Children, Youth and Environments 28(2), 2018

State of Play: Methodologies for Investigating Children's Outdoor Play and Independent Mobility

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Citation: Han, C. S., Mâsse, L. C., Wilson, A., Janssen, I., Schuurman, N., Brussoni, M., & The Playability Study Research Team (2018). State of play: Methodologies for investigating children's outdoor play and independent mobility. *Children, Youth and Environments, 28*(2), 194-231. Retrieved from http://www.jstor.org/action/showPublication?journalCode=chilyoutenvi

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Abstract

Our research goal is to define the "playability" of local neighborhood outdoor environments for children aged 10-13 years, indicating how friendly these environments are for children's outdoor play and independent mobility. To understand children's actual behaviors, we used the technology of GPS and accelerometers to collect mobility and physical activity patterns among 105 children for one week. We also employed various participatory research methods to better

garner children and their parents' perceptions of their neighborhood for children's outdoor play and independent mobility. In this paper, we describe the methodology and methods used in our research, and share pivotal lessons learned.

Keywords: neighborhood environment, mixed-methods research, independent mobility, physical activity, playability, child-friendly participatory methods

Background

Play is crucial for a child's healthy development and well-being. Outdoor play (OP), in particular, affords many benefits to children (Brussoni et al., 2015; Gray et al., 2015), including better physical health (Larouche, Garriguet, & Tremblay, 2016; Stone & Faulkner, 2014; Tremblay et al., 2015; Janssen, 2014), as well as mental and psychosocial benefits (Janssen, 2016; Larouche, Garriguet, Gunnell, Goldfield, & Tremblay, 2016). Despite the numerous benefits, the literature documents a steady decrease in the amount of OP among children across generations (Gray, 2011; Holt et al., 2016; Pooley, Turnbull, & Adams, 2007). Notably, this trend coincides with the decrease over the past 40 years in children's independent mobility (IM) (Karsten, 2005; Kyttä, Hirvonen, Rudner, Pirjola, & Laatikainen, 2015; Shaw et al., 2015).

While there are a myriad of multi-level and interconnected socio-ecological factors that influence children's OP and IM (Badland et al., 2016; Christensen & O'Brien, 2003; Page, Cooper, Griew, & Jago, 2010), gender seems to exert a critical influence (Carver, Timperio, & Crawford, 2008; Carver, Timperio, Hesketh, & Crawford, 2010a; Mitra, Faulkner, Buliung, & Stone, 2014; Valentine & Mckendrickt, 1997). Literature consistently reports boys spending more time outdoors, engaging in more physically active and structured-sport activities, and having higher IM than girls (Carver et al., 2008; Hillman Adams, & Whitelegg, 1990; Larson, Green, & Cordell, 2011; Leung & Loo, 2017). In addition, while the literature does not show consistent patterns, girls and boys may benefit differently from such experiences (Brussoni et al., 2015; Leung & Loo, 2017). For instance, Piccininni and colleagues (2018) found that among girls, spending around a half-hour per week outdoors on average was associated with lower prevalence of psychosomatic symptoms, compared with those who had no time playing outdoors. Interestingly, no such relationship was observed among boys.

In addition to child's gender, children's OP and IM also appear to be heavily influenced by neighborhood physical (built and natural) environments (Fjørtoft, 2001; Prezza et al., 2001; Schoeppe, Duncan, Badland, Oliver, & Curtis, 2013; Schoeppe, Duncan, Badland, Oliver, & Browne, 2014). Numerous research has found that having accessible, aesthetically child-friendly, and multi-use parks and play spaces in close proximity were associated with an increased number of children playing outside, as well as their physical activity levels (Bohn-Gauldbaum et al., 2013; Fair, Kaczynski, Hughey, Besenyi, & Powers, 2017; Mitchell, Clark, & Gilliland, 2016; Veitch, Ball, Crawford, Abbott, & Salmon, 2012; Žaltauskė & Petrauskienė, 2016). In the same vein, Kurka and colleagues (2015) reported that children living in neighborhoods that were more walkable had higher outdoor physical activity levels than children living in neighborhoods that were less walkable with less street connectivity.

Parents' critical role in influencing children's OP and IM is also well-evidenced in the literature (Ferrao & Janssen, 2015; Kercood et al., 2015; McFarland, Zajicek, & Waliczek, 2014). For instance, findings confirm how parental perception of their neighborhood safety served as the key predictor of children's active transport and IM (Carver et al., 2010a; Veitch et al., 2017); similarly, the attitudes and

perceptions that parents had towards nature and their neighborhood influenced the amount and quality of time children spent playing outdoors (Ferrao & Janssen, 2015; Kercood et al., 2015; McFarland et al., 2014). This is particularly the case for younger children and adolescent girls, where parents' fear of strangers, and concerns about social and physical environments can significantly limit children's IM (Carver et al., 2008; Carver, Timperio, Hesketh, & Crawford, 2010b; Foster, Villanueva, Wood, Christian, & Giles-Corti, 2014).

In the past few decades, the topic of children and their environments has increasingly gained research attention from diverse disciplines. However, much of the research with children tends to rely on parent (or proxy) report, observations, or using methodologies that are not child-friendly (Christensen & James, 2000; Hill, 1997). As Yarwood and Tyrrell (2012) have argued, children's perceptions of place are diverse and differ from adults' perceptions, highlighting the need for research focused on children's perspectives and sensitive to their realities. Therefore, in designing and conducting a mixed-methods study to define the "playability" (i.e., how friendly these environments are for children's outdoor play and independent mobility) of local neighborhood outdoor environments for boys and girls between the ages of 10-13 years, we adopted multiple child-friendly participatory research methods to better understand—hence better cultivate—children's perceptions of their neighborhood, specifically in the context of their OP and IM.

Playability: Mixed-Methods Study

Theoretical Underpinnings

Primarily informed by Ecological Systems Theory (Bronfenbrenner, 1986) and the Social Construction of Gender Framework (Alberico, Schipperijn, & Reis, 2017; Ridgeway, 2009), we developed a mixed-methods study, similar to Christensen and colleagues' (2011) and Loebach and Gilliland's (2016) research. Bronfenbrenner's Ecological Systems Theory emphasizes that proximal contexts that occur in the home and immediate social environments affect health behaviors, such as OP and IM. However, behaviors are also affected, more distally, by the larger cultural and societal contexts in which children live. Contexts are both dynamic and interactive, such that shifts and evolution in one social context have implications for other social contexts. From this theory, we considered the interactions between individual and social factors as well as characteristics of the built and natural environment in relation to children's OP and IM.

The Social Construction of Gender Framework (Alberico et al., 2017; Ridgeway, 2009) understands gender to be relational, dynamic and contextually sensitive rather than biologically or evolutionarily determined. Scholars have advanced the idea that gender—masculinities and femininities—is shaped through exposure to the gender norms of community and society (Connell, 1995; Connell & Messerschmidt, 2005). This framework provided a lens to look at children's OP and IM as a gendered practice, which may be structured by parental beliefs, social norms about gender roles and idealized cultural practices.

Overarching Research Aims

The overarching goal of the Playability study is to understand the determinants of OP and IM, develop an index of playability, and determine if playability is associated with children's behavioral, physical and psychological health. We are guided by three specific aims.

- Aim 1: To assess how individual, social, and built- and natural-environment factors facilitate or impede children's OP and IM in their neighborhood.
- Aim 2: To develop gender-sensitive indices of playability to measure different environmental characteristics that determine how playable a neighborhood environment is for children.
- Aim 3: To validate how neighborhood playability relates to children's actual physical activity behaviors, as well as their physical and mental health.

Aim of This Paper

The aim of this paper is to describe the methodology and participatory research methods we used for Aim 1 of our research. It also provides an overview of the process, while drawing on broad methodological and ethical insights and our reflections on lessons learned exclusively in conducting this arm of the study. We begin with an outline of our research to provide the context for our overarching aim and data collection process to explain the use of each method we employed in our research.

