipulation, decoration, and tokenism* occur when children are assigned as representatives in this process, brought to meetings or walkabouts, and have their approval attached to the action plan development by adult stakeholders. This is a methodological shortcoming when considering the principal objective of the STP process – to plan for active travel of children. Geographer Ron Buliung and colleagues discuss in their pilot study using STP resources that this current paradigm has had mixed effectiveness, and call for the broad consideration of “…neighbourhood barriers that may be faced by a significant cohort of children” (Buliung et al. 2011: 711). To achieve this consideration and be more effective, the investigation of these barriers must take into account the expertise of community stakeholders, in addition to student initiated discussion and contributions. Developing an action plan to remove barriers to AT faced by children requires the very same children to engage in the investigation. There exists a gap in the research to examine how youth can best contribute their perception of barriers to active travel in their neighbourhoods.

Great care has been taken to prevent this research falling within the realms of *manipulation, decoration, tokenism* or general *nonparticipation*. The approach taken in this research satisfied Hart’s four requirements for a project to be considered participatory:

1. **The children understand the intentions of the project;**
2. **They know who made the decisions concerning their involvement and why;**
3. **They have a meaningful (rather than ‘decorative’) role;**
4. **They volunteer for the project after the project was made clear to them.**

- (Hart, 1992: 11)
The co-researcher status in the child-led aspect of the CLPM elevates children to the sixth rung of Hart’s participation ladder—adult initiated, shared decisions with children. This method is entirely dependent on the participants understanding the issue at hand, taking this issue seriously, assuming a leadership role, and determining the extent of their participation. While adults may bring the topic forward, the findings are significantly child-led and directed. This is aligned with Hart’s definition of the sixth rung as being projects that “…are initiated by adults, [with] decision-making …shared with the young people” (1992: 12). This represents a significant improvement over the degree of participation of the conventional STP process.

Active travel is a suitable target for built environment interventions using the resources and relationships at the disposal of the STP process. As the previously discussed review has shown, however, there is not the required amount of evidence available to strategically develop and locate these interventions. As urban theorist Kevin Lynch stated:

We are continuously engaged in the attempt to organize our surroundings, to structure and identify them. Various environments are more or less amenable to such treatment. When reshaping cities it should be possible to give them a form that facilitates these organizing efforts rather than frustrates them. (Lynch, 1960: 90)

Lynch identified this objective in 1960, but it remains unrealized today. Identifying the environments that can be organized and structured is fundamental in planning for healthy neighbourhoods for children. Understanding how children perceive and move through their environment is fundamental in gaining the required contextual information to plan for neighbourhoods conducive to active travel. The subsequent chapters will describe the methods used in this thesis that are informed by children, and the findings from these methods. It is hoped
that this work will provide valuable contextual insight towards overcoming barriers to active school travel of children.
Chapter 3  Methodology

The purpose of this chapter is to describe the methods used in this research project. The research for this thesis was carried out under the umbrella of a larger research project, informally known as the STEAM project (Spatial Temporal Environment and Activity Monitoring). This project called for participatory methods and ultimately shaped the Child-Led Perception Mapping method used in this research. The method and its execution are described in detail, specifically the influence that the work of urban theorist Kevin Lynch had on study design. This chapter also discusses methodological concerns regarding working with children, and how these concerns were addressed.

3.1 STEAM Project

The objective of the ‘STEAM’ study is to assess how the physical environment (both natural and built elements) impacts physical activities and eating behaviours among elementary-school children in Southwestern Ontario. The STEAM project helped shaped the objectives and methodology for this thesis. The three schools that participated in the activities described in this thesis were all participants in the larger STEAM project. As part of the larger STEAM project, a team of researchers were present in participating schools each day for a full week in the spring and a full week in the fall to collect data, to build relationships with the participants, and to ensure that participants were complying with study protocols. The routine interaction between the researcher and the participants shared responsibility with the students as ‘co-researchers’, and was achieved through the application of participatory action research principles (Bartlett et al. 2007) discussed in the previous section. The research process became important to the students, and left them with a positive perception of having had knowledge created with them (Berg, 2009). The co-researcher relationship during the STEAM project provided fuel for meaningful
and informative discussions on children’s obstacles to active travel. Input directly from participants shaped the focus and discussions of the research at hand. A large requirement of STEAM is to gather data in this manner and of this regard – highly collaborative, contextual data that contributes towards an understanding of perceived environments, and how perception may affect use.

3.2 Case Study Areas

Three schools were identified for the purpose of in-depth analysis. The schools were selected for more intensive research methods because of feedback from students on the built environment and barriers to AT at their schools during the STEAM project. Figures 7 through 9 define the built environment of the three case study schools in terms of street network and land use, widely used classifications for describing the built environment of a neighbourhood. All GIS streets and land use data was provided by the Planning Division of the City of London (2012). School A is located in central London, and has a more classic urban style of development, as evidenced in Figure 7 by the grid like residential neighbourhoods, and diverse mix of land uses. There is a large government facility in the neighbourhood, and railroad track to the South of the school. School B (Figure 8) is an older suburban neighbourhood on the Southwestern corner of London. The residential areas are composed of many loops and lollipops, while most land use mix occurs along one arterial road on the Northern border of the map. The neighbourhood of School B also houses large agricultural (farming) and industrial (quarry) areas. Lastly, School C is an older suburb located North of a major arterial road, whereon the majority of the mix of institutional, commercial, and industrial land uses occurs. School C also has railroad tracks on the Western side of their neighbourhood, and has the Thames River Northwards, along with the
Thames River Pathway network of walking and cycling paths. For definitions of each land use designation, consult *Appendix C*. 
Figure 7: Street Pattern and Land Use in Study Area of School A

Source: Data from Planning Division, City of London, 2012
Figure 8: Street Pattern and Land Use in Study Area of School B

Source: Data from Planning Division, City of London, 2012
Figure 9: Street Pattern and Land Use in Study Area of School C

Source: Data from Planning Division, City of London, 2012
3.3 Mixed Methods Approach

This thesis used a mixed methods approach by combining child-led perception mapping and GIS-based analyses to answer the research question stated in Chapter 1. The use of mixed methods is widely advocated in the literature on children’s active travel, with van Loon and Frank (2011) stressing the need for mixed methods that combine complementary data on specific behaviours resulting in physical activity to understand children’s active transportation and the built environment. Concepts of school environments and the experience and perceptions of the children travelling through them give rise to complex questions that cannot be answered using a singular approach. Children are a sub-population that can be thought of as a vulnerable group; and there are specific ethical concerns and risks associated with child-based research (Matthews et al. 1998). It is imperative that research done with children does not accentuate the inherent hierarchies between adults and youth, as this limits participation and the amount and quality of the feedback given (Morgan et al. 2002).

Child-based research can position children as others, or as inferior to adults. Rather than stressing the children themselves, research instead focuses on teachers or parents to draw conclusions on childhood behaviour (Darbyshire et al. 2005). While this may not necessarily be a conscious decision, it can be an indirect by-product of study or method design. Children have their own skill sets, interests and perceptions. Children “...view, experience and value their environments in fundamentally different ways than do adults” (Loebach & Gilliland, 2010: 55). The mixed methods approach taken in this thesis recognizes the uniqueness of children as a sub-population, and that children have a “visual voice … [that] is not usually taken into account” (Burke, 2007: 368). The flexible
nature of data collection within child-led participatory mapping (CLPM) capitalized on the visual voice of children by posing questions within the environments that are being examined and with a strong visual cue present; understanding that providing a connection with the environments being examined will assist in reflection and discussions. Similarly, the form that the GIS analysis took was determined by the feedback from these visual voices.

Exploring local perceptions of place and neighbourhood is a longstanding goal of geography (Domosh et al. 2010; Anderson, 2009; Lynch, 1960). Geographers, as well as other social scientists, have long understood the importance of this, as place “constitutes as well as contains social relations and physical resources” (Cummins et al. 2007: 1825). The nature of place, as an arena and as a determinant of social relations, makes it a fruitful research topic from which meaningful data and conclusions can be drawn that contribute to the understanding of human behaviour. The methods used in this research, when taking a relational approach and informed by a participatory action research framework, are effective tools in the examination of the relationship between children and place and how it impacts planning for healthy neighbourhoods.

3.4 Methods Used

This research uses a mixed methods approach to gain a deeper understanding of the barriers and encouraging factors in children’s active use of the built environment. To achieve this objective, in November of 2012 child-led perception mapping (CLPM) sessions were conducted at three schools in London, Ontario. Participants (n=75) were in grades 5 and 6, and ranged from 9 to 12 years of age. Based on results from the larger STEAM study, these schools were identified as having an appropriate balance of students
who travelled passively and those who travelled actively to and from school to ensure a variety of environmental perceptions. After extending an invitation to the principals of each school, the project was explained to teachers of eligible grades, and one teacher in each of the three schools agreed to participate (Note: the goal was only to have one class in each school due to availability of human resources). A short presentation was given to each class on what geographers do, and how they make and use maps. Objectives and general directions of the research activity were explained, and students who were willing to participate were then given the option to participate. In each school, every student in the participating class agreed to participate in the CLPM. Each CLPM session took 2 hours in total, and consisted of two activities lasting 1-hour each, separated by a morning recess.

