An Evaluation of Google Street View as an Environmental Data Source for Conducting Park Audits

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Background

- In Canada, physical inactivity is responsible for an estimated $6.8 billion of direct and indirect health care costs; this represents 3.8% of overall health care costs[1].
- The built environment, including access and quality of public open space, influences physical activity[2].
- Google Street View (GSV) is a convenient and freely available data source that has the potential to be used for auditing the built environment and is more efficient than foot audits[3,4].
- Few studies[5], however, have taken advantage of GSV to audit public open space and park-specific features that influence physical activity.

Objective

- To evaluate the feasibility, reliability, and validity of conducting virtual park audits using environmental park attribute data sourced from GSV.

Methods

- Parks (n=34) were purposively sampled from 11 neighbourhoods with differing socioeconomic status (low, low-medium, high-medium, and high) and urban form (grid-pattern, warped-grid, and curvilinear).
- Two raters systematically audited parks using the Public Open Space Tool (POST[6]; adapted to the Canadian context) via GSV and Google Maps aerial image at two time points (ten days between each audit round).
- Percent of overall agreement (POA), Cohen's kappa and the intraclass correlation coefficient (ICC) were used to estimate intra and inter-rater reliability and concurrent validity.

Figure 1. Example park sourced from GSV

References

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5. Taylor BT, et al. (2011). Measuring the Quality of Public Open Space Using Google Earth. Am J Prev Med, 40(2): 105–112.
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Results: Intra- and inter-rater reliability for GSV audits