Study Neighborhoods

We strategically selected three Metro Vancouver area neighborhoods to include in this study, namely, Vancouver's Grandview-Woodland, North Vancouver's Lonsdale and Richmond's Steveston (Figure 1).

Figure 1. Map of the three study neighborhoods

We chose these to be our target communities because they have very different physical environments, population densities, ethnic make-ups, and populations of children (Table 1) and thus would ensure sufficient variability and diversity of the study population.

Table 1. Characteristics of the three study neighborhoods

Study area & boundaries **North** **South** **West** **East**	**Vancouver**[†] **Grandview-Woodland** Burrard Inlet. East Broadway St. Clark Dr. Nanaimo St.	**North Vancouver**[§] **Lonsdale** Trans-Canada Hwy. Burrard Inlet. Westview Dr. Grand Blvd.	**Richmond**[‡] **Steveston** William Rd. Fraser River. Strait of Georgia. No. 2 Rd.
Neighborhood type	Urban	Urban-suburban mix	Suburban
Geography	East of downtown Vancouver. Bound by water on one side and urban neighborhoods on the other three.	Geographically unique due to the neighborhood's proximity to the North Shore Mountains.	Suburb in the City of Richmond bound by water on two sides and on agricultural land on another.
Street network	Gridiron/fused	Gridiron and mid-density residential	Curvilinear and cul-de-sac
Recreational/Green Spaces/Protected Areas[†]	14%	49%	13%
~ Population per km²	5492.6[†]	4465.1[§]	1534.1[‡]
Population under 15 years old (%)	11.2%[†]	13.4%[§]	13.7%[‡]
Median household income (after tax)	$56,908[†]	$58,415[§]	$57,779[‡]
Single-family homes	11%[†]	31%[§]	30%[‡]

[†]Statistics Canada (2017a)
[§]Statistics Canada (2017b)
[‡]Statistics Canada (2017c)

Participant Recruitment

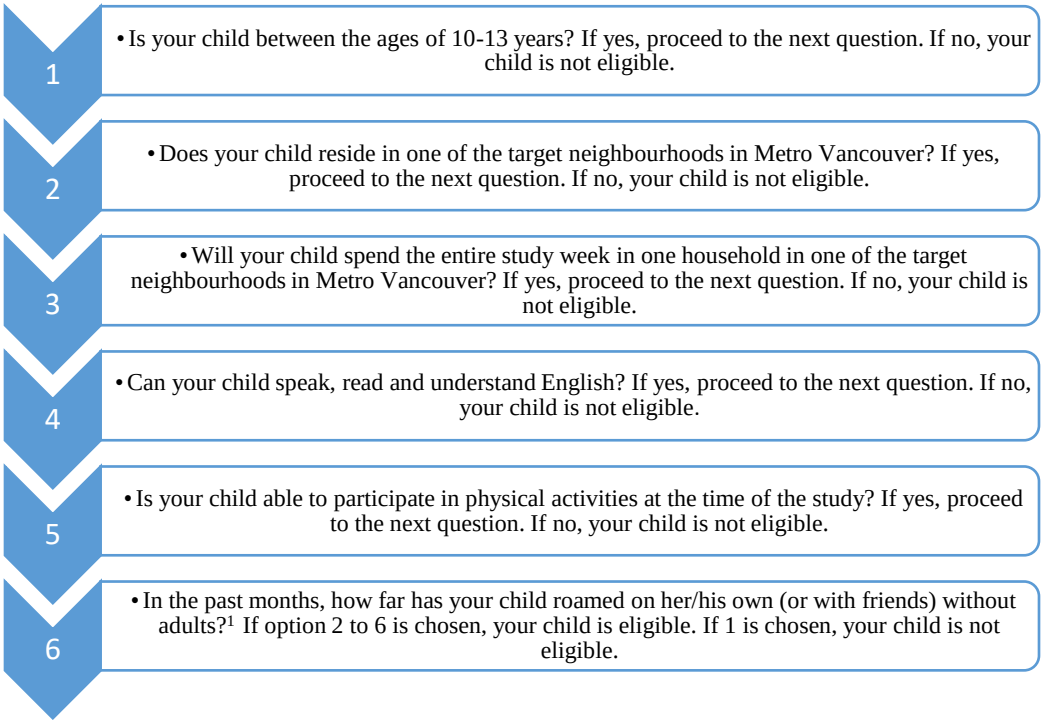
Following ethics review and approval by the University of British Columbia/Children's and Women's Health Centre of British Columbia Research Ethics Board, we recruited participants using a number of strategies. Study collaborators and community partners posted and distributed study flyers at their facilities or online. We also used social media channels and sent notices through our networks. In the early stage of recruitment, Facebook ads proved the most efficient and convenient medium to reach potential participants based on geographical location, age, gender and interest. In the latter stages of recruitment, snowball sampling was most effective, with families who participated in our study referring

friends, classmates, and neighbors. Each participating child received $100 and each participating parent received $50 in cash for their time and contribution to our study.

Participant Inclusion/Exclusion Criteria

In this study, we targeted children aged 10 to 13 years because this age range has been shown to be the most dynamically shifting period in terms of children's play and IM (Matthews, 1987; O'Brien, Jones, & Sloan, 2000). Eligible children and their parents were required to speak, read and understand English, and reside in one of the three target neighborhoods in Metro Vancouver. In addition, participating children must have spent the entire study participation week in their home, meaning no sleep-overs, weekend trips, or shared custody arrangements during the week. We also ensured that children had at least some IM granted in their neighborhood, as our main research interests focused on children's unsupervised OP and IM. Specifically, we asked the parents, "In the past months, how far has your child roamed on her/his own (or with friends)?" and provided six options with differing degrees of IM. Further, in order to be eligible to participate, children must have been able to roam unsupervised at least within his/her yard and/or driveway. We did not impose eligibility criteria that would have limited children with any disabilities, as long as they were physically mobile. Only one child per family was allowed to participate to ensure we received parental input specifically on their participating child, not general input about their children as a whole.

Figure 2. Participant screening questions



[1] *1. My child has not been out alone; 2. Within my yard and/or driveway; 3. Within my street; 4. Within 2-3 streets from my home; 5. Within a 15 min walk from my home; 6. More than 15 min walk from my home.*

Screening was completed online through FluidSurvey™ and Qualtrics™, except for a few cases done over the phone. Recruitment ads (e.g., Facebook Ads, posters, emails) provided a link to our screening survey page where interested participants could complete the questionnaires to determine eligibility (Figure 2). Eligible candidates were invited to share their email address so we could send them copies of consent/assent forms and coordinate a date and time for an initial meeting.

Participants

One hundred and five children (50.4 percent girls; M age = 11.4 years, 65.7 percent Caucasian) participated in our study—35 from each of the three selected neighborhoods (Table 2). At least one parent/legal guardian per family participated (M age = 45.5 years, 72.6 percent Caucasian). Thirty-four families (32.4 percent) had household incomes of $130,000 or more, and the majority resided in a single-family detached home (52.4 percent).