The first hour was used to present the project and material to the students, and to conduct the perceptual mapping exercises in groups of 4-5 students, paired with 2 facilitators. Facilitators included professors, graduate researchers, urban planners, public health officials, engineers, teachers, and members of community organizations (e.g., Block Parents, Active & Safe Routes to School); all local stakeholders within the STP process. As seen in Figure 10, each group was then given a table-sized map of their school and its surrounding area. Each group member was also given a uniquely coloured set of markers and stickers, so that every individual participant had the means to contribute an identifiable, creative voice in the process. Students identified their home with Home stickers, then “destinations” using coloured stickers, they then drew “routes” regularly traveled using marker lines, and drew “zones” using marker polygons. Pens were given to each child to allow him or her to write text to label, clarify or expand on
any environmental feature. Digital audio recorders were placed in the center of the table to record discussions about specific environmental features identified by the participants.

![Image of students completing the CLPM](image)

**Figure 10: Students Completing the CLPM**

To truly be child-directed, specific instructions were given to facilitators to provide students with only broad parameters for how they were to fill in their maps. The typology was explained; however, no direction was given toward specific destinations, routes, or zones. To avoid leading students to select pre-identified destinations or areas, the only notations on the map were road names. The facilitators were there to help wayfind on the map as needed, to ask students to elaborate on features as they were identified, to facilitate group discussion, and to make sure each child had an opportunity to speak.
These discussions and elaborations are fundamental to accessing the definition of features specific to a child’s perception (Morgan et al. 2002). Studies that have used similar, child directed methods have shown that there is a high yield of rich observational data to be gained (Loebach & Gilliland, 2010).

After completing the mapping activities, each group of students was given the opportunity to present their findings to the entire class and then conduct a neighbourhood walkabout with the community stakeholders to the most prominent features identified by the group on their map, and to take photographs and continue a group discussion. Digital audio recorders were present in each group mapping session and walkabout to record context to the maps. Students identified the features on the map where walkabouts would be conducted, carried the digital recorders, and took all photographs. In doing so, all findings and discussion were child initiated and child directed.

Upon completion of the mapping activities, the paper maps were digitally scanned and geo-rectified (i.e. assigned geographic coordinates) in ArcGIS 10.0 (Environmental Systems Research Institute, Redlands, CA). Once in a GIS, the data could be organized and analyzed using various tools provided in ArcGIS 10.0. All of the features and text on the maps were manually digitized precisely as they appeared to construct an environmental perception database representative of the exact specifications drawn and perceived by the children. The environmental features identified by the students were then spatially joined to land use data for the three schools in order to gain an

---

1 School A did not participate in the walkabouts due to extreme weather, but rather each group conducted “virtual walkabouts”, which involved “visiting” and discussing key destinations and zones in their neighbourhood using the Google Maps with StreetView application projected on a large SmartBoard in front of the entire class and facilitators. It is believed that this method did not compromise the research process, and indeed provided opportunity for class wide discussion.
understanding of how children’s perceptions related to the built environment of each
neighbourhood.

ArcGIS 10.0 was also used to calculate and tabulated key descriptive statistics on
land use allotment and percentages for all zones and destinations in each school
neighbourhood. Destinations, routes, and zones were overlapped as necessary to provide
a count to ensure that each student’s selection was considered in the results. The analysis
allowed for a count of the perceived features, and also connected each feature identified
to the built environment through the land use designation. This analysis satisfied the
research question and objectives not only though its raw findings, but also by maintaining
the exact contour of each feature identified by participants. This stage in the analysis of
the maps was important for overcoming some of the complexities of qualitative data
interpretation. Digitizing every feature exactly as the students perceived it was critical to
overcoming misinterpretations often made in research using computer aided analysis
(Nagy Hess-Biber, 2004).

3.4.1 Lynchian Typology

These CLPM sessions, a form of qualitative GIS, were inspired by the work of
urban theorist Kevin Lynch in *The Image of the City* (1960). In this classic text, Lynch
used perception mapping with adults to gain an understanding of limitations to mobility
in three American cities. Lynch also recommended this method be used on smaller scales
and with younger participants to achieve greater depth and breadth (Lynch, 1960).
Several other researchers have based their methods on the work of Lynch, and this classic
methodology, it can be argued, formed the contemporary basis of qualitative GIS; a
widely used method in urban planning research (Boschmann & Cubbon, 2013; Mennis et
al. 2013). Lynch argued that the built environment within cities could be categorized into five essential elements: *paths, edges, districts, nodes, and landmarks* (Lynch, 1960). Paths are the “…channels along which the observer customarily, occasionally, or potentially moves.” (Lynch, 1960: 47). Edges are understood as the “linear elements not used or considered as paths…boundaries between two phases, linear breaks in continuity…” (Lynch, 1960: 47). Districts are identified as “…medium-to-large sections of the city…recognizable as having some common, identifying character.” (Lynch, 1960: 47). Nodes are best understood as meeting points, “…junctions … a crossing or convergence of paths…” (Lynch, 1960: 47). Lastly, landmarks are defined as a notable point of reference, a “…simply defined physical object: building, sign, store or mountain…that for all practical purposes symbolize a constant direction.” (Lynch, 1960: 48).

Lynch developed this typology to better understand the characteristics of the built environment that relate to the identity and structure that shape the perceptions of users. This understanding is essential to improve upon what he referred to as the *imageability* of the city; the “…quality in a physical object which gives it a high probability of evoking a strong image in any given observer” (Lynch, 1960: 9). Lynch determined by using this method for an analysis of the central areas of Los Angeles, Boston, and New Jersey that this typology could form the basis for developing built environments in a way that was coherent, functional, and fluid (Lynch, 1960: 91).

Lynch used the original typology with participants aged 18 or older. The typology remains in use today because it has been shown to be an effective tool in dissecting built environment perception and experience. The challenge that this thesis
research faced was to adapt the method to make it appropriate for youth between the ages of 9 to 12 and to focus issues concerning active travel and physical activity based in a school environment. Three of Lynch’s original five classifications were used in these sessions: routes (paths), districts (zones), and landmarks (destinations). This adapted typology was used to simplify the method and terminology for the students and to work within the time frame allotted to the research project by each school.

3.5 Considerations

CLPM is an effective method for studying issues that have a contextual aspect, specifically those with research questions on place, community or neighbourhood. As a mode of inquiry, it has strengths akin to mobile interviews, a variation of traditional interviewing techniques that have usefulness for exploring and understanding localized context (Carpiano, 2009). The contextual relationship between individuals and place is difficult to observe and analyze, but these CLPM sessions put researchers in a position to do so (Mitchell, 2001). The format is semi-structured, with researchers having broad objectives prepared ahead of time, but with no predetermined questions or expectations for children. Loebach and Gilliland (2010) used similar methods in their examination of children’s perceptions of the environment surrounding their school. Their research methods allowed them to understand childhood place and lived experiences of the neighbourhoods that the children traveled through each day. Loebach and Gilliland found that participants in these sessions were engaged and expressive if given the responsibility of a leadership role within the research. The children contributed narratives that helped researchers better understand their experience in these places (Loebach & Gilliland, 2010).
Safety and confidentiality are two fundamental issues in this research (Jones, 2001). Any research involving children has complex ethical concerns (Matthews et al. 1998). The addresses and names of the children were withheld in the analysis, and any record of this information was destroyed following completion of the project, as this sensitive data might reveal where a child lived and travelled. The comments and observations made by the children remain anonymous to avoid the risk of any identifying characteristics or descriptions given, or a differing insight creating a sense of otherness from their peers that could be detrimental to their emotional well-being (Jones, 2001).

There were also numerous safety issues that were considered. Walkabouts were targeted to areas specifically identified by the children. However, if an area was strongly perceived as unpleasant by the children, or they felt it to be unsafe because of crime or frightening individuals, the areas were omitted, to avoid putting children in a potentially negative situation. Instead, travelling nearby or along the areas of concern was deemed to be sufficient. Also, sufficient numbers of adults (i.e., a minimum of one female and one male) were present so that the group could be kept intact, and no child was doing something that put him or her at risk of injury or peril (i.e. climbing fences, talking with strangers, or running across the road). These concerns were not major limitations to the use of walkabouts, but rather imperative concerns that were communicated to each facilitator and participant during these sessions (Matthews et al. 1998; Jones, 2001).

