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Research Paper

An evaluation of participatory mapping methods to assess urban park benefits

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ABSTRACT

Traditional urban park research has used self-reported surveys and activity logs to examine relationships between health benefits, park use, and park features. An alternative approach uses participating mapping methods. This study sought to validate and expand on previous participatory mapping research methods and findings and address spatial scaling by applying these methods to a large urban park system. Key challenges for spatial scaling included ambiguity in park classification and achieving representative sampling for larger and spatially-dispursed urban residents. We designed an internet-based public participation GIS (PPGIS) survey and used household and volunteer sampling to identify the type and locations of urban park benefits. Study participants (n = 816) identified locations of physical activities and other urban park benefits (psychological, social, and environmental) which were analyzed by park type. Consistent with previous suburb-scale research, we found significant associations between urban park type and different urban park benefits. Linear parks were significantly associated with higher intensity physical activities; natural parks were associated with environmental benefits; and community parks were associated with benefits from social interaction. Neighborhood parks emerged as significantly associated with psychological benefits. The diversity of park activities and benefits were positively correlated with park size. Distance analysis confirmed that physical benefits of parks were closest to participant domicile, while social and environmental benefits were more distant. These results validate previous suburb-scale findings despite greater variability in park types and sample populations. Future urban park research using participatory mapping would benefit from greater effort to obtain participation from under-represented populations that can induce nonresponse bias, and analyses to determine whether system-wide results can be disaggregated by suburb or neighborhood to address social inequities in urban park benefits.

1. Introduction

Urbanization is a dominant global trend with over half the world's population now living in cities (United Nations, 2015). Urban parks and greenspaces are widely held to contribute to human well-being and quality of life (Chiesura, 2004; Larson et al., 2016), but the empirical evidence for the link between human well-being and urban green space is weak due to poor study design, confounding effects, bias or reverse causality, and weak statistical associations (Lee & Maheswaran, 2011). The diversity and variability in urban populations, in combination with the heterogeneity of urban physical environments, make assessing urban greenspace benefits challenging. Urban design and planning outcomes that provide for parks and conserve greenspaces appear broadly justified based on *perceived* benefits, but parks and greenspaces do not contribute equally to the collective benefit enjoyed by urban inhabitants. In many cases, physical, psychological, and social health benefits appear inequitably distributed across urban populations (Jennings, Larson, & Yun, 2016). Further, perceived access to urban parks (Wang, Brown, Liu, & Mateo-Babiano, 2015) or a favorable orientation to nature (Lin, Fuller, Bush, Gaston, & Shanahan, 2014) appear more important than geographic access or proximity in predicting urban park use.

A variety of social research methods have been used to examine the putative benefits of urban parks and greenspaces. Participatory mapping methods, alternatively called public participation GIS (PPGIS), participatory GIS (PGIS), or volunteered geographic information systems (VGI), are increasingly used as a social research tool to assess the multiple benefits of urban parks and greenspaces. These methods offer

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an alternative to self-reporting surveys, activity logs, and direct observation methods such as SOPARC (McKenzie, 2005) for identifying the public health benefits from park activities (Brown, Schebella, & Weber, 2014). Further, these participatory mapping methods have the flexibility to identify broader social values and cultural ecosystem services associated with urban greenspaces (Tyrväinen, Mäkinen, & Schipperijn, 2007; Ives et al., 2017; Rall, Bieling, Zytynska, & Haase, 2017; Ribeiro & Ribeiro, 2016).

Participatory mapping methods for assessing urban park and greenspace benefits have multiple threats to research validity. Some of the key validity issues for the spatial mapping of benefits include the variables/constructs being mapped, spatial scale of the study area (e.g., park, suburb, or entire urban area), physical landscape variability (e.g., water, vegetation, topography), park/greenspace facilities/amenities, distance from domicile, accessibility, park/greenspace classification, and population sampling representativeness. To date, these methodological issues have not been comprehensively addressed within the same study, with reported studies examining a subset of these research issues.

In this study, the research objectives are to: (1) assess whether findings about the distribution of park benefits (physical, environmental, psychological, social) identified in previous participatory mapping studies that were limited in scope and scale are applicable to a large, diverse urban park system; and (2) examine the methodological challenges for scaling-up participatory mapping methods to assess urban park benefits in a large urban park system.