Table 2. Participant demographics

Child variables (N=105)		North Vancouver (N=35)	Vancouver (N=35)	Richmond (N=35)	Total (N=105)
Age	10	11 (31.4%)	8 (22.9%)	7 (20.0%)	26 (24.8%)
	11	10 (28.6%)	9 (25.7%)	9 (25.7%)	28 (26.6%)
	12	9 (25.7%)	7 (20.0%)	10 (28.6%)	26 (24.8%)
	13	5 (14.3%)	11 (31.4%)	9 (25.7%)	25 (23.8%)
Gender	Male	19 (54.3%)	16 (45.7%)	16 (45.7%)	51 (48.6%)
	Female	16 (45.7%)	18 (51.4%)	19 (54.3%)	53 (50.4%)
	Other (Genderqueer)	0 (0%)	1 (2.9%)	0 (0%)	1 (1.0%)
Race/Ethnicity	Caucasian	21 (60.0%)	25 (71.4%)	23 (65.7%)	69 (65.7%)
	Asian	6 (17.1%)	3 (8.6%)	4 (11.4%)	13 (12.4%)
	Mixed (Caucasian/Asian)	2 (5.8%)	2 (5.7%)	5 (14.3%)	9 (8.6%)
	Other	6 (17.1%)	5 (14.3%)	3 (8.6%)	14 (13.3%)

Parent Variables (N=135)		North Vancouver (N=46)	Vancouver (N=48)	Richmond (N=41)	Total (N=135)
Age	30-40	3 (6.5%)	2 (4.2%)	6 (14.6%)	11 (8.2%)
	40-50	35 (76.1%)	31 (64.5%)	28 (68.3%)	94 (69.6%)
	50-60	8 (17.4%)	15 (31.3%)	7 (17.1%)	30 (22.2%)
Gender	Male	13 (28.3%)	16 (33.3%)	8 (19.5%)	37 (27.4%)
	Female	33 (71.7%)	32 (66.7%)	33 (80.5%)	98 (72.6%)
Race/Ethnicity	Caucasian	32 (69.5%)	36 (75.0%)	30 (73.2%)	98 (72.6%)
	Asian	9 (19.6%)	6 (12.5%)	6 (14.6%)	21 (15.5%)
	Mixed (Caucasian/Asian)	1 (2.2%)	1 (2.1%)	2 (4.9%)	4 (3.0%)
	Other	4 (8.7%)	5 (10.4%)	3 (7.3%)	12 (8.9%)
Marital status	Married	17 (37.0%)	18 (37.4%)	12 (29.3%)	47 (34.8%)
	Common-law	26 (56.5%)	24 (50.0%)	28 (68.3%)	78 (57.8%)
	Separated	2 (4.3%)	1 (2.1%)	0 (0%)	3 (2.2%)
	Divorced	1 (2.2%)	2 (4.2%)	1 (2.4%)	4 (3.0%)
	Other	0 (0%)	3 (6.3%)	0 (0%)	3 (2.2%)
Education	Less than college graduate	8 (17.3%)	3 (6.3%)	4 (9.8%)	15 (11.1%)
	College graduate	9 (19.6%)	9 (18.7%)	11 (26.8%)	29 (21.5%)
	University graduate	16 (34.8%)	20 (41.7%)	17 (41.4%)	53 (39.3%)
	Post graduate degree or higher	13 (28.3%)	16 (33.3%)	9 (22.0%)	38 (28.1%)
Employment	Employed	25 (54.3%)	31 (64.6%)	21 (51.2%)	77 (57.0%)
	Self-employed	8 (17.4%)	11 (22.9%)	11 (26.8%)	30 (22.2%)
	Homemaker	4 (8.7%)	4 (8.3%)	7 (17.1%)	15 (11.2%)
	Other	9 (19.6%)	2 (4.2%)	2 (4.9%)	13 (9.6%)

Family variables (N=105)		North Vancouver (N=35)	Vancouver (N=35)	Richmond (N=35)	Total
# of participating parents	1	24 (68.6%)	22 (62.9%)	29 (82.9%)	75 (71.4%)
	2	11 (31.4%)	13 (37.1%)	6 (17.1%)	30 (28.6%)
# of children in household	1	9 (25.7%)	10 (28.6%)	3 (8.6%)	22 (21.0%)
	2	20 (57.2%)	18 (51.4%)	18 (51.4%)	56 (53.3%)
	3	6 (17.1%)	6 (17.1%)	9 (25.7%)	21 (20.0%)
	>= 4	0 (0%)	1 (2.9%)	5 (14.3%)	6 (5.7%)

Net household income	Less than $50,000	6 (17.1%)	4 (11.4%)	1 (2.9%)	11 (10.5%)
	$50,000 - $89,999	7 (20.0%)	8 (22.8%)	5 (14.3%)	20 (19.0%)
	$90,000 – 129,999	9 (25.7%)	10 (28.6%)	7 (20.0%)	26 (24.8%)
	$130,000 or more	8 (22.9%)	12 (34.3%)	14 (40.0%)	34 (32.4%)
	Prefer not to answer	5 (14.3%)	1 (2.9%)	8 (22.8%)	14 (13.3%)
Home dwelling structure	Single-detached house	13 (37.1%)	21 (60.0%)	21 (60.0%)	55 (52.4%)
	Semi-detached house	3 (8.6%)	9 (25.7%)	4 (11.4%)	16 (15.2%)
	Row house	6 (17.1%)	2 (5.7%)	5 (14.3%)	13 (12.4%)
	Apartment/condo	7 (20.0%)	1 (2.9%)	3 (8.6%)	11 (10.5%)
	Other	6 (17.2%)	2 (5.7%)	2 (5.7%)	10 (9.5%)

Research Methods

In recent decades, giving children a voice in research and researching *with* them in the tradition of participatory research approaches has been recognized as important (Christensen & James, 2000; Greene & Hogan, 2005). Particularly in the context of our study where we explored children's space, it was imperative to invite them as experts to provide their own perspectives on how they perceived and utilized their environments (Christensen, Mikkelsen, Nielsen, & Harder, 2011; Christensen & O'Brien, 2003; Clark, 2010). In designing the study, we consulted a group of youth between 14-17 years of age via the KidsCan Advisory Group at BC Children's Hospital.

To develop playability indices, we used a concurrent triangulation model, as illustrated in Figure 3. Thus, we collected the qualitative and quantitative data concurrently, privileging the qualitative data in guiding analyses, while also being guided by the theoretical perspectives previously described (Castro, Kellison, Boyd, & Kopak, 2010; Hanson, Creswell, Clark, Petska, & Creswell, 2005; Janssen & LeBlanc, 2010; Žaltauskė & Petrauskienė, 2016). We used a variety of participatory research methods, quantitative and qualitative, to investigate children's lived experiences in a holistic manner (Table 3). Combining multiple research techniques served to increase the validity of research findings and address limitations inherent in each data collection tool (Denzin, 1989). Qualitative research methods, including in-depth interviews and visual research methods (e.g., map drawing, photo taking), were used to capture more comprehensive details, as well as children's perceptions and personal insights, that would have otherwise been difficult to acquire.