The CLPM sessions can be considered as a form of map-based focus groups, with a principal objective to observe if there was any consistency of neighbourhood and built environment perceptions among children in the same age group, living in the same neighbourhood. To encourage communication and participation in the mapping activities,
students referred to the facilitators by their first names, and a pedagogical session was held before the mapping activities to introduce all participants to each other. Other studies that have used focus groups with children support the size of focus groups used in this research, as four to five students per group is large enough to encourage discussion but small enough to not be overwhelming (Morgan et al. 2002; Morgan, 1998). Groups with three or less are found to tire participants and exhaust discussion quickly (Morgan et al. 2002). CLPM sessions were held in the morning so that students were more likely to be alert and attentive, considering that other research has found that work done earlier in the school day encourages student participation (Kennedy et al. 2001). The design of these sessions, combining dialogue with mapping activities, reflected the notion that “…children need less verbally intense and more naturalistic methods” (Kennedy et al., 2001: 186).

As with all focus groups, CLPM sessions are vulnerable to dominant voices and personalities (Smithson, 2000). In the case of CLPM sessions, the success of the method was not simply dependant on the hierarchy of the participants, but also on the facilitators remaining objective and being mindful that they were working with younger, vulnerable participants (Morgan et al. 2002). In an attempt to mitigate these potential pitfalls, facilitators were informed well ahead of the sessions of the overall objectives, and given instructions to dress casually (yet conservatively) and be friendly and conversational with the students. While mitigating any dominant voices in focus groups is largely left to the facilitators, the nature of the mapping activities provided students a visual voice that can aid in this mitigation. Having a set of uniquely coloured markers and stickers specific to their perceptions permitted each student to self-define their neighbourhood in whatever
way they saw fit. There were two opportunities for less dominant participants to contribute, rather than a singular discussion as in conventional focus groups.

CLPM is aligned with the notion that place is uniquely constructed by each student. The decision a child makes on how to move through his or her environment is best understood through individually perceived reasons. The relational perspective described in Chapter 2 helps guide CLPM away from the idea of a measurable context, instead focusing on a more flexible and fluid approach of analysis (Cummins et al. 2007). The methods used in this research shift focus onto the processes and interactions between people and places as recommended in relational theory, contributing towards a new understanding of the relationship between children and place (Cummins et al. 2007).
Chapter 4  Results

Chapter 4 describes the findings of the analysis of data gathered via the CLPM sessions, and are presented in the form of text, quotations, maps, and tables. Results are derived at through analysis done with the aid of ArcGIS 10.0, and compares the maps created by the participants against the built environment as represented by land use. Patterns emerged from the analysis are presented and used to discuss both similarities and contrasts between each school.

4.1  Perceptual and Wayfinding Capability

Facilitators maintained their passive role, being monitored by the head researcher while conducting the mapping exercises. There were no instances of students altering the identifications made by their group members, as was verified by the audio recordings. Several key themes emerged in the analysis of the CLPM.

Students embraced the mapping activities, showing high levels of wayfinding skills and environmental cognizance. They identified regular active travel routes to schools and destinations, as well as a variety of zones that were perceived to be important to them. There was a substantial degree of consistency between the groups within each school. Participants did not require extensive assistance from adult facilitators. Once they familiarized themselves with the map, the children began to actively seek out areas, annotate them with their markers and pens, and discuss them with their classmates. For example, Group 7 of School C was discussing adjacent schools that they frequented for recreational purposes, and one group member posed the question of “What do you do when you go there?” to the rest of the group (Participant, Group 7, School C).
Detailed illustrations of findings at each school can be found in Figures 11 through 13 on the subsequent pages. These maps overlay all features identified by each school onto land use data. Active travel routes are identified overtop of the gray roads by an orange line. Graduated stars, sized according to the number of counts that a destination received, represent destinations. The intervals of low, medium, or high were based on the natural breaks specific to each school as determined by ArcGIS. Lastly, zones are illustrated using a line fill; vertical lines for play zones, and horizontal lines for avoid zones. The results specific to features location in relation to land use are presented within the subsequent tables and sections.
Figure 11: CLPM Results for School A

Source: Data from Planning Division, City of London, 2012
Figure 12: CLPM Results for School B

Source: Data from Planning Division, City of London, 2012
Figure 13: CLPM Results for School C

Source: Data from Planning Division, City of London, 2012
As evidenced by the elements included on Figures 11 through 13, children were acutely aware of both positive and negative features of their school neighbourhood environments. They were adept at dividing their neighbourhood into ‘avoid’ and ‘play’ zones, each zone occupying 45.9% and 54.1% respectively of their average identified zone area. While there are differences from school to school, students consistently demonstrated high levels of awareness through their independent identification of specific elements in their neighbourhood as either positive or negative. Although a small number of students were initially confused by the map, an effective orienteering approach was to begin by assisting each student to locate their home or a local landmark that they desired to locate. The effectiveness of this approach mirrored the theory of Kevin Lynch: that without notable landmarks, wayfinding through an environment is difficult and often wandering (Lynch, 1960). In the case of these students, landmarks were not only homes, but also various destinations. As one student stated in his or her navigation of the map: “I go down from the baseball diamond, follow the trail, and play on the lake.” (Participant, Group 6, School C). For this student, the baseball diamond contributed to the ‘imageability’ of their neighbourhood.

Descriptive statistics based on the spatial analyses of the GIS maps generated from the products of the CLPM sessions at each school are presented in Table 4, below.
Table 4: Descriptive Statistics Based on Quantitative Analysis of CLPM Results at each School

<table>
<thead>
<tr>
<th></th>
<th>School A</th>
<th>School B</th>
<th>School C</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map Area (sq km)</td>
<td>7.58</td>
<td>7.54</td>
<td>7.4</td>
<td>7.51</td>
</tr>
<tr>
<td>Destinations Identified</td>
<td>25</td>
<td>30</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Total Zones (sq km)</td>
<td>0.94</td>
<td>3.58</td>
<td>1.71</td>
<td>2.08</td>
</tr>
<tr>
<td>Play Zones (sq km)</td>
<td>0.46</td>
<td>1.59</td>
<td>0.50</td>
<td>0.85</td>
</tr>
<tr>
<td>Avoid Zones (sq km)</td>
<td>0.35</td>
<td>2.13</td>
<td>0.85</td>
<td>1.11</td>
</tr>
<tr>
<td>Food Zones (sq km)</td>
<td>NA</td>
<td>0.03</td>
<td>NA</td>
<td>0.03</td>
</tr>
<tr>
<td>Shop Zones (sq km)</td>
<td>NA</td>
<td>0.13</td>
<td>NA</td>
<td>0.13</td>
</tr>
<tr>
<td>Total Zones % (of total map area)</td>
<td>12.67</td>
<td>48.39</td>
<td>23.32</td>
<td>28.13</td>
</tr>
<tr>
<td>Play % (of total map area)</td>
<td>6.20</td>
<td>21.55</td>
<td>6.80</td>
<td>11.52</td>
</tr>
<tr>
<td>Avoid % (of total map area)</td>
<td>4.70</td>
<td>28.85</td>
<td>11.54</td>
<td>15.03</td>
</tr>
<tr>
<td>Food % (of total map area)</td>
<td>NA</td>
<td>0.47</td>
<td>NA</td>
<td>0.47</td>
</tr>
<tr>
<td>Shop % (of total map area)</td>
<td>NA</td>
<td>1.75</td>
<td>NA</td>
<td>1.75</td>
</tr>
<tr>
<td>Home % (of total map area)</td>
<td>NA</td>
<td>13.48</td>
<td>6.77</td>
<td>10.12</td>
</tr>
<tr>
<td>Total Length of Roads in map area (km)</td>
<td>83.36</td>
<td>63.74</td>
<td>73.86</td>
<td>73.65</td>
</tr>
<tr>
<td>Total Length of Active Travel Routes (km)</td>
<td>16.29</td>
<td>71.72</td>
<td>33.23</td>
<td>40.41</td>
</tr>
<tr>
<td>Total Length of Active Travel Route to Destinations (km)</td>
<td>9.32</td>
<td>62.91</td>
<td>24.74</td>
<td>32.32</td>
</tr>
<tr>
<td>Total Length of Active Travel Route to School (km)</td>
<td>6.98</td>
<td>8.81</td>
<td>8.50</td>
<td>8.10</td>
</tr>
<tr>
<td>Total Length of Active Travel Routes w/Road Segment (km)</td>
<td>13.89</td>
<td>56.14</td>
<td>23.82</td>
<td>31.28</td>
</tr>
<tr>
<td>Length of Active Travel Routes to Destinations w/ Road Segment (km)</td>
<td>8.82</td>
<td>51.49</td>
<td>18.46</td>
<td>26.26</td>
</tr>
<tr>
<td>Length of Active Travel Routes to School w/ Road Segment (km)</td>
<td>6.22</td>
<td>7.28</td>
<td>7.19</td>
<td>6.89</td>
</tr>
<tr>
<td>% of Roads Used for Active Travel</td>
<td>16.66</td>
<td>88.07</td>
<td>32.24</td>
<td>45.66</td>
</tr>
<tr>
<td>% of Roads Used for Active Travel to Destinations</td>
<td>10.58</td>
<td>80.79</td>
<td>24.99</td>
<td>38.79</td>
</tr>
<tr>
<td>% of Roads Used for Active Travel to School</td>
<td>7.46</td>
<td>11.41</td>
<td>9.73</td>
<td>9.54</td>
</tr>
</tbody>
</table>

Fully described throughout the sections below, the findings in *Table 4* represent the broad trends as illustrated in *Figures 11* through *13*. The schools had a fair amount of difference between each other, particularly between their number of zones and active travel routes identified. Food and Shop zones did not emerge in Schools A or C, while featuring very minimally in School B. The schools saw the most commonality in the number of destinations identified, averaging 28 as a group, as well as percentage of roads in the total map area used for active travel to school.