1.1. Review of related participatory mapping research

Brown et al. (2014) examined the distribution of urban park benefits (physical, psychological, social, and environmental) by park type using a park classification system developed by the National Recreation and Parks Association (NRPA) (Mertes & Hall, 1996). The study relied on a predominantly volunteer sample of urban residents (n = 242 participants) living in one suburb in the larger urban area of Adelaide, Australia. The study found that different urban park types provide opportunities for physical activities with differential health benefits. Linear parks provided the greatest overall physical benefit while other park types provided important psychological, social, and environmental benefits. Distance to park was not a significant predictor of physical activity but park size was related to benefits with larger parks providing greater and more diverse benefits. The potentially confounding variables of park accessibility, park amenities, and physical landscape characteristics were not examined.

Ives et al. (2017) implemented a PPGIS study in four urbanising suburbs in the Lower Hunter region of NSW, Australia, and requested residents (n = 418 participants) to identify important values of greenspace. The analyses examined the relationship between mapped values to physical landscape characteristics and also evaluated a simple greenspace classification typology (general, natural, sportsfield). The most frequently mapped value was physical activity and the majority of mapped values reflected positive attributes of greenspaces. Significant predictors for multiple greenspace values were distance to water and suburb identity, while the greenspace category was not significantly related to mapped values.

Rall et al. (2017) examined patterns of perceived cultural ecosystem services (CES) in the city of Berlin mapped by residents using convenience sampling (n = 562 participants). The study examined the distribution of CES by land cover classification. About three-quarters of all CES were mapped in urban greenspaces or forests. The study found spatial differentiation of perceived cultural ecosystem services (CES) in greenspaces where the density of CES decreased from the inner to the outer edges of the city. Recreation, social, cultural heritage, and identity services were concentrated more heavily in the inner-city, while biodiversity, spiritual, inspirational, nature experience and educational services were more spatially scattered.

Bijker and Sijtsma (2017) examined whether greenspaces at different distances are important for the wellbeing of urban dwellers. The study focused on urban residents drawn from internet panels in three countries (Germany, Denmark, Netherlands: n = 3763 respondents). Participants were asked to identify natural places that were attractive, valuable, or important at four different spatial scales: local, regional, national, or world. The attractiveness of natural places increased with spatial scale while local natural places were visited most frequently. As the spatial scale expanded from the local area, more greenspace qualities were identified. At all spatial scales, “green nature”, recreation, and water qualities were the most frequently identified. Urban residents appear to have a “portfolio” of favorite places at multiple scales with local places being less special, but visited more frequently to counterbalance the stressful effects of population density. Places at the local and regional level especially provided opportunities for physical and social activities.

Pietrzyk-Kaszyńska, Czepkiewicz, and Kronenberg (2017) used participatory mapping to assess the non-monetary values of greenspaces in three cities in Poland. The study relied on sampling of volunteer participants (n = 1640) who identified important urban greenspaces on a map, both formal and informal greenspaces, and who provided qualitative statements for their importance. The study found between 17% and 41% of places where respondents spent time were areas outside of formal greenspaces that were valued for their greenness, pleasant views, uniqueness, wild character and natural habitats. The findings highlighted the need to identify and include informal greenspaces in urban spatial planning and governance.

With the exception of the Brown et al. (2014), these studies assessed park benefits indirectly through measurement of landscape values, ecosystem services, or park qualities, and none of the studies implemented both household and voluntary/convenience samples in the recruitment of study participants. The novelty of this research is the direct measurement of urban park benefits in a large urban park system using participatory mapping methods, the inclusion of multiple sampling methods to evaluate potential bias and representativeness, and the identification of park classification issues when applying the methods to a large urban park system.

1.2. Study purpose and research questions

This study seeks to advance knowledge about the strengths and limitations of participatory mapping as a social research method for identifying urban park benefits in a large urban park system. We follow the initial design of Brown et al. (2014) who identified urban park activities and benefits (physical, psychological, social, and environmental) by park type in a study of a suburb in Adelaide. However, this study is more than a replication study and contains new research design innovations in addition to addressing the important issue of methodological scaling by applying the participatory mapping process to a large urban area and park system located in Brisbane, Australia (est. pop. 1.2 million). The key challenges for scaling-up from suburb to large urban park system include the ambiguity in park classification resulting from a greater diversity in parks and reserves across the system and sampling for larger and more heterogeneous human populations.

The first study innovation was to simplify the list of park activities to assess physical health benefits based on metabolic equivalent of task (MET). Metabolic equivalents are a unit used to estimate the metabolic cost of physical activity, with the value of one MET being approximately equal to an individual’s resting energy expenditure (Jette, Sidney, & Blümchen, 1990). METs can be estimated for a range of physical activities based on the nature and the intensity of engagement in the activity. Park activities that could be mapped ranged from low energy, sedentary activities such as sitting, to higher energy activities such as running, cycling, and playing sport. The list of activity markers included new activities not previously used (*dog walking*, *water-based activities*, and *supervising children in parks*). As a design trade-off for