Figure 3. Playability mixed-methods model

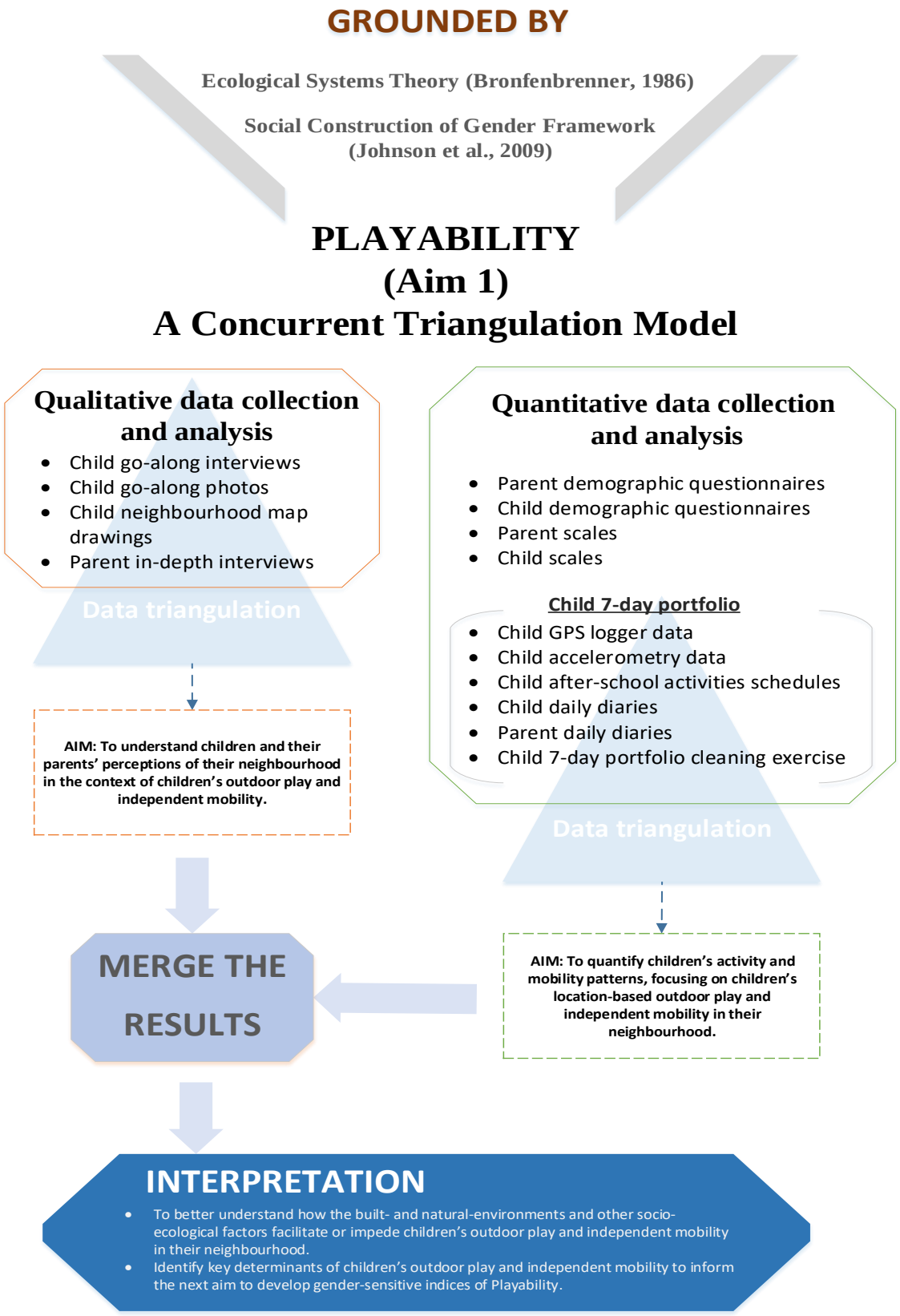


Table 3. Summary of data collected

METHOD [QUANtitative or QUALitative data]	**PURPOSE**
Parent demographic questionnaire [QUAN]	To collect demographic information from parents.
Child demographic questionnaire [QUAN]	To collect demographic information from children.
GPS monitor [QUAN]	1] To collect children's location coordinates during the 7-day data collection period in order to quantify mobility patterns; 2] To record go-along interview routes.
Accelerometer [QUAN]	To collect data relating to children's physical activity patterns – for example duration, frequency and intensity.
Child daily diaries [QUAN + QUAL]	To collect children's daily activities based on the 5 W's (i.e., where they were, what they were doing, with whom, when and why) for each activity they engage in.
Parent daily diaries [QUAN + QUAL]	To log their child's unsupervised outdoor time based on the 5 W's (i.e., where they were, what they were doing, with whom, when and why) for each unsupervised activity their child engages in – to the best of their knowledge.
Child map drawing exercise [QUAL]	1] To understand children's perception of the neighborhood they live in 2] To help guide the go-along interview.
Child go-along interview [QUAL]	To understand children's perception toward outdoor play and physical environments, as well as how different factors impact their outdoor play and independent mobility.
Parent individual interview [QUAL]	To understand parents' perspectives toward children's outdoor play and their perceptions of physical environment, as well as how different factors impact children's outdoor play and independent mobility.
Child 7-day portfolio cleaning exercise [QUAN]	To fill any data gaps that remain after comparing the 7-day portfolio of GPS and accelerometry data with the child and parent daily diaries.
Parent survey [QUAN]	To gain insight on parent' behaviors and perceptions surrounding risk, outdoor play, independent mobility, neighborhood makeup, and the built environment. Survey includes: • Social Danger Perception Scale (Prezza et al., 2001) • Perception of Positive Potentiality of Outdoor Autonomy for Children Scale (Prezza et al., 2005) • Neighborhood Relations Scale (Prezza et al., 2001) • Licenses for Independent Mobility (Shaw et al., 2015) • Neighborhood Environment Walkability Scale – Youth (Rosenberg, 2009) • The Tolerance of Risk in Play Scale (Hill & Bundy, 2014) • Parental Perception of Independent Mobility Scale
Child survey [QUAN]	To gain insights on children's perceptions surrounding their outdoor play, their overall physical and mental wellbeing, as well as their neighborhood. Survey includes: • Attitudes Towards Outdoor Play Scale (modified from Beyer et al., 2015)

	• Neighborhood Social Capital Scale subscales selected from Health Behavior in School-aged Children (Elgar et al., 2010; Freeman et al., 2015) • Independent Mobility (modified from Page et al., 2009) • Nuisance (Page et al., 2010) • Social Norm (Page et al., 2010)
Child after-school activities weekly schedule [QUAL]	To collect children's weekly after-school structured activities (e.g., math tutor, soccer practice, piano lesson, etc.).
Go-along photos [QUAL]	To document locations of significance can be documented during children's go-along interviews.

Data Collection Process and Methods

Similar to other Canadian studies on the physical environment and travel behavior of children (e.g., Stone, Faulkner, Mitra, & Buliung, 2014), we collected data from 2016 to 2018 during the spring and fall months (April through June, September through October) of the Canadian school year to account for the effect of school on children's OP, while avoiding the rainy season in Metro Vancouver (i.e., November through March), which can significantly limit outdoor activities.

Initial Meeting

A researcher visited participants' homes to explain the study and obtain participant assent/consent. The researcher also explained how to wear and operate the study devices, as well as how to complete the daily diaries, demographic questionnaires, and scales—for which online and printed options were available. The researcher asked children to draw a map of their neighborhood (see below), and participating parents to complete their child's after-school structured activities schedule. Throughout the study period, daily reminders, either via email or text message, to wear the study devices and to complete the daily diaries, were sent to those who requested them (the child, the parent or both).

Children's Map of Their Neighborhood

At the initial meeting, the researcher instructed the participating child to draw a map of their neighborhood (Béneker, Sanders, Tani, & Taylor, 2010; Sobel, 1998). We provided only a brief instruction sheet (Figure 4) to explain the purpose of this map drawing exercise, making it largely free-format. Children had at least one week to finish the drawing.

Figure 4. Instruction to map drawing exercise

Children's Seven-Day Activity and Mobility Portfolio

We used different quantitative methods (i.e., Global Positioning System (GPS) and accelerometry data, demographic questionnaires, scales, daily diaries, after-school activities schedule) to generate an objectively measured overview of children's everyday outdoor activities and mobility patterns. Children were instructed to wear a GPS logger (Garmin™ Forerunner 230) and an accelerometer (Actical™ by Philips Respironics) for one week during waking hours, except when engaging in activities that required the removal of any of the study devices (e.g., showering, swimming). This served to capture a comprehensive representation of children's physical activity and mobility patterns over the course of seven days, which we hereafter refer to as the *seven-day portfolio.* Daily diaries (see Appendix A) that detailed every activity (e.g., walking to school, chatting with friends, doing homework) in which children engaged during the study participation week, were completed separately by children and their parents, and were critical for interpreting children's seven-day portfolio. For example, the diaries allowed us to isolate data that represented when and where children engaged in unsupervised OP. In addition to

daily diaries, participants completed a demographic questionnaire, an after-school activities schedule, and a series of scales.