The subsequent sections will present findings with respect to the children’s identification of neighbourhood destinations, zones, routes, and their association to land use.
4.2 Destinations

It is important to note at the outset that participating students appeared to be highly skilled in map reading. As seen in Table 5, students from Schools A and B identified the majority of destinations on their map (a 2012 satellite image) with near perfect accuracy of their true destination (96.7% and 87.3% accuracy respectively), while students from School C achieved 100% accuracy of destinations identified in relation to their actual location. On average, the schools identified their destinations with an accuracy of 94.4%.

Table 5: Accuracy of Student Identified Locations of Destinations to Actual Locations

<table>
<thead>
<tr>
<th>Land Use</th>
<th>School A</th>
<th>School B</th>
<th>School C</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>23</td>
<td>52</td>
<td>80</td>
<td>155</td>
</tr>
<tr>
<td>Industrial</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Institutional</td>
<td>23</td>
<td>14</td>
<td>27</td>
<td>72</td>
</tr>
<tr>
<td>Recreational</td>
<td>32</td>
<td>62</td>
<td>18</td>
<td>112</td>
</tr>
<tr>
<td>Residential</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Agricultural</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Water</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>134</td>
<td>132</td>
<td>356</td>
</tr>
</tbody>
</table>

As previously seen in Table 4, the students in the three schools identified an average of 28 destinations. Some destinations were identified by one individual, but more often they were commonly identified by many participants. As seen in Table 6, three land uses most frequently identified as containing destinations for the students in each school were commercial, institutional, and recreational.
Table 6: Destinations Identified for Each School

<table>
<thead>
<tr>
<th>Land Use</th>
<th>School A</th>
<th></th>
<th>School B</th>
<th></th>
<th>School C</th>
<th></th>
<th>Average</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counts</td>
<td>% of All</td>
<td>Counts</td>
<td>% of All</td>
<td>Counts</td>
<td>% of All</td>
<td>Counts</td>
<td>% of All</td>
</tr>
<tr>
<td>Commercial</td>
<td>23</td>
<td>26.70%</td>
<td>52</td>
<td>38.80%</td>
<td>80</td>
<td>60.60%</td>
<td>155</td>
<td>42.03%</td>
</tr>
<tr>
<td>Industrial</td>
<td>0</td>
<td>0.00%</td>
<td>3</td>
<td>2.20%</td>
<td>2</td>
<td>1.50%</td>
<td>5</td>
<td>1.23%</td>
</tr>
<tr>
<td>Institutional</td>
<td>31</td>
<td>36.10%</td>
<td>14</td>
<td>10.40%</td>
<td>27</td>
<td>20.50%</td>
<td>72</td>
<td>22.33%</td>
</tr>
<tr>
<td>Recreational</td>
<td>32</td>
<td>37.20%</td>
<td>62</td>
<td>46.30%</td>
<td>18</td>
<td>13.60%</td>
<td>112</td>
<td>32.37%</td>
</tr>
<tr>
<td>Residential</td>
<td>4</td>
<td>4.70%</td>
<td>3</td>
<td>2.20%</td>
<td>2</td>
<td>1.50%</td>
<td>9</td>
<td>2.80%</td>
</tr>
<tr>
<td>Roads</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Agricultural</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>1</td>
<td>0.80%</td>
<td>1</td>
<td>0.27%</td>
</tr>
<tr>
<td>Water</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>2</td>
<td>1.50%</td>
<td>2</td>
<td>0.50%</td>
</tr>
<tr>
<td>No LU Data</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>100.00%</td>
<td>134</td>
<td>100.00%</td>
<td>132</td>
<td>100.00%</td>
<td>352</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

The number of destinations within recreational land uses (e.g., parks, playgrounds, and sporting complexes) and institutional land uses (e.g., churches, schools, community centers, and libraries) is generally high and not surprising given their intended use according to their land designation; however, the counts do reveal some differences among the schools. School B had by far the most destination counts within recreational land (62) as compared to School A (32) and School C (18). Proportionate to the total destinations and their associated land use, the designated recreational area of School A (35.6 %) and School B (46.3 %) is represented very well in children’s perceived areas of importance. Contrastingly, School C not only has the lowest number of destinations in recreational areas, but also a lower proportionate use of recreational land use for destinations (13.6 %). This suggests that in the neighbourhood of School C, recreational destinations were not prominent in the minds of the participants.

The large count of destinations within land designated as institutional is a positive neighbourhood asset for School C (27), as these ranged from community centers, to other
schoolyards. On the other hand, the large count (80) and proportionate use (60.6 %) of destinations within commercial land relative to School A (25.6 %) and School B (38.8 %) can be seen as a potential barrier to children’s health and well-being. For example, over 50% of commercial destinations identified by the three schools were either fast food restaurants or variety/convenience stores (as seen in the commercial destination breakdown section of Table 6). These were not simply locations that were registered because participants were aware of them. Discussion amongst groups with variety store or fast food locations elaborated on the reason for the destination selection, and those that appear on the maps are those that were frequented by students for ‘junk food’ such as “slushies” (Participant, Group 7, School C) or “pizza” (Participant, Group 5, School B).

While the CLPM sessions were effective in collecting data on the destinations and routes the children commonly use in their neighbourhood environments, the open nature of the method also proved effective in identifying areas of concern at a neighbourhood level. As seen in Figure 14, students in School C were able to identify 14 moderate-to-highly travelled to destinations in the neighbourhood, all within a radius of 1,100 metres of the school.
Figure 14 demonstrates that students’ destinations were spread throughout their neighbourhood. While students in School C were the most adept at identifying neighbourhood features outside of the school environment, students in Schools A and B also showed a significant awareness of community features. The method also captured the active routes being taken to these destinations, providing a larger arena for potential built environment interventions.
4.3 Zones

On average, the students from the three schools identified an average of 28.1% of the provided map area as some sort of zone. The two most frequently identified zones for each school were play zones and avoid zones. Table 7 contains a cross tabulation of both avoid and play zones, sorted according to their associated land use designation. It shows where these zones were distributed according to the built environment.

Table 7: CLPM Zone Distribution in Land Uses

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>Land use</th>
<th>Number of Counts</th>
<th>Percentage of ALL Counts</th>
<th>Coverage of Land Use by Zone Type (m²)</th>
<th>Percentage of ALL Zones in Given Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Avoid</td>
<td>Play</td>
<td>Together</td>
<td>Avoid</td>
</tr>
<tr>
<td>A</td>
<td>Commercial</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Institutional</td>
<td>5</td>
<td>32</td>
<td>37</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>Recreational</td>
<td>17</td>
<td>21</td>
<td>38</td>
<td>11.3%</td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>22</td>
<td>7</td>
<td>29</td>
<td>14.7%</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>22</td>
<td>16</td>
<td>38</td>
<td>14.7%</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>No LU Data</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>71</td>
<td>79</td>
<td>150</td>
<td>47%</td>
</tr>
<tr>
<td>B</td>
<td>Commercial</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>0.1%</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
<td>12</td>
<td>8</td>
<td>20</td>
<td>0.9%</td>
</tr>
<tr>
<td></td>
<td>Institutional</td>
<td>42</td>
<td>18</td>
<td>60</td>
<td>3.0%</td>
</tr>
<tr>
<td></td>
<td>Recreational</td>
<td>326</td>
<td>577</td>
<td>903</td>
<td>23.2%</td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>168</td>
<td>96</td>
<td>264</td>
<td>11.9%</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>72</td>
<td>38</td>
<td>110</td>
<td>5.1%</td>
</tr>
<tr>
<td></td>
<td>Agricultural</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>8</td>
<td>9</td>
<td>17</td>
<td>0.6%</td>
</tr>
<tr>
<td></td>
<td>No LU Data</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>0.4%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>643</td>
<td>765</td>
<td>1408</td>
<td>46%</td>
</tr>
<tr>
<td>C</td>
<td>Commercial</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>2.3%</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
<td>15</td>
<td>9</td>
<td>24</td>
<td>5.6%</td>
</tr>
<tr>
<td></td>
<td>Institutional</td>
<td>2</td>
<td>30</td>
<td>32</td>
<td>0.8%</td>
</tr>
<tr>
<td></td>
<td>Recreational</td>
<td>12</td>
<td>50</td>
<td>62</td>
<td>4.5%</td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>35</td>
<td>28</td>
<td>63</td>
<td>13.2%</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>39</td>
<td>17</td>
<td>56</td>
<td>14.7%</td>
</tr>
<tr>
<td></td>
<td>Agricultural</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0.4%</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>1.5%</td>
</tr>
<tr>
<td></td>
<td>No LU Data</td>
<td>6</td>
<td>1</td>
<td>7</td>
<td>2.3%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>120</td>
<td>146</td>
<td>266</td>
<td>45%</td>
</tr>
</tbody>
</table>
Of the two most prominent zones, play zones were most likely to be found in recreational land for each school (School A: 14.0 %; School B: 41.0 %; School C: 18.8%) as well as institutional for School A (21.3 %). Although initial results are not surprising, further interpretation reveals contextual perceptions of specific land uses. Institutional land use, the highest counted play zone land use for School A, and second highest (11.3 %) for School C, fails to register strongly among the participants at School B (1.3 %). This corresponds with the low count (10.8 %) of destinations falling within institutional land uses for School B, despite a community center, pool, library, and other schools in the map extent provided to the students.

