



Investigating the impact of Sense of Place on site visit frequency with non-motorized travel modes

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ABSTRACT

This paper examines the relationships between: (i) Sense of Place (SOP); (ii) non-motorized travel; and (iii) the use of information and communication technologies (ICT). A guiding principle in built environment design for sustainability and livability is a latent construct termed Sense of Place (SOP), which leads visitors to perceive and associate a strong identity or character with a particular location. We hypothesize that visitors' SOP affects their access of sites via walking/biking or other non-motorized travel modes. Furthermore, we also hypothesize their ICT use shapes their SOP. In an information era, mobile ICT provide ubiquitous information and communication across multiple geographies, expanding interaction with locations to include both the physical and virtual. Visitors can engage with a location pre and post-trip through online reviews or virtual visualizations, such as Google Street View. To investigate these interrelationships, we conduct a visitor intercept survey and analyze the responses to investigate the direction and magnitude SOP impacts on non-motorized site visit frequency. The estimation results indicate that SOP statistically impacts non-motorized visits; ICT use for learning about the site was found to positively impact visitors' estimated SOP.

1. Introduction

Increasingly geographers and urban planners focus on building livable communities that benefit community well-being. Livable communities require a *Sense of Place* (SOP), which characterizes human relationships with the natural and built environments. Locations with a strong SOP can facilitate visitors in building lasting connections with their environments. SOP has gradually entered several planning dialogues, from local municipalities and neighborhoods (Soini et al., 2012; Tester et al., 2011) looking to improve livability to international discussions on ecology and the environment (Newman and Jennings, 2012). Common applications include urban space design (Billig, 2005; Deutsch, 2013) and natural resource management (Brown and Raymond, 2007). Furthermore, the United Nations Environmental Program (UNEP) identifies SOP as an essential feature of sustainable environments, including aspects of the surrounding ecosystem (Newman and Jennings, 2012). From the perspective of the natural environment, a strong SOP may encourage or strengthen commitment and environmental stewardship towards a given place, such as national park (Williams and Stewart, 1998).

In this study, we investigate the interrelationships between: (i) Sense of Place (SOP); (ii) non-motorized site visit frequency; and (iii) the visitors' use of information and communication technologies (ICT)

for gaining site information. The literature (Beidler, 2007; Stedman, 2003a, 2003b) agrees on the importance of following broad SOP components: (i) physical characteristics; (ii) human activities taking place and (iii) user perceived affects and meanings. We extend these components and also consider visitors' ICT use to interact with the location online. We also examine the impact of SOP on site visits and non-motorized access travel mode, such as walking and biking. We hypothesize that visitors' ICT use may shape their SOP by allowing interaction with the site online. This virtual interaction comes in many forms, from reading online reviews from other visitors to more directly interacting through Google Street View. Ubiquitous access to the site online may further affect visitors' SOP, although the interaction is only virtual. Additionally, a strong SOP may encourage non-motorized access to sites, allowing direct exposure to the environment. We address the following research questions:

- 1) Is there a relationship between visitor access of information about a location through ICT and their *Sense of Place*?
- 2) Does *Sense of Place* affect a visitor's non-motorized site visit frequency, for example by walking or biking?

To address these questions, we conduct a visitor intercept survey to model and estimate visitors' SOP perception with respect to several

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attitudinal indicators and site visit frequency. This work extends the existing literature on SOP by: (1) broadening previous components to include travel mode access and ICT adoption; (2) developing a framework for measuring SOP and quantifying its relationship to other dimensions; and (3) identifying the most salient SOP attitudinal factors as perceived by visitors.

We have two main hypotheses in this study. One hypothesis is that increase in mobile ICT use, recently, impacts visitors' underlying SOP. We argue that ICT has evolved to a point where online users can “visit” the sites without physically traveling to them. Existing examples include online museum sites which offer visitors access to many artworks via their mobile app. For neighborhoods, Google Street View offers views from the streets without physically visiting these locations. Second, we also hypothesize that non-motorized and sustainable travel access to sites can strengthen SOP development relative to personal auto, due to the direct exposure to the environment. Even for transit travel modes, riders can sit and observe the passing environment, as opposed to driving which requires focus on vehicle operations and wayfinding.

The next section discusses the literature related to SOP and its measurement. The following section presents the data collection effort and sample characteristics, followed by the model formulation. After a presentation and discussion of estimation results, this paper summarizes the main findings and future research directions.

2. Background: perspectives on Sense of Place (SOP)

Sense of Place (SOP) continues to play an important role in urban redevelopment and community-focused built environment design. From the perspective of geographers and planners, identifying the main factors driving SOP and measuring them can improve environmental design to ensure the site contributes positively to SOP and promotes sustainability and livability. For example, if a social atmosphere contributes positively towards SOP, then designers and planner may plan and allocate more space towards facilitating socializing. The majority of the literature in geography and anthropology consists of studies based on introspective, observational and theoretical writings, but not location specific, and indicates the challenge in defining SOP (Ryden, 1993; Seamon, 2014; Beidler, 2007, Beidler and Morrison, 2016). While theories and definitions vary, the literature shows consensus on three broad components: (i) the physical setting; (ii) activity within the setting and (iii) meaning associated with the setting, all of which are intertwined. We consider social interactions a sub-category of (ii) human activity, similar to Stedman (2003a, 2003b).