At the end of the study week, researchers collected the study devices and materials for pre-data cleaning. To construct each child's seven-day portfolio, the GPS and the accelerometry data were processed and merged through the Personal Activity and Location Measurement PALMS™ software (Center for Wireless and Population Health Systems, University of California, San Diego, CA). Based on each 15-second accelerometer epoch, PALMS provided a preliminary preview of each child's time-based GPS latitude and longitude coordinates during the study week along with a corresponding physical activity reading for each epoch. PALMS also identified periods of time with missing GPS coordinates, and vehicle and non-vehicle trips. (For more details on how we used PALMS to link GPS and accelerometer data to identify trips, see Borghese and Janssen (2018)). We then used children's and parents' daily diaries to fill in data gaps in the child's seven-day portfolio and to identify activities of interest. That is, each activity during each 15-second epoch of children's seven-day portfolio was coded as supervised/unsupervised, inside/outside/both, trip mode, and number of trips. This process was crucial because GPS or accelerometry data separately could only give a fragmented picture of children's physical activity and mobility patterns. Outstanding enquiries were flagged for clarification during interviews with the participants.

Go-Along Interviews

The map drawings the children were asked to complete at the initial meeting were used as a guide when they led us on a go-along interview to visit places that were important to them. As the name implies, the go-along interview method involves researchers visiting and touring participants' familiar places, in our case children's neighborhoods (Carpiano, 2009). This method helped us minimize the researcher-participant power dynamic, and also provided a glimpse of each child and family's everyday experiences *in vivo*. The go-along interviews occurred after we had collected all the data needed to create each child's seven-day portfolio and had the opportunity to review their map drawing. During the go-along interview, we posed questions about their perceptions towards their neighborhood, OP and IM. These were guided by semi-structured interview questions, as well as specific prompts that their data had highlighted for us (see Appendix B for the interview guide).

Interviews were typically conducted within two weeks of completing seven-day portfolios. Two researchers visited each participating family to conduct interviews with the child and the participating parent(s) separately. Children's go-along interviews lasted 45-60 minutes and were audio- and GPS-recorded. Each go-along interview was geographically tracked using a GPS logger. Additionally, children wore a lapel microphone to ensure clear recording despite background noises, and were given the option of bringing a friend or parent along with them on the go-along interview (13 children requested this). Following the interviews, we reviewed the child's seven-day portfolio (i.e., child seven-day portfolio cleaning exercise), while showing GPS visuals of his or her study participation week through Google Maps, hosted on the Garmin website. This was done to fill in any data gaps identified from the pre-data cleaning step, in addition to clarify inconsistencies

between children's daily diaries and their GPS and accelerometer data. Following the completion of interviews, researchers completed field notes to document the setting and the general mood, their own reflection and impression of the interviews, and anything else they deemed notable (Emerson & Baines, 2011).

Children's Photographs

During the go-along interviews, we provided children with a digital camera (with built-in GPS function) and asked them to take photographs of places and routes reflecting their interest. Both visual research methods used in our study—the map drawing exercise (Béneker et al., 2010; Sobel, 1998) and photo taking (Bignante, 2010; Fusco, Moola, Faulkner, Buliung, & Richichi, 2012; Harper, 2002)—served as reflexive and representational tools and artifacts that aided children in more fully constructing and expressing their realities. In addition, children's GPS-tagged photographs helped us to pinpoint and visualize locations of their places of interest. The photographs and map drawings could then be overlayed onto each child's go-along interview route on a web mapping service, such as Google Maps™.

Parents' Perceptions of Their Neighborhood

Concurrent with the go-along interview, another researcher conducted individual semi-structured interviews with the child's parent in order to capture his or her perceptions of the neighborhood and perspectives on the child's OP and IM. At the end of the interview, parents were presented with printed maps of their neighborhood and asked to mark their child's boundaries, usual hang-out places and the farthest places they had ever been without adults—to the best of their knowledge.

Post-Data Cleaning for Analyses

Each child's seven-day portfolio was finalized according to participant feedback. At this stage, additional "time" information was merged into the master file, including: 1) the sleep and weather data in the daily logs; 2) the start and end times of the school day and school recess times; and 3) whether each day represented a school day or a non-school day (weekend or holiday). Cleaned data were then uploaded into ArcGIS™ (Esri, Redlands, CA) and processed to visualize periods of inside/outside/both, school, sleep, physical activity intensity (e.g., light, moderate, or vigorous intensity) and supervised/unsupervised time on color-coded maps layered over different map stratums (e.g., crime data, park). See GPS-related issues under Study Limitations below for more information on GPS data cleaning.

De-identified interview transcripts were entered into NVivo 10™ (QSR International PTY Ltd, Melbourne, Australia) to facilitate coding. Anonymized visual data—by blurring faces included in photos and stripping identifiable details from map drawings—were also included in the transcripts, and researcher field notes were linked to each participant. Children and their parents' qualitative data are currently being examined to develop a "big picture" sense of the data as well as identify emerging patterns of built and natural environments and socio-ecological factors recognized as important to children and their parents. This iterative process will lead us to identify key determinants of children's OP and IM to inform Aim 2 of our study, which is to develop gender-sensitive indices of playability.

In Retrospect: What Worked Well and What We Have Missed

The Value of Mixed-Methods Research: What Worked

The mixed methods used for Aim 1 of the Playability study enabled us to examine the issue from multiple perspectives for a socio-ecological understanding and triangulation of data—while simultaneously being child-friendly in order to facilitate gathering the child participants' perspectives. In particular, narratives collected during the go-along interviews along with the photographs children had taken provided rich context and unique insight into their lived experiences, beyond what traditional interview methods could ever afford. For instance, a 13-year-old girl (1005_1) took a picture (Figure 5) of an otherwise ordinary-looking tree by her old school and explained what this tree meant for her:

Figure 5. 1005_1's Tree

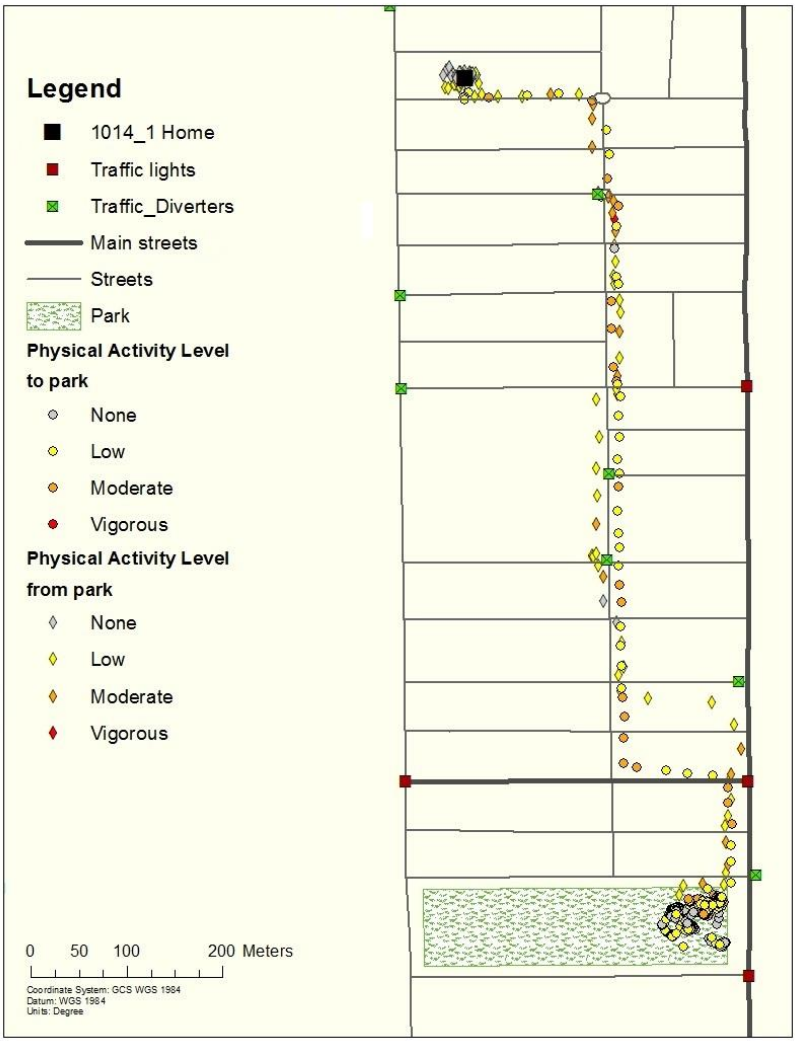
1005_1: So I used to climb this tree a lot all the time, yeah.
Researcher: It is a really nice tree.
1005_1: Yeah, it's really nice and it's really easy to climb up like you can just like… Oh, I'm actually terrified of heights but I try to push myself so I went up to like way up there. I was like at the top.
Researcher: Really?
1005_1: Yeah, the top of the tree where I sat after school, waiting for my mum to pick me up.