Avoid zones were most likely to occur in residential, road, and recreational land uses for School A (14.7%; 14.7%; 11.3% respectively) and School B (11.9%; 5.1%; 23.2% respectively). School C had avoid zones in residential, road, and recreational land (13.2%; 14.7%; 4.5% respectively) and also industrial (5.6%). Recreational areas, although viewed as a positive neighbourhood asset in conventional environment and health analyses, was the most frequent type of land use to be classified as either a play zone, an avoid zone, or both. The reasons for areas being attributed as either a play or avoid zone were many, but centered on a common theme: lived experience. Classification may reflect intended use of an area, but rarely did zones ever follow any formal boundaries, such as play zones being directly along the edges of parks. Rather, zones were fluid and based on the personal experience of participants. Avoid zones stretched across multiple land uses and areas for reasons ranging from intense vehicular traffic, feelings of being unsafe from individuals, or a lack of any desirable features. Play zones were allocated simply based on where play occurred, and were found in forests, industrial
areas, and institutional parcels of land. Both the reasons and delineation of zones in this research speak to the importance of perception based on lived experience when examining children’s built environments.

4.3.1 Conflicting Spaces

There were dualisms for how certain areas were perceived by the participants, particularly recreational areas. Researchers, urban planners, elected officials, or adults in general, usually see environmental features such as parks or trails as positive aspects of the built environment. For the child participants, however, these areas were often conflicted destinations with contextual divergences. Recreational areas in particular emerged as sites of conflict for the students. Recreational land use in each of the three elementary school areas examined constituted an average of 25% of the total avoid zone area identified by all participants. The defining characteristics of avoid zones ranged from feeling unsafe because of older kids and strangers, to busy nearby traffic and poor lighting. Yet considering this, an average of 23.1% of all play zones fell within recreational land uses. This contradiction suggests that although an area might have a designated purpose, land uses cannot be considered singularly. These zones and land uses are perceived differently. In the case of a prominent avoid zone north of School A (Pictured in Figure 15), students reported feeling unsafe for multiple reasons, including one student’s assertion that “There’s always scary people hanging there” (Participant, Group 1, School A) and another student’s claim that “People sell drugs and stuff” (Participant, Group 2, School A). When one adult facilitator tried to summarize the observations by saying: “So we avoid the zone, but we still go play in the park?” (Facilitator, Group 2, School A), the participating children unanimously responded with
comments that it was always different, and depended on who is in the park and the time of day.

![Avoid Zone North of School A](image)

**Figure 15: Avoid Zone North of School A**

Below, *Figure 16* depicts the region immediately south of School B – including the schoolyard, a forested path, and a much-used outdoor recreation complex. Play zones can be found on the image on the left side of *Figure 16*, and avoid zones on the right.
Figure 16: Conflicting Spaces in School B

While the combination of these three features is, again, normally reported as a positive feature in built environment and health research and/or adult led walkabouts, children had more complex perceptions. Many participants reported “mountain biking” (Participant, Group 3, School B) and “playing” (Participant, Group 5, School B) in the schoolyard and forested section to the south. It was revealed that students avoided a significant portion of their schoolyard due to a frightening “…guy who like, watches us all recess” (Participant, Group 5, School B), an account shared by most students in the class during the presentations. When a facilitator took note by saying she was amazed they avoid sections of the playground due to a creepy individual, the response was that “Creepy is a light way of putting it!” (Participant, Group 5, School B), a sentiment
echoed by the rest of the group. Additionally, the students found older kids would hang out in the darkened trail through the woods, and would sometimes intimidate them or prevent them from using the path or adjacent schoolyard because that area was “Where a lot of bad things happen” (Participant, Group 6, School B) and where “bullies” hung out (Participant, Group 5, School B).

4.4 Routes

Students identified an average of 45.7% of the roads in the map area provided as being used for active travel to and from various destinations. Students were able to recall specific routes that they travelled, and did not restrict their findings to the road network. They mapped any trail systems or cut-throughs used to travel to their chosen destination, often referring to “shortcuts” (Participant, Group 3, School A) and “pathways” (Participant, Group 5, School B) en route to their destinations. School specific breakdown of the distribution of routes along land uses can be seen in Table 8. Roads were not considered as a land use within this table as they dominate the location of active travel given their intended purpose. The objective of the routes tabulation was to observe the types of land uses students either travelled through or alongside.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>School A Usage</th>
<th>School B Usage</th>
<th>School C Usage</th>
<th>Average Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>15.3%</td>
<td>4.0%</td>
<td>15.1%</td>
<td>11.5%</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.0%</td>
<td>3.9%</td>
<td>1.7%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Institutional</td>
<td>21.3%</td>
<td>26.3%</td>
<td>14.5%</td>
<td>20.7%</td>
</tr>
<tr>
<td>No Land Use</td>
<td>0.0%</td>
<td>0.0%</td>
<td>1.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Recreational</td>
<td>46.0%</td>
<td>54.3%</td>
<td>20.8%</td>
<td>40.3%</td>
</tr>
<tr>
<td>Residential</td>
<td>17.5%</td>
<td>11.4%</td>
<td>47.0%</td>
<td>25.3%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
The land uses adjacent to active travel routes differed from school to school, dependent on the spatial distribution of land uses of each specific neighbourhood, and the destinations that students sought out. None of the schools had significant active travel occurring adjacent to industrial or to areas with no designated land use. There was no consistent relationship between the percentage of a specific land use in a given area and the amount that land use is actively travelled alongside or through.
Chapter 5    Discussion

The purpose of this chapter is to elaborate on the results presented in Chapter 4, and will do so in two sections: Discussion of Key Findings and Discussion of Methodological Contributions. The significance of the results related to children’s perceptions and use of their neighbourhood environments will be discussed in the Findings section. The Methodology section of this chapter will discuss the experience and effectiveness of the methods used for this research, including the effectiveness of the CLPM activities using the adapted Lynchian typology and GIS analyses.

5.1 Discussion of Key Findings

The literature discussed in Chapter 2 explores linkages between the built environment and children’s active travel. Previous studies (e.g., Larsen et al. 2011; 2009; Giles-Corti et al. 2009) and the conclusions that they reached inspired this researcher to contribute a more participatory examination of children’s perceptions of their built environment. The findings of this study supports the growing body of research that states specific elements of the built environment can directly influence a child’s travel choices (Larsen et al. 2011; 2009; van Loon & Frank, 2011; Giles-Corti et al. 2009; McMillan, 2007). The built environment offers many aspects in need of the amount of research it receives and warrants further exploration, as evidenced by the amount of data and discussion that child participants were able to contribute to this study. Children extensively categorized their neighbourhood according to perception, and designated large areas of land as avoid zones or play zones, thereby deeming them as either desirable or undesirable for use. There was a high degree of attention towards elements of safety,
such as areas that lacked lighting, viability, or a sense of security – essentially what urban theorist Jane Jacobs referred to as ‘eyes on the street’ (Jacobs, 1961).

Researchers van Loon and Frank (2011) maintained in their review that further research towards the relationship between land use and children’s active travel is fundamental in understanding the built environment and designing potential interventions. This has been shown to be true, as when given the opportunity children can contribute meaningful data on how they perceive their environment relative to land use. Analysis of the mapping activities revealed that specific land uses can be linked to perception and behavior in a manner that reveals more about the performance or efficacy of the built environment. While work focused on establishing correlations between reported rates of active travel and built environment features contributes towards the broader understanding of child interactions with their surroundings (Su et al. 2013; Larsen et al. 2011), there is a real need for work directed on the perception of built environment features. How an area is understood, rather than what it is originally intended for (i.e. by city planners, engineers, developers, municipal officials, policymakers, or other actors or agents in the built environment), may in fact mean more to the behaviours and travel decisions made by children.