	INTRA-RATER RELIABILTY		INTER-RATER RELIABILTY	
Variable	**Percent overall agreement (%)**	**Kappa/ Intraclass correlation***	**Percent of overall agreement (%)**	**Kappa/ Intraclass correlation**
• Amount of formal entrances	`**	0.95	`	0.86
• Area type	86.8	0.73	52.9	0.21
ACTIVITY AREAS				
• Presence of a tennis court	100	1.00	100	1.00
• Presence of a soccer field	100	1.00	100	1.00
• Presence of a football field (rugby, gridiron)	98.6	0.66	97.1	`
• Presence of a skating/hockey rink	98.5	0.88	97.1	0.79
• Presence of a baseball diamond or cage	100	1.00	100	1.00
• Presence of a children's playground	98.5	0.97	100	1.00
• Presence of a skate park or ramps	98.5	`	100	`
• Presence of a dog exercise or off leash area	100	1.00	97.1	`
• Other areas present within the POS***	97.1	0.49	94.1	`
PATHS/SHADE/LIGHTING				
• No Presence of formal walking/cycle paths, sidewalks, in POS	94.1	0.64	100	1.00
• Presence of formal walking/cycle paths on the perimeter inside POS barrier/fence	89.7	0.78	88.3	0.75
• Presence of formal walking/cycle paths on the perimeter outside POS barrier/fence	95.6	0.88	94.1	0.85
• Presence of formal walking/cycle paths crossing through the POS	97.1	0.93	97.1	0.93
• Presence of other formal walking/cycling paths in the POS	97.1	`	100	`
• Amount of shade along formal paths	`	0.89	`	0.96
• No presence of informal walking/cycle paths in the POS	80.9	0.57	70.6	0.39
• Presence of informal walking/cycle paths on the perimeter inside POS barrier/fence	75	0.46	79.4	0.54
• Presence of informal walking/cycle paths on the perimeter outside POS barrier/fence	95.6	0.64	85.3	`
• Presence of informal walking/cycle paths crossing through the POS	79.4	0.59	67.6	0.35
• No Presence of lighting	92.7	0.84	85.3	0.67
• Presence of lighting located around courts, buildings, BBQ, and play equipment	97.1	0.87	97.1	0.87
• Presence of lighting located along paths	95.6	0.75	94.1	0.64
• Presence of lighting located on the perimeter all sides	98.6	0.66	100	1.00
• Presence of lighting located on the perimeter some sides	91.2	0.82	85.3	0.71
• Presence of lighting located randomly throughout	98.5	`	97.1	`
• Presence of lighting could not be determined	95.6	`	97.1	`
• Shade level around playground	`	0.97	`	0.96
PLAYGROUND EQUIPMENT				
• Presence of any children's playground equipment	100	1.00	100	1.00
• No presence of play equipment	100	1.00	100	1.00
• Presence of swing/s	95.6	0.91	94.1	0.88
• Presence of slide/s	94.1	0.88	94.1	0.88
• Presence of climbing equipment	95.6	0.91	88.2	0.76
• Presence of hanging bars/rings	95.6	0.90	91.2	0.79
• Presence of seesaws/rockers	94.1	0.88	91.1	0.82
• Presence of bridges/tunnels	89.7	0.66	76.4	0.31
• Presence of activity panels	95.6	0.83	88.2	0.54
• Play equipment could not be determined	100	1.00	94.1	0.48
• Presence of fencing around playground	`	1.00	`	1.00
PLAYGROUND SURFACE				
• There is no playground surface because there is no playground	100	1.00	100	1.00
• Playground surface is sand	98.5	`	100	`
• Playground surface is rubber	98.5	0.79	94.1	`
• Playground surface is gravel or pebbles	94.1	0.88	95.3	0.69
• Playground surface could not be determined	97	0.65	91.2	`
AMENITIES				
• Presences of seating/benches	97	0.91	97	0.90
• Presence of drinking fountains	98.4	`	96.7	`
• Presence of public access toilets	98.4	0.88	93.5	`
• Full, restricted, or no access for dogs	`	0.94	`	0.66
• No water features present in, or immediately adjacent to, the POS	98.5	`	100	`
• No features present within the POS	97	0.91	94.1	0.82
• Presence of a transit stop located on perimeter of POS	98.6	0.90	97.1	0.79
• Presence of statues or monuments or sculptures	100	1.00	100	1.00
• Presence of a gazebo or rotunda	97.1	`	100	`
• Presence of gardens (landscaped)	95.6	0.78	79.4	`
• Presence of a pedestrian bridge	100	1.00	100	1.00
• Presence of picnic tables	97.1	0.93	97.1	0.93
• Presence of barbeques	100	1.00	97.1	`
• Presence of any other features	95.5	0.55	91.2	`
TREES				
• Estimate number of trees	`	0.73	`	0.30
• No applicable location for trees because there are no trees	97.1	`	94.1	`
• Trees are located on the perimeter at all sides of the POS	80.9	0.61	91.2	0.81
• Trees are located on the perimeter at some sides of the POS	72.1	0.44	82.3	0.65
• Trees are located along walking paths in the POS	92.7	0.72	85.3	0.47
• Trees are located randomly throughout the POS	70.6	0.32	58.8	0.10
INCIVILITIES				
• Presence of trash cans within, or along paths entering, the POS	95.6	0.87	97.1	0.92
• Number of trash cans provided within, or along paths entering, the POS	`	0.97	`	0.94
• Presence of graffiti	`	0.74	`	1.00
• Presence of vandalism	`	0.65	`	`
• Presence of litter	`	0.63	`	`
• Amount of house frontage that connects with POS	`	0.94	`	0.32

Any variables that were not identified by rater 1 or 2 were excluded from table
* = Kappa coefficient was used for categorical variable. Intraclass correlation was used for ordinal variables, or nominal variables that had more than two response options
** = ' ' = Cannot be estimated
*** = POS = Public open space

Results

Figure 2. Example neighbourhood – audited parks outlined in red.

- *Intra-rater reliability* for the aerial image audits was poor to excellent (POA = 83.8% - 100% and kappa/ICC = 0.31-1.00).
- *Inter-rater reliability* of the aerial image audits showed agreement ranging from poor to excellent (POA = 50%-100% and kappa/ICC = 0.28-1.00).
- *Concurrent validity* of GSV compared to aerial image audits ranged from very poor to excellent (POA = 63%-100% and kappa/ICC = 0.12-1.00).
- GSV audits took an average of **13±4** minutes, while aerial image audits took **7±2** minutes to complete.

Conclusions

- GSV is a potentially reliable and valid method for conducting park audits, with the majority of the audited variables having good - excellent intra- and inter-rater agreement, as well as concurrent validity with aerial image audits.
- Conducting park audits using GSV is a feasible and less resource intensive approach to collecting park built environment data than conducting in-person parks audits. GSV audit times in this study were comparable to other studies[4] supporting the feasibility of using GSV for park audits.

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