This excerpt revealed multiple realities for this child, encompassing built- and natural-environment elements to the child's developmental journey. This tree (aesthetically child-friendly) in her old school yard (accessible) was easy to climb (playable) and afforded her a chance to test her limits and overcome her fear of heights (risky play), while she also used it for perspective to see her mom coming

to pick her up (prospect). There are hundreds of pictures of trees collected in our study; however, each tree bore different and multiple meanings to each child, serving a multitude of purposes (e.g., shading, climbing, affixing a swing set) and with different emotional sentiments and storytelling attached to it (e.g., confidence, sense of achievement, feeling of safety).

Likewise, very effective was the data-triangulation of interview narratives, children's seven-day portfolios, and the daily diaries. Together, these provided optimal synergies, strengthening most of the methodological limitations typically encountered when resorting to a single research method. In particular, the GPS tracking made it possible to explore children's daily OP and IM in real time and space. For instance, Figure 6 shows the exact route an 11-year-old boy (1014_1) had chosen to get to "P" park, along with his physical activity level during the trip.

Figure 6. 1014_1's Journey to "P" Park



Added from the child's daily diaries were rich contextual details, revealing that he was on his scooter with his friend, without an adult, scooting through sprinklers at the park for an hour. In addition, 1014_1's seven-day portfolio revealed that he had a greater IM range than his mother had indicated (i.e., within two or three streets from their home). During the go-along interview, we discovered he had been going beyond his mother's boundaries since age 10, and he had no intention of telling her about it. As evident, these data produced a fuller understanding of children's daily OP and IM, as well as broader socio-ecological determinants of their activities.

Study Limitations

Despite the successful aspects of this study, we have encountered a number of methodological and ethical issues—both anticipated and not—that have the potential to inform similar research.

GPS-Related Issues

The use of location data collected with GPS loggers presented multiple limitations and issues throughout the data collection phase of the study. As a result, there were instances that required assumptions and discretionary decisions in order to clean and finalize the dataset. We list a summary of these issues below, but will provide detailed technical limitations and the protocols we implemented in a subsequent publication. First, the coordinates recorded by the GPS loggers were subject to error when children were in urban areas with tall buildings (i.e., urban canyons) and indoors. At times, errors were straightforward to detect, as GPS coordinates jumped around to locations or at speeds that would be impossible to travel under the circumstances (i.e., GPS jitter). At other times, however, these errors were very difficult to sort out. For example, a four-hour time period spent at home may show coordinates both inside and outside of the house (i.e., GPS drift). If children do not recall specifically remaining indoors for the entire period, or if they are unable to recall the exact times that they were outdoors in the yard, it becomes difficult to know which coordinates are accurate and which are not. Therefore, in circumstances in which children spent a period of time at home but did not recall specifically when they were indoors or outdoors, only that they were frequently back and forth between the two, we allowed them to indicate on their daily diary that an activity period took place both inside and outside.

Having identified this issue as a limitation early on in the data collection process, we were able to streamline the data cleaning and interview processes by including the "both" option, which was clarified with children and/or their parents during the interview process, if required. From all 105 children, there were 4,167,053 15-second epochs collected; and, excluding sleep time, there were a total of 2,456,740 15-second epochs—of which 54.5 percent were categorized as inside, 11.4 percent as outside, 4.5 percent as both, 28.6 percent as school and 0.9 percent as unidentified. In addition to inside/outside/both, each epoch was also coded with multiple descriptors, including description of the activity, supervised/unsupervised, physical activity intensity, as well as trip number and mode of transportation, if applicable. This strategy allowed for flexibility in including or excluding criteria in the analysis, as deemed appropriate. For instance, to examine children's

unsupervised OP and IM, we could include 1) "unsupervised" and "outside" time; or, 2) "unsupervised," "outside" and "both" time.

Another methodological challenge resulted when there were discrepancies between the GPS data and children's daily diaries. Since the seven-day portfolio data cleaning exercise happened after we examined their data, it provided an opportunity to clarify these discrepancies. Errors typically resulted from children forgetting to wear the GPS logger, or making mistakes in logging daily activities, such as forgetting to include certain activities or logging incorrect times. These errors were relatively easy to rectify during the seven-day portfolio data cleaning exercise, as GPS data provide a time-stamped account of the child's whereabouts. GPS data was privileged over the child's daily diary if the researcher could determine that an activity matched with an entry from the child's daily diary. Otherwise, further clarification was sought during the interview. Additionally, GPS error was problematic for the trip detection feature in the PALMS software. Rapid movement and large jumps in the GPS signal could trigger potentially false identification of trips. Therefore, while PALMS facilitated identification of children's physical activity and mobility patterns, considerable data cleaning was needed to manage missing or inaccurate GPS coordinates and miscalculated trips or false trips. When possible, missing geospatial coordinates were imputed by the research team with the help of Google Maps and the information from PALMS and daily diaries that both children and their parents filled in.

As a result of problems with trip detection, GPS error, and inconsistent daily diary data, a series of revisions were made to daily diaries to ensure we collected all the information needed to understand the "five Ws" (i.e., where the child was, what she or he was doing, with whom, when and why) on each activity outside school hours. While the initial version of the daily diaries required children to detail only unsupervised periods and physical activity, the updated version asked them to provide an outline of their full day, detailing each discrete activity, from the time they awoke until bedtime. This gave us a better understanding of children's daily life, allowing us to fill any data gaps while having to rely less on children's retrospective memories of the event as recalled during the seven-day portfolio cleaning exercise, as well as helping to reduce the time required for that exercise. Children were also more likely to recall specific details of a day when provided with their own play-by-play accounts versus when they were only provided with detail of their independent or physically active time.

Ethical Issues

Ethical dilemmas emerged during the study related to respecting children's privacy, ensuring their safety and collecting accurate data. For example, our data made it evident that one participant regularly skipped school. In this instance, we shared our information with the child while on the go-along interview, when their parents were not present. The child informed us that his parents were aware of his absences from school and we did not pursue this issue further. Our protocol was to respect children's privacy unless there was an imminent danger to the child, their parents and/or the researcher. For instance, we did not inform 1014_1's parents about 1014_1 roaming outside his mother's boundaries because we did not

perceive any looming danger for the child. Fortunately, we did not run into any case that necessitated disclosure.

However, we did encounter a case in which we suspected child abuse or neglect. Our study procedures required the interviewer to first determine that there was no imminent harm to the participant. Once that was established, the interviewer reported the case to the Ministry of Children & Families Development. This is standard recommended practice at the University of British Columbia, in addition to including information on the consent form indicating that potential harm to children represents a time when we would have to violate confidentiality. This incident served as an important reminder of the extra care and vigilance needed when researching with children so as to ensure their safety and well-being, as well as that of the interviewer. As a result of this incident, we refined our protocol regarding reporting suspected child abuse and neglect to outline step-by-step instructions, and provided a training session to all the interviewers discussing how to recognize child abuse and neglect, what to report, and how different agencies and organizations work together to respond to suspected child abuse and neglect.