The built environment, as these mapping activities revealed, is not straightforward, nor do elements necessarily function as intended. Considering land use as definitive, either as a singular variable or as an index of “land use mix” as researchers have tended to do in the literature (e.g., van Loon and Frank), ignores the ‘imageability’ of individual land uses or built environment components. While an area may score high on its ‘mix’ of land uses such as School C or A, the land uses in these mixed areas may
not fair well in the perception of children. Effectiveness of land use cannot simply be thought of as certain mix or amount, but must be based on the performance of the land use as perceived by the target audience. The features discussed in previous literature such as a mix of land use (McMillan, 2007) or residential density (Su et al. 2013) assume that these land uses are used as they are meant to be, and that all land uses perform equally. Studies that seek to gain understanding of children’s use of environment must pose perceptual questions alongside quantitative analysis. What this thesis revealed is that when researching children’s relationship with their built environment, a high degree of participation is needed.

The findings of this research corroborate the conclusion of the systematic review contained in Chapter 2. The variety of types and sites of interventions in the review matches the diverse findings at each case study school. There is simply no one conclusion that can be drawn to identify where interventions should be located. The same can be said for the type of intervention that may be effective in increasing active travel. Each of the schools examined had such contextually specific avoid zones and barriers to neighbourhood mobility that attempting the same intervention in each neighbourhood would likely not be successful across the board. As concluded in the systematic review, this study asserts that research must continue to be done on a site-specific level in order to design interventions that will have the optimal chance at success.

The findings from the CLPM sessions further the understanding of the relationship between the built environment and children’s active travel, permitting certain neighbourhood problems to be identified, and strengths to be further developed. Environmental components used as landmarks by children to wayfind their
neighbourhood can be accentuated and have their profile raised with improved signage or better lines of sight in order to increase their usage. Amenities that seem to be overlooked in the discussion, such as the community centre and pool in the School B neighbourhood, should receive greater focus from planners and stakeholders in order to raise their profile within the school community. For those areas that have higher frequencies of avoid zones, conflicting spaces, or community level concerns (as seen in Figures 14 and 16), it is recommended that further research be done with students (and parents, teachers, and city planners) to attempt to determine the root causes of key issues and to construct an action plan that addresses site specific or neighbourhood level concerns.

These findings also have implication for the school travel planning (STP) process. In the current form of STP, the real contextual issues that constitute these avoid zones for children would be overlooked. The park north of School A is a highly travelled route for many of the students on their active journey to and from school. While this journey may contribute to daily physical activity levels from walking or biking, it is not a journey that children take without reservations. Although children travel through and use a space meaningfully, it does not mean that they are doing so comfortably or by choice. An adult would likely not feel the same fear as a child would from seeing teenagers or older kids hanging around on the periphery of a park, or drinking alcohol in public. As illustrated in the conversation between a facilitator and a group of students contained in Chapter 4, the interpretation of an avoid zone may just be “creepy” to an adult, but to the students this is something negatively impacting their daily recess, and they view it in a more profound sense.
While planning for journeys to and from school identifies regular active travel opportunities, recognizing where and how children are moving to destinations throughout their neighbourhood as a whole is the basis for achieving broader behavioural changes. Expanding the travel planning process to a neighbourhood level as opposed to a school level could offset the inherent gaps in school travel by providing AT opportunities on weekends and during vacations. A neighbourhood level examination of active travel would also allow for a discussion of the types of locations to which students travel. The prominence of commercial destinations, specifically variety stores and fast food restaurants is also a cause for concern, as the health implications of the food consumed at such ‘junk food’ outlets is well known (He et al., 2012), and is likely to outweigh the benefits of active travel to and from them. This is not encouraging for planning healthy school neighbourhoods, particularly for School C when considering the number of junk food sites identified. Active travel at the neighbourhood level could prove to be a more effective use of the resources and partnerships within the STP process, thereby effecting improvements of behaviour and attitudes at a wider level.

5.2 Discussion of Methodological Contributions

CLPM proved to be an effective research method to gather data on how children move through and perceive their environment. The typology inspired by the work of planner and urban theorist Kevin Lynch was detailed enough to extract data with breadth and depth, while simple enough to maintain student engagement. Considering the execution and success of this project, it is argued that Child-Led Perceptual Mapping fits on the 6th rung of Hart’s Ladder of Youth Participation (1992). While adults initiated the
activities, students took control of the activities, initiated all meaningful findings and led the discussion however they saw fit.

Introducing this typology to children both refutes and corroborates a number of conclusions reached by Lynch in his original text from 1960. Lynch asserted that a lack of landmarks or difficulty orienteering for participants might have been caused by a lack of spatial prominence of features, or dominant features on the landscape such as tall buildings or tourist attractions (Lynch, 1960: 51). While this may be true in downtown urban cores, students in each of the schools were able to identify an extensive amount of features in landscapes that were seemingly devoid of structures that would be considered by urban theorists or planners as major landmarks. This suggests that imageability of a neighbourhood or area is not bound by universal determinations of significance, rather prominence is assigned on an individual basis. These students may not have had a major landmark in their neighbourhoods in the conventional sense, such as a museum or city hall, but participants perceived other features as having spatial dominance, such as parks and variety stores. While this refutes the aforementioned conclusion of Lynch, it supports a later note by Lynch, that a landmark can be small or large and is more reliant on visibility rather than grandeur.

Lynch also found that there was no structure or interrelation between the various perceptual components (i.e., paths were separate from districts, landmarks separate from nodes, etc.) (Lynch, 1960). The conflicting spaces discussed in Chapter 4 directly refute this notion. Spaces can be diverse, falling within multiple perceptual categories. Avoid zones are not necessarily solely avoid zones, and may contain destinations, routes, or play zones. This may indicate a shortcoming in Lynch’s initial methodology – that instead of
giving participants the opportunity to freely designate attributes to their city, they operated within a more constrictive system. Perception considered singularly, as Lynch does, is still valuable data – but the combination of perceptual data with designated land use allows for this assertion to be refuted.

The use of GIS for managing all of the data generated through the participatory mapping activities opened up numerous avenues for powerful spatial and statistical analyses that were not possible in Lynch’s time. The tools available in ArcGIS 10.0 and the availability of municipal land use and built environment data in digital format made it possible to combine perceptual data with designated land use for a deeper understanding of children’s environments in this thesis. Lynch could also have done this in his early work by overlaying his suite of ‘image maps’ on top of city land use maps, but it would have been more difficult and time consuming at that time (and such maps did not appear in his text). Nevertheless, it has been argued that the ‘overlay technique’, which is fundamental to geographic information systems and now commonplace in geography and urban studies, was first popularized later in the 1960s by landscape architect Ian McHarg (1967).

Major strengths as identified by Lynch also emerged in this research. The nature of environmental components that Lynch found in his research proved to be consistent. Lynch attested that districts (called ‘zones’ in this research) are “thematic continuities” (Lynch, 1960: 67) that can consist of any sort of components such as form, activity, or maintenance. Additionally, Lynch found that routes were not just selected based on the road travelled, but by the features alongside the routes (Lynch, 1960). Lynch also found that people revert to their locality, and those landmarks that were near important locations
for participants were the most often identified. Students in this research exemplified all three of these phenomena in their wayfinding as exemplified by the variety of underlying reasons that various zones, routes, and routes were identified.

Additionally, Lynch found that visual scope and singularity were qualities of neighbourhoods that factored heavily into an area’s imageability (Lynch, 1960). Visual scope is considered to be the range of which a feature can be considered and identified. This was evident in the research for this thesis, and exemplified in following two cases. The community center and pool that registered poorly as a destination for children in School B is tucked away on the inside of a block. The lack of visual connectivity between potential users and the center made it difficult to connect to a wide audience. Conversely, children in School C identified a large number of destinations. The majority of these were along an expansive major arterial road with long-range visibility, as well as distinctive advertising signs. The scope of School C destinations is very large compared to School B, and therefore the imageability in School C neighbourhood is also greater than in the School B neighbourhood.

Singularity is the contrast a feature has to either physical surroundings or to an observer’s experience that makes it identifiable (Lynch, 1960: 105-106). In terms of singularity, this emerged in the participatory mapping process witnessed within each school. However, as Lynch asserted in his text, people rely more on uniqueness and individual meaning to categorize their neighbourhoods. This was also found in the research conducted for this thesis, as evidenced by the quotations in Chapter 4, particularly those related to conflicting spaces. While participants did identify areas according to their intended use (i.e., parks as recreation, industrial areas as avoid),
categorization was often dependant on uniqueness. Landmarks, avoid zones and play zones were in particular categorized by personal experience. Landmarks were not based on grandeur or design, but rather usage and proximity such as the variety store in School B, known for its pizza rather than the design of its facade. Zones were almost entirely experiential as students relied on their experience and perception for categorization. The findings contained in this thesis support the notion from Lynch that planned use of space does not correspond with its interpretation.