2.1. Definitions and concepts

Both human and physical dimensions comprise SOP (Stedman, 2003a, 2003b). Human dimensions find their basis in attitude theory (Deutsch, 2013; Stedman, 2003a, 2003b; Tapsuwan et al., 2011). With respect to SOP, researchers in the literature consistently characterize SOP along three dimensions (Jorgensen and Stedman, 2001). (i) *Place Attachment* indicates an affective positive bond between visitors and their environment (Low and Altman, 1992). (ii) *Place Dependence* measures the perceived strength of association between visitor and place (Stokols and Shumaker, 1982). (iii) *Place Identity* represents visitors' personal identity in relation to the environment (Proshansky et al., 1983, Proshansky, 1978). Other identified dimensions in the literature include *Place Satisfaction*, *Social* and *Place Aesthetics*. *Place Satisfaction* refers to a summary judgment on the perceived quality of a place/environment (Mesch and Manor, 1998). *Social* follows from a social atmosphere, the level of crowdedness, amount of activity, safety, the level of (general) friendliness to visitors and safety in walking around (Deutsch, 2013, Deutsch and Goulias, 2013, Deutsch and Goulias, 2009, Deutsch and Goulias, 2012). *Place Aesthetics* includes views on architecture, the beauty of the place, the balance of decorative

and functional attributes, artistic value, peaceful and relaxing atmosphere.

While each dimension is important from the visitors' perspectives, the design practice and literature disagrees on which dimension weighs more for encouraging SOP, with some advocating the physical environment over activity facilitation or associated meaning (Jackson, 1994). The literature also disagrees on the role of time (Tuan, 1979). While long-term association with the place is necessary, some researchers argue that time erodes the acute awareness experienced, leading to increasing insensitivity towards a place.

Second, with respect to associating SOP with non-motorized travel few studies exist. Complete streets design guides focus on accommodating multi-modal and non-motorized travel, but do not directly indicate improvement in SOP as a result of these designs (Burden and Litman, 2011; Rue et al., 2017). In the literature, researchers have modeled SOP and included it as an explanatory variable for travel choice modeling. Zandvliet et al. (2006) studied *Place Identity* and its relation to destination choices in the Netherlands. Recently, a large body of research from University of California, Santa Barbara explore many trip-making facets of visitors (arrival time, mode, frequency, sequence of activities, companionship, and long-distance travel) and SOP at two malls in Santa Barbara, CA (Deutsch, 2013, Deutsch and Goulias, 2013, Deutsch and Goulias, 2012). One result from Deutsch and Goulias (2013) is that satisfaction with the amount of people at the location (*Place Satisfaction*) positively impacts the likelihood of walking. In this study, we focus exclusively on non-motorized travel which exposes the traveler to the surrounding environment, compared to auto travel. We hypothesize this exposure may impact visitors' SOP. Curiously missing from the literature on travel and SOP are network effects, such as the connectivity or accessibility of locations. These may play important roles in shaping SOP, especially for visitors residing far from the location of interest.

Research on the intersection of ICT use and SOP is virtually non-existent in the literature, despite the widespread market penetration of personal mobile ICT. While past studies leverage data collected through mobile ICT to infer SOP (Sekar et al., 2017; Schwartz, 2015; Dias et al., 2013; Oz and Temizel, 2015), few studies examine how ICT use impacts SOP. The geography literature has long examined the concept of virtual geographies, but not the relationship between SOP and these virtual environments (Miller and Horst, 2013; Crang et al., 1999; Batty, 1997; Graham, 1998). Recently, Bork-Hüffer (2016) interviewed 30 German professionals in Singapore on their digital media choices and use during their relocation and settlement process. She develops a theoretical model on how digital and offline places combine in the construction of Sense of Place (SOP), and how the digital sphere affects engagements with place attachment. However, this model was based on personal interviews, and did not quantitatively assess SOP. We contribute to this growing body of geography literature on the digitization of places and quantify the impact of ICT use on SOP.

2.2. Methodology approaches for assessing Sense of Place (SOP)

With respect to evaluation methods, researchers used both qualitative and quantitative methods. Qualitative approaches, which dominate the literature, investigate the meaning in personal experiences from the study participants (Hammersley, 1992; Taylor and Bogdan, 1998). These methods include visitor interviews that engage the community with face-to-face conversation and photos of the location (Bork-Hüffer, 2016; Kyle and Chick, 2007; Stedman et al., 2004).

Data-driven quantitative approaches have seen limited application in studying SOP (Pretty et al., 2003). These studies adopt a multi-dimensional perspective, examining the strength of each dimension for a particular location. One notable study is Stedman (2003a, 2003b) who develops a direct-effects model based on Likert-scale response to affective dimensions of SOP, but rejects this model based on poor fit with collected data. These studies typically use intercept surveys

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