Data Quality Assurance

As expected, the quality of children's data varied despite using a standardized protocol for initial meetings where study logistics were explained. Some children provided a complete dataset to create a perfect seven-day portfolio while some submitted GPS and accelerometry data with gaps, along with the daily diaries that did not coincide with their GPS maps. However, our study protocol and procedures helped to ensure that 95 percent of the quantitative data (i.e. no less than 10 hours per day of GPS and accelerometry wear time during waking hours, and at least four days a week including one weekend day) was valid for analysis.

Similarly, the quality of children's go-along interviews varied depending on the child's motivation and personality, the researcher's interview skills, and the weather. To minimize the potential effect due to different interview skills and approaches, only eight researchers were involved in the interview process. Researchers were trained by Dr. Mariana Brussoni, by shadowing at least one interview she conducted, then being shadowed by Dr. Brussoni before conducting interviews alone. However, factors that were difficult to control, such as each child's level of interest and energy, had a direct impact on the quality of their data. Children with a strong interest in participating in the study tended to have higher quality go-along interviews compared to those participating at their parents' request. Interview quality was also affected by the personalities of participants, as well as researchers' ability to establish rapport with the participants. Finally, weather played a role in go-along interview quality, as adverse conditions such as rain and cold were more likely to have children rush through the interview than when conditions were warm and sunny. In addition, interviews tended to be shorter during the fall months when the sun sets early compared with spring months.

Conclusion: Looking Ahead

In recent years, there has been an increase of research into children's OP and IM across a variety of disciplines, each with its own focus and interest, such as for

promoting physical activity, learning, mental health, a healthy gut microbiome, or to prevent myopia (Burdette & Whitaker, 2005; Finlay & Arrieta, 2016; Tremblay et al., 2015; Whitebread, 2017; Yang et al., 2018). This increased interest provides an unprecedented opportunity to consider children's play from multiple angles, as befits its complexity. However, it is also critical that children and childhood are not lost in this increasing instrumentation of play, necessitating studies that use child-friendly methods and fundamentally privilege children's and parents' perspectives.

Our experiences with the Playability Study have taught us much about designing and conducting research to examine the physical and social determinants of OP and IM in children's neighborhoods. These lessons have been practical as well as philosophical. The use of GPS and accelerometer technology is challenging given the rapid advances in technology that render items obsolete almost from the moment of purchase. However, our experiences serve to illustrate the value of combining these data with qualitative data collected using diverse methods in order to develop a powerful dataset that can be interrogated to provide deep insight into multiple socio-ecological layers that influence children's OP and IM.

While we sought to include families from a variety of socioeconomic and cultural backgrounds in this study, it is clear that our dataset includes mostly middle- and upper-middle-class families from predominantly Caucasian backgrounds. We approach our data understanding that any interpretations will be limited to families from similar backgrounds. There is research suggesting that the limits to children's OP and IM are particularly acute among families of higher socioeconomic backgrounds (Aggio et al., 2017; Malone & Rudner, 2011; Wijtzes et al., 2014), thus, this is an important population to study. However, it is important to consider OP and IM experiences for children from all backgrounds, particularly lower socioeconomic and cultural minority backgrounds, as communities include diverse populations. A limited sample will only shed light on a limited experience. Furthermore, there is a danger that subsequent interventions to increase OP can unintentionally increase inequities if they are primarily informed by research data that do not include diverse perspectives.

We are motivated by the current intellectual climate that is interrogating OP and IM from diverse disciplines and anticipate that our powerful dataset will provide an important contribution to building the literature and highlighting the importance of supporting children's OP and IM. It is particularly important for investigators to share lessons learned at this time to ensure that future research benefits from and builds upon previous experiences, helping to move the science forward and influencing policy with high-quality research.

Acknowledgments

We thank the participating children and parents for their generosity with their time. This study was funded by the Canadian Institutes of Health Research, Grant #MOP-142262. Drs. Brussoni and Mâsse are supported by salary awards from the British Columbia Children's Hospital Research Institute. In addition to the authors listed above, the Playability Study Research Team includes the following members, listed alphabetically: Jaspreet Dhillon, Guy Faulkner, Pamela Fuselli, Brent Hagel, Susan Herrington, Amalie Lambert, Yingyi Lin,

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Appendix A. Daily Diaries

CHILD PARTICIPANT DAILY SURVEY [Participant ID:]

DAY [EXAMPLE] – DATE:

1. What time did you wake up today?	7:00 AM	2. What time are you going to bed tonight?	9:30 PM
3. What was the temperature like today?	○ Hot ✓ Comfortable ○ Cold	4. What was the weather like today? <u>Please select ALL that apply</u>	✓ Sunny ○ Rainy ✓ Overcast ○ Snowy

5. What did you do today? Please write down what you did today from the time you wake up till you go to bed (<u>excluding school hours 9AM-3PM</u>)

Start time	End time	What were you doing? (e.g., playing; practicing sports; staying at home; in transit/travelling; getting ready for school, etc.)	Where were you? (e.g., home; friend's house; shopping mall; at the park; in the car, etc.)	If you were in transit/travelling, how did you get to your destination? (e.g., walk, bike, bus, car etc.)	Did this activity take place inside or outside? (Select all that apply)	Were you physically active (e.g., walking, running, biking, playing, practicing sports etc.)?	Were you with adult(s)?	Were you with friend(s) or sibling(s)?
7:00	8:30	Getting ready for school	Home	-	✓ inside ○ outside	○ yes ✓ no	✓ yes ○ no	✓ yes ○ no
8:30	8:50	Going to school	Outside	By bike	○ inside ✓ outside	✓ yes ○ no	○ yes ✓ no	✓ yes ○ no
8:50	3:00	At school	School	-	✓ inside ✓ outside	✓ yes ✓ no	✓ yes ○ no	✓ yes ○ no
3:00	3:15	Coming back home	In the car	Mom drove	✓ inside ○ outside	○ yes ✓ no	✓ yes ○ no	○ yes ✓ no
3:15	4:30	Eating snack, reading books	Home	-	✓ inside ○ outside	○ yes ✓ no	✓ yes ○ no	✓ yes ○ no
4:30	5:00	Playing/hanging out outside with friends	In my neighbourhood	-	○ inside ✓ outside	✓ yes ○ no	○ yes ✓ no	✓ yes ○ no
5:00	5:10	Going to friend's house	In my neighbourhood	We walked	○ inside ✓ outside	✓ yes ○ no	○ yes ✓ no	✓ yes ○ no
5:10	6:00	Hanging out at friend's house – inside and backyard	Friend's home	-	✓ inside ✓ outside	✓ yes ✓ no	✓ yes ○ no	✓ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no

See back page for more space and questions.

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CHILD PARTICIPANT DAILY SURVEY [Participant ID:]

DAY [EXAMPLE] (cont'd)

Start time	End time	What were you doing? (e.g., playing; practicing sports; staying at home; in transit/travelling; getting ready for school, etc.)	Where were you? (e.g., home; friend's house; shopping mall; at the park; in the car, etc.)	If you were in transit/travelling, how did you get to your destination? (e.g., walk, bike, bus, car etc.)	Did this activity take place inside or outside? (Select all that apply)	Were you physically active (e.g., walking, running, biking, playing, practicing sports etc.)?	Were you with adult(s)?	Were you with friend(s) or sibling(s)?
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no
					○ inside ○ outside	○ yes ○ no	○ yes ○ no	○ yes ○ no

6. Did you take any of the monitors off during the day? If yes, please write down all the details below for each time you've taken your monito(s) off during the day.

Which monitor?	From what time to what time?	Why did you take it off?
GPS monitor	7:30-8:00	Taking shower

Thank you!
Please don't forget to save your Location data and charge your Location monitor for tomorrow.