This illustrates Lynch’s idea that a well performing space works in “…evoking a strong image in any given observer…[providing] highly useful mental images of the environment” (Lynch, 1960: 9). Students consistently related their travel behaviour and the location of features to specific elements of their experience. The high rate of accuracy when locating destinations in relation to their actual location indicated that children between the ages of 9 to 12 are not only capable of using maps, but they are also very cognizant of their neighbourhood and can contribute reliable and meaningful information to a discussion on the built environment.

Most significantly, these methods elevated children to the status of co-researchers. CLPM sessions create a bridge between urban planning theory, STP, and child based research that has not, at the time of writing, been made in other published research, but which has been widely called for (Loebach & Gilliland, 2010; Hart, 1994). While the methods employed within school-based research should be tailored to each school, it should also consistently strive for a high degree of participation by the students. Participants in these research sessions not only showed a high level of participation, but also a high level of environmental awareness that helped them to contribute meaningfully
to the discussion surrounding active school travel planning. Students were able to independently identify specific elements of their neighbourhood that were both encouraging and prohibitive to AT. It was clear that children do not define land uses or parcels as adults or city planners do, nor do they define them singularly (Hart, 1994).
Chapter 6  Conclusion

This concluding chapter will take a high level approach in examining the place of this research in the broader knowledge base. The chapter reiterates the findings of this research relative to the research question posed in Chapter 1, and identifies the implications of this work on a school, city, and systemic level. This chapter concludes by looking forward towards potential future research that can build upon this work.

6.1 Achieving the Research Objectives

Research on the built environment is rarely participatory in nature. Therefore, this study of children’s experience of their neighbourhood built environments aimed to fill a gap in the literature. Conducted in this manner, CLPM allowed researchers to tap into the contextual specificity of an individual child’s lived experience. This method represents a positive step forward in participatory methods used in planning healthy environments for children. CLPM is a valuable tool in providing context to conventional GIS analysis of children’s environments, and should continue to be used to contribute meaningfully towards planning healthy, traversable neighbourhoods.

The combination of CLPM and GIS analysis used in this thesis allowed for a comprehensive understanding of where children are travelling, the conditions of these areas, and how children perceive the environments. Integrating these three modes of inquiry helped to shed light onto the reciprocal relationship between place and individuals and how that relationship affects the way people choose to travel through their neighbourhood. The data collected reflects a key assertion of a relational perspective: both internal and external processes define place. In this instance, these
processes include the decisions of children to either move actively through their environment, or to avoid active travel in certain places.

The objective of this research was to contribute to a growing body of knowledge aimed at understanding the influence of the built environment on the well being of Canadian children. This has been accomplished through this study, which answered the research question:

1. How do children's perceptions and use of their school neighbourhood vary according to the built environment?

This study used child-led perception mapping sessions with groups of children in three diverse elementary schools to identify key built environment features that impact the propensity for active travel among children. The method was effective in categorizing children’s neighbourhoods into travel destinations and routes taken, and for examining how children perceive and/or use or avoid certain zones. This was analyzed according to land use, which allowed for elements of the built environment such as park and recreational space, residential land use, and commercial locations to be linked to perception. Digitizing, managing, layering, analyzing, and presenting the data in a GIS could observe variations and consensus.

Notably, at no point did the children fail to recognize the importance of the issue of providing a safe environment in which to travel actively. They led discussion, and in doing so provided rich data with valuable context. The wayfinding capability of the children involved far surpassed expectations, and they were able to effectively compartmentalize elements of their environments into avoid and play zones, destinations,
and routes travelled. This demonstrates that when given the opportunity, children can and should play a leadership role in planning for increased rates of active travel.

The broader objective remains to have the findings adopted by local decision makers, school boards, city planners, parents and the youth themselves in their processes in planning for healthy environments. The facilitators that were recruited for the CLPM sessions are all invested stakeholders with an interest in active school travel planning (e.g., teachers, city planners, transportation engineers, and public health nurses, as well as representatives from local Block Parent and Active & Safe Routes to School Committees). Likewise, there were several key policymakers and decision makers present who are in a position of influence to translate the findings and recommendations of this thesis to action.

6.2 Implications

6.2.1 Children in the School Travel Planning Process

A high level of participation by children is important not only to develop effective interventions, but also to involve students in a meaningful and substantial manner in the school travel planning process. The findings and discussion suggest that children do indeed have a voice and meaningful insights to offer towards better understanding active travel issues. The STP process must recognize how the fluidity of place means that it is constructed differently for every individual. The stakeholder approach in place does reflect that a diversity of expertise and background are needed to solve problems. Without extending that paradigm to children, however, the process will have vestiges of tokenism or decoration (Hart, 1992). The role of children needs to increase particularly in
the baseline data collection, action plan development, and action plan implementation phases. To achieve this, children must have their role as an equally important shareholder written into STP policy. The potential long-term benefit of a greater involvement of children would facilitate a knowledge transfer of these issues and resolutions from current stakeholders to the students, and empower the future decision makers with the value of participatory decision-making.

6.2.2 City and School Level Policy

As discussed in Chapter 2, this research shows that there are multiple issues to be addressed to increase levels of active school travel. Importantly, as the literature review demonstrated in Chapter 2, no single intervention design strategy has been found as of yet to effectively facilitate and encourage active travel. The findings of this thesis do not change this state of the field, and instead call for multi-dimensionality in study design. There is no one size fits all solution, and what may be right for one school may not be right for another. Schools A and B could benefit from interventions focused on safety of the children in surrounding parks and schoolyards, perhaps with increased lighting or the presence of a program such as Block Parents (e.g. www.londonblockparent.ca). These same interventions, however, would have little to offer to School C, where students reported few negative occurrences in nearby parks and schoolyards.

Research on the impact of the built environment on children’s active travel should be supported and delivered to partners within municipal and school level planning administration so that best practices can reflect the most current state of knowledge. On a municipal level, cities should take steps to ensure that at a high level, active transportation is a priority in all transportation master plans and official plans. In doing
so, the foundation will be set for planners and city officials to justify infrastructure installation, intervention planning, and the funding of research on AT conditions specific to the built environment within their city. At the time of writing this thesis, the City of London was undergoing an official plan review process, and has accepted a report from the Middlesex-London Health Unit and the Human Environments Analysis Laboratory on the state of active travel in London and directions for moving forward, including recommendations for policy changes (Middlesex-London Health Unit, 2012).

Additionally, school boards must also embrace active travel as a transportation priority in their selection of school sites and determination of catchment area boundaries. Schools typically focus their resources and staff on bus transit planning. As the benefits of active travel become increasingly clear, and more children prefer to travel actively (Larsen et al. 2011), local school boards and the provincial Ministry of Education recognize walking and biking to school as equally important means of transit. The Ministry of Education might earmark some funding for the purpose of active transportation planning from student transportation authorities. Firm boundaries of walk zones can be established using school-wide participatory mapping. Participation in a form of school travel planning with increased student participation as recommended by Hart (1992) can also be encouraged by empowering the students by working with them, and avoiding tokenism. Taking these steps would provide schools with the direction and support to engage in the school travel planning process to identify ways that they may encourage increased active school travel among their students.

The findings support the idea that the lack of uniform intervention design or location is not a shortcoming, but rather reflective of the uniqueness and diversity of each
set of issues at each school. Interventions should be based on thorough, mixed-methods research with a high level of participation (Hart 1992). In doing so, the likelihood of achieving further significant results or some positive change with respect to children’s well-being will increase. Interventions, particularly infrastructure installation or upgrades, are expensive and time consuming. If they achieve meaningful results, the possibility of further intervention being funded and guided by municipal government, community groups, independent funding organizations, or the school board will increase exponentially. Using the same or similar methods as those used in this thesis can help develop a comprehensive and accurate baseline assessment of conditions.

6.2.3 Toward a Systems Approach

The findings of this thesis suggest that a systems approach is effective in increasing rates of active school travel. Community level destinations were identified that revealed the broad nature of avoid and play zones that span areas controlled by school boards, the City, and private stakeholders. Children electing not to travel actively—or parents not allowing it—may be the symptom of reduced rates of AT, but it is not essentially the cause. Through an integrated systems approach, stakeholders can appreciate the broad variety of environmental barriers that influence perception of a neighbourhood and then change behaviour. The emphasis on the interconnections between different sectors in the community and between residents and their surroundings makes this approach highly suited to addressing active travel (Serpas et al. 2013; Kohl et al. 2012). In this framework an intervention must not simply change behaviour, it must also be sustainable (Serpas et al. 2013; Kohl et al. 2012). A systems approach with schools as the focal point for interventions meets these criteria, as student travel to and
from the school is regular and will provide a constant usage towards making the impact of the intervention sustainable. A systems approach advocates being contextually aware of the neighbourhood characteristics “…to see the whole picture so that intended and unintended consequences of intervention strategies can be recognized and strategies altered if required” (Serpas et al. 2013: 81).