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PARENT PARTICIPANT DAILY SURVEY [Participant ID:]

DAY 1 – DATE:

1. Was your child alone or without an adult anytime today? (For example: playing in the backyard, at the park, going to a friend's house)

- **Yes – If yes, please write down all the details below for each time your child was alone or without an adult anytime today.**
- **No**

Start time	End time	What was your child doing?	Who was your child with?	Did the activity take place inside or outside?

Thank you!
Please don't forget to save your child's Location data and charge the Location monitor for tomorrow.

Version 4 July 7, 2016

Appendix B. Interview Guides

Interview Guide – Children

Instruction for researcher:

- Bring a separate set of GPS camera and take pictures to highlight places you visited with children during the interview. These photos are in addition to children's photos.
- Place a lapel microphone on children and record the interview.
- State the date and time of the interview, researcher's name, participant ID.

Interview:

General background and children's drawing of their neighborhood:

- Can you tell me a little bit about yourself?
- How long have you been living in this neighborhood?
- Do most of your friends live in the same neighborhood as you? Do you all go to the same school?
- What are some of your favorite *fun things** to do after school and on the weekend, and how much time do you spend doing these? (Query indoors vs. outdoors activities, with who).
- In a typical week in spring and summer, how much time do you spend doing fun things with your parent(s)? (If necessary, query weekday vs. weekend; ask how typical weekday or weekend looks like, if needed).
- Where do you usually go to hang out or play outside? What do you do? With who?
- Can you tell me about your map?
- Where is your favorite (or least favorite) place to go in your neighborhood? Is it on your map?
- Other questions when necessary (e.g., choice of color)

**Fun thing* means any kind of activities that <u>you</u> find enjoyable and amusing. This may include but not limited to playing at the playground, drawing or painting, playing a sport together, taking a hike, working a puzzle etc.

Children's unsupervised outdoor play:

- In a typical week in spring and fall, how much free time do you have after school? How about on the weekends? Do you think you get enough free play time? Does that work for you?
- How much time do you spend outside playing? How much of this time is 'unsupervised'?
    - What does 'unsupervised' mean to you.
    - Then, how do you feel about playing outside 'unsupervised'?
    - Do you think you get enough unsupervised time?
- How far from home are you allowed to go without your parent(s) or another adult around? Do you ever go past that point?
- What kinds of things are you allowed to do without your parent(s) or another adult around?

- What kinds of things are you not allowed to do without your parent(s) or another adult around?
  - All these places you can't go and things you can't do, who set these rules? Are you happy with them? (If not, how would you like to change them?)
- Is there anywhere you'd like to go or anything you'd like to do without your parents or another adults that you are currently not allowed to?
- How do you feel about playing outside without your parent(s) or another adult around?
- What would make you feel more comfortable going outside without your parents or another adult around?
- Do boys and girls play outside differently? What do boys like to do? What do girls like to do? Do you hang out with opposite gender peer?
- When knowing that there are adults around, do you think children play or behave differently than when they are by themselves?
- Has anything scary or weird ever happened to you in your neighborhood or elsewhere? (If necessary, ask if they have ever been lost) [How did you deal with it?]
- How do you feel about playing outside after dark?
- At what age do you think you should get a cell phone? [Prompt: how is it being used; sense of safety; do you feel more independent; parental control issue, etc.]
- How different do your parents seem to feel about you being unsupervised and being more independent? [Do you think your mom and dad are different in their comfort levels and styles?]

Children's perceptions of their neighborhood and built environments:

- Are there things you'd like to do that you don't have a chance to do? What are some of the things that make it difficult for you to do these things?
- Do you feel safe playing outside in your neighborhood? What concerns you the most?
- Do you find your neighbors friendly?

Go-Along Interview Questions:

Objective: Ask children to take you on a tour around their neighborhood, and take pictures of places they want to tell you about. Record the interview and wear a GPS monitor for the tour.

- Where: where do you usually hang out? Your favorite or least favorite place to hang out? Places that are meaningful to you? Any of your friends live close to you? Is there any place in your neighborhood, you don't like to go? Why you don't like this place?
- Who: Who do you usually play with here (friends, siblings, parents, by yourself)?
- What: What do you usually do when you hang out here? Favorite thing to do when hanging out here? Things that you would like to do but you can't?
- Why: Why do you like/dislike this place? What is special about this place? How does it make you feel when you play here?
- Why: [when children take pictures of places/things that they have not talked to] why are you taking a picture of this place/thing?

Interview Guide – Parents

Objective:

- This is to better understand parents' perspectives towards children's outdoor play (independent or supervised) and their perceptions of built environment – as well as how different factors (e.g., individual and social factors) impact children's outdoor play.
- These questions are designed to better understand your thought process so they can seem repetitive or probing. Please be aware that you do not have to answer any questions that you are not comfortable answering and you can stop the interview at any time without any penalty.

General background:

- Can you give us a brief introduction about yourself? We are especially interested to know about your own childhood and your general philosophy around children's outdoor and unstructured play.
- How would you describe your child? (probe child's personality and maturity)
- What are some of your favorite things to do with [child]? (If necessary, query indoors vs. outdoors activities).
- In a typical week, how much time do you spend doing *fun things** with [child]? (If necessary, query weekday vs. weekend, summer vs. winter).
- Are there things you'd like to do with [child] that you don't have a chance to do now? What are some of the things that make it difficult for you to do these things with [child]?

**Fun thing* means any kind of activities that your child finds enjoyable and amusing. This may include but not limited to playing at the playground, drawing or painting, playing a sport together, taking a hike, working a puzzle etc.

Children's unsupervised outdoor play:

- In a typical week in spring and fall, how much time does [child] spend outside playing after school hours? On the weekend? How much of this time is *unsupervised*? What does it mean to you?
- Do you think [child] has a good balance between structured and free play time?
- [skip if not relevant] Where do you think [child] is when [child] is playing outside unsupervised? What do you think [child] is doing?
- How do you feel about [child] playing outside without you or another adult around?
- [skip if not relevant] How do you encourage your child to be more independent?
- What things concern you about [child] going out unsupervised?
- Would you feel differently if [child] was a [opposite gender]?
- What age does it seem to be appropriate for [child] to get her/his own cell phone or some sort of mobile technology? [Probe: main purpose of getting it; safety issue; indirect supervision; a new mode supervision; etc.]

- Has any frightening thing ever happened to [child] in your neighborhood or elsewhere?

Parents' perceptions of their neighborhood and built environments:

- What things would make you more comfortable in allowing [child] to go out unsupervised? (If necessary, query attitudes toward neighborhood, social circumstances, built environment).
- Do you feel connected to your neighbors? (i.e. would someone be there to help you child if they needed something while they were playing in your neighborhood?)
- Do you feel safe in your neighborhood? Do you feel safe for [child] in your neighborhood?
- What types of crime concern you for [child]'s safety? Is there is a lot of such crime in your neighborhood?
- If there was suddenly a lot of break and enters in your neighborhood, would this make you worry about [child]'s safety?
- If there was suddenly a number of assaults in your neighborhood, would this make you worry about [child]'s safety?

Independent mobility

- How far from home is [child] allowed to go without supervision?
- What kinds of things is [child] allowed to do without supervision?
- "Have thoughts about judgement by others ever affected your decisions regarding your children being outside unsupervised?" [On the neighborhood map] can you mark on this map, a) places where [child] usually go and hang out in your neighborhood; and, 2) farthest places they have been to on their own in your neighborhood. [Note: this is to develop a quantitative radius (e.g., in Km or blocks)]
- How do you and [child's other parent] differ in your approach to [child's] unsupervised outdoor play?
- [Looking at the child's weekly calendar] Just to confirm, is there anything different this week/the study week?
- What made you decide to participate in our study? How do you find it?
- Has participating in this study changed your or your child's behavior in any way?
    - For instance, have you allowed your child to do things you wouldn't normally allow to do during the study week?
- Is there anything else you would like to add to our interview?