From the research and systematic review, there emerges no singular manner by which to address barriers to active and safe travel to school. A systems approach takes the collaborative and broad approach necessary to consider active travel as the complex issue that it is. Similar to the ecological classification of physical activity by van Loon and Frank (2011), active travel is affected by multiple individual factors as well as a variety of proximate environmental features. A systems approach to understanding this issue allows for an open discourse that is sure to yield more comprehensive results. Priorities can be made on what needs attention first. Instead of merely assigning resources to a perceived problem, a systems approach allows for more pressing issues to emerge from discussion. In doing so neighbourhood shortcomings become more manageable, and stakeholders will not be overwhelmed with trying to tackle any issues all at once. A systems approach affords a coordinated response to a problem that can affect real and meaningful change in the lives of students who could potentially travel actively to and from school. This would be a marked improvement over how issues relating to active school travel are most often handled; internally within the school, using only school resources.

At the time of writing, there are no studies advocating a systems approach for active travel and the built environment specific to children. However the broader
literature points out that planning for active travel in general is most effective when it takes a systems approach (Garrard, 2011), and is reflective of the uniqueness of specific neighbourhood features not just limited to roads or sidewalks, but land uses and built environment features within the broader area (Larsen et al, 2009 McMillan, 2007). Identifying where features are located allows researchers and facilitators to work with the individuals who have the required contextual knowledge or expertise -- be it children, school administrators, business owners, city officials, or community partners (Buliung et al. 2011). CLPM is effective in identifying neighbourhood characteristics that can focus the scale of STP activities, or broaden them to wider horizons. For example, the findings from these schools could be forwarded to local policy makers to assess the merits of policies that restrict the siting of fast food sites. Additionally, the partnerships within STP can be developed through the mobilization of Block Parent groups or other neighbourhood watch groups that can address issues of safety and danger of the participants stemming from local parks, schoolyards, and trails (Buliung et al. 2011). CLPM provides the opportunity for policy to be developed that reflects specific, contextual realities.

6.3 Moving Forward

Future research should continue to address the involvement of children on work about children’s active travel and physical activity. Innovative research methods and community engagement tactics are required if the decline in childhood health, physical activity, and active travel is to be reversed. A deployment of the methods contained in this thesis to a broader school base through a STP organization such as Ontario Public Health Agency, Green Communities Canada or HASTe BC (Hub for Active School
Travel, 2013) could produce interesting results. In doing so, the methods could be further refined and modified to best suit the needs of schools and students. These methods and findings must be deployed in neighbourhoods of varying sizes and composition so as to gain further depth and understanding of barriers to active travel. Future research questions regarding children’s perception of their built environment and the widespread applicability of the CLPM method itself can be answered in doing so.

Knowing how community assets are used and perceived can go a long way in promoting active travel behaviour. Avoid zones and play zones proved to be the most salient features in the discussion, alongside destinations and routes travelled. The findings from the CLPM sessions were valuable in their own regard, but can also serve to motivate other neighbourhoods to begin dialogues on their own strengths and weaknesses. Continued research that is iterative, reflexive, and participatory will play a large part in better understanding the complex system that impacts active travel. Through research designed in this manner and a strong community engagement strategy, increased rates of active school travel and physical activity are achievable in the future.
Chapter 7    References


Green Communities (2013). *School Travel Planning Toolkit.*


Healthy Canadians (2011). *Childhood Obesity.*


Appendices

Appendix A: Ethics Approval for Use of Human Participants

Use of Humans Participants - Ethics Approval Notice

Statement of the Principal Investigator:

Principal Investigator: Dr. Jason Gilliland
Review Number: 1091/BS
Review Level: Delegated

Protocol Title: Identifying causal effects on the built environment on physical activity, diet, and obesity among children.
Department & Institution: Social Sciences/Geography, University of Western Ontario
Sponsor: Canadian Institutes of Health Research
Heart and Stroke Foundation of Canada

Ethics Approval Date: June 08, 2011
Expiry Date: August 31, 2014

Documents Reviewed & Approved & Documents Received for Information:

<table>
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<tr>
<th>Document Name</th>
<th>Comments</th>
<th>Version Date</th>
</tr>
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<tr>
<td>Other</td>
<td>Revised Healthy Neighbourhood Survey for Parents.</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Revised Health Neighbourhoods Survey for Youth</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Revised Activity and Travel Diary for School Days and Weekend Days</td>
<td></td>
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This is to notify you that the University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussions related to, nor vote on, such studies when they are presented to the NMREB.

The Chair of the NMREB is Dr. Riley Hinson. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 0000941.
# Appendix B: Validity Assessment of Review Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Randomness 2</th>
<th>Control Group 3</th>
<th>Comparability 4</th>
<th>Representative 5</th>
<th>Measured AT/PA 6</th>
<th>Period of Assessment 7</th>
<th>Criteria Met</th>
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<tbody>
<tr>
<td>Farley, 2007</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<td>Fitzhugh, 2010</td>
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<td>Veitch, 2012</td>
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<td>Tester and Baker, 2009</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Carver, A., 2010</td>
<td>Yes</td>
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<td>Brink, 2010</td>
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<td>Yes</td>
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</tr>
</tbody>
</table>

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2. Were participants, neighbourhoods, areas randomly allocated to intervention and/or control status?

3. Did the study include a control group to compare effects of intervention?

4. Was the study able to compare baseline to post-intervention (or of intervention to control). No concurrent or other confounding factors that may have altered post-intervention results

5. Does the population studied represent claims of the paper?

6. Measured PA/AT. Not self reported.

7. Were increases in PA/AT observed or reported for periods >1 day
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<thead>
<tr>
<th>Study</th>
<th>Selection</th>
<th>Randomization</th>
<th>Crossover</th>
<th>Attrition</th>
<th>Transport</th>
<th>Continuity</th>
<th>Sample Size</th>
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<td>Ridgers, 2010</td>
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<td>Cohen, 2012</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Cohen, 2009</td>
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<td>Yes</td>
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<tr>
<td>Boarnet, 2005 A</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
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<td>Boarnet, 2005 B</td>
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<td>Hinckson, 2011</td>
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<td>Day, 2007</td>
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### Appendix C: Land Use Definitions (Adapted from City of London, 2012)

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Shall mean any land or structure used for permanent or semi-permanent inhabitation; including but not limited to town houses, detached single family homes, and apartment complexes.</td>
</tr>
<tr>
<td>Recreational</td>
<td>Shall mean land or public structures used for recreation or social activities; including but not limited to recreation complexes, public pools, public parks, and trail systems.</td>
</tr>
<tr>
<td>Commercial</td>
<td>Shall mean the use of land or building for the sale of goods; including but not limited to retail stores, grocery, auto sales, restaurants, and variety stores.</td>
</tr>
<tr>
<td>Institution</td>
<td>Shall mean facilities provided by any level of government or by any other group or organization without profit or gain for such special purposes; including but not limited to schools, churches, libraries, research facilities, and museums.</td>
</tr>
<tr>
<td>Industrial</td>
<td>Shall mean any land or building designated to industrial activities; including but not limited to manufacturing, processing, and large scale shipping and receiving, such as train tracks and yards.</td>
</tr>
<tr>
<td>Roads</td>
<td>Shall mean any paved surface intended for car travel; not including private or public parking lots.</td>
</tr>
<tr>
<td>Agricultural</td>
<td>Shall mean the use of land, buildings or structures for; the tillage of soil, growing and harvesting of crops; the raising of all kinds of livestock poultry.</td>
</tr>
<tr>
<td>Water</td>
<td>Shall mean any permanent body of water; natural or constructed.</td>
</tr>
<tr>
<td>No Land Use</td>
<td>No assigned land use on public record.</td>
</tr>
</tbody>
</table>
Curriculum Vitae

Education:

M.A. in Geography
Fall 2011 - February 2013 (Expected)
Western University (London, ON)

B.A. in Geography, Honours
Fall 2007 - April 2011
Carleton University (Ottawa, ON)

Academic Exchange - Continuation of B.A.
January 2010 to May 2010
University of Leeds (Leeds, UK)

Work Experience:

School Travel Planning Facilitator
September 2013 – January 2014
Green Communities Canada

Research Associate
September 2011 – August 2013
Human Environments Analysis Laboratory (HEAL)

Teaching Assistant
September 2011 – May 2013
Western University

GIS Researcher
May 2010-August 2010
Social Planning Council of Ottawa

Awards and Scholarships:

$1,500 – Canadian Public Health Associations: Knowledge Translation Student Award 2013

$1,000 – Edward G. Pleva Fellowship 2012

$7,200 - Western Graduate Research Scholarship 2011-2013

$2,500 - Ontario International Education Opportunity Scholarship 2010

$10,000 - Entrance scholarship to Carleton University 2007

Formal Reports:

Students, Profs and Pros: Using Participatory Methods to Elevate Children as Co-Researchers in Planning Healthy Environments (abstract) (Fitzpatrick, 2013)

Healthy City / Active London: Evidence-Based Recommendations for Policies to Promote Walking and Biking (HEAL, 2012)