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Modeling travel behavior and sense of place using a structural equation model

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ABSTRACT

Understanding the way in which people conduct their daily activities is the central focus of travel behavior modelers. This often requires an understanding of the way in which people interact with their surroundings. Theorists have paid special attention to the interactions of people and place, specifically the endowment of meaning to places (termed sense of place). This work has a host of applications to explain different facets of behavior. Among these, travel behavior is a prime area for sense of place application due to the constant interaction of land use with transportation. In this paper, we explore relationships and examine sense of place using structural equations and derive six distinct factors representing unique dimensions of sense of place. The data used are from a 719-person survey of two shopping centers in Santa Barbara, California, specifically designed to measure sense of place. The factors extracted represent aspects of attachment – the bond between person and place, dependence – the strength of association between person and place, identity – the individual's identity with respect to place, satisfaction- which corresponds to many of the services offered at each place, atmosphere – such as aesthetics and surrounding ambiance, and community – which highlights the views of the place as being family and kid friendly, or a place with kind or friendly people around. These factors are pilot tested as determinants in behavioral models of mode selection, sequencing of activities, and companionship during activities exhibiting substantial potential of explanatory power. This finding motivates a few additional research directions we outline in this paper.

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1. Introduction

It has been recognized that the interaction between land use and travel behavior is something that must be adequately considered when attempting to describe behavior, build predictive models, and take actions to change behavior. Foundational to the activity based approach of travel demand modeling is the assumption that travel is a derived demand, and is produced by the need or desire to participate in activities in different locations. Understanding the attractive forces that are responsible for the distribution of activities in space is key to deriving accurate predictive and forecasting models. It is important when considering this human-environment interaction to not only consider the physical interaction with place and the economic or need based reasons for that interaction, but also the emotional and affective interactions. These emotional and affective interactions, although harder to measure than attributes such as cost or travel time between two locations, can provide richer explanations for observations in behavior. The rich history of sense of place theory development as well as recent work in quantifying facets of sense of place makes the theory ripe for application to travel behavior research.

The process of travel behavior modeling involves capturing observed variation among people. To do this, researchers often use individual and household attributes to model differences and explain behavior with increasingly finer detail. This detail is needed in many travel demand forecasting model systems that recreate the daily life of households and individuals. In this context, heterogeneous behavior is explained by collecting data about locations that an individual visits, and by recording his or her activities. Econometric models are then estimated using these data, and used to predict the daily whereabouts of people for an entire region (Vovsha et al., 2005; Bradley et al., 2010). Behavioral models often go beyond simple indicators of socio-demographic information in their specification to include attitudes (Kuppam et al., 1999; Sunkanapalli et al., 2000), personality (Prevedouros, 1992), and latent and observed factors of intra-household interaction (Yoon and Goulias, 2010). The inclusion of these types of information creates models with richer detail. Analysts also hope to use these data as travel behavior determinants for specific harder-to-predict facets such as destination choice.

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Among these relatively new types of determinants included in models is *sense of place*. Sense of place researchers have long theorized the emotional connection between people and places and, in more recent research, have attempted to quantify the meaning. The theory of sense of place had its beginnings in the early 1970s. Among those credited with the initialization of the theory was Tuan (1974), who defined it as the "affective ties with the material environment" (p. 93). Many of the early theorists stressed that sense of place was phenomenological in nature. Because of the highly personal and individualized nature, any attempts to quantify this fuzzy concept were considered futile. Although this concept had phenomenological roots, researchers saw the potential of quantifying sense of place (Canter, 1983; Golledge and Stimson, 1997). Several additional concepts related to sense of place were produced as a result of such rich discussions including place identity, which is "the individual's personal identity in relation to the physical environment" (Proshansky, 1978, p. 155), place attachment, which is defined as "the bonding of people to places" (Altman and Low, 1992, p. 2), place dependence, which is defined as the "[person's] perceived strength of association between him- or her-self specific places" (Stokols and Shumaker, 1981, p. 457) and place satisfaction a "the utilitarian value [of a place] to meet certain basic needs" (Guest and Lee, 1983, p. 234).

An evaluation of the scope of research interests can illustrate the scale at which sense of place is studied. For instance, sense of place has been studied as associated with home (Jorgensen and Stedman, 2001, 2006), neighborhoods (Brown and Werner, 2009), in conjunction with physical attributes of the place (Stedman, 2003), at different geographic scales (Shamai, 1991), and with different applications including ecosystem management (Williams and Stewart, 1998), tourism (Brown, 1999; Hallak et al., 2012), place based teaching (Semken and Freeman, 2008), and even association with health care potential (Gesler, 1993). Considerable debate about the psychometric properties of the place-based constructs is still ensuing. Much discussion has centered on the structure of these constructs and the relations between sense of place, place attachment, identity, dependence and others (see Jorgensen and Stedman (2001) for a review of many of these discussions). The existence and nature of these relationships have been statistically examined using structural equation modeling to determine the optimal relationship among these concepts. The research in this paper uses measurement tools and findings from Jorgensen and Stedman (2001). Although there is no uniform agreement on the structure of these place concepts, this work provides theoretical and statistical reference for the investigation of sense of place and related concepts and their influence on behavior. For this reason the estimated factors in this paper should not be considered the last word in the definitions of sense of place constructs. However, we are encouraged by the most recent developments that focus on quantifying sense of place and expressing its facets as factors that we performed in preliminary analysis (Deutsch and Goulias, 2009, 2010).

This work is meant to expand previous work in both sense of place and travel behavior. It explores the potential for sense of place-related explanatory variables in travel behavior models that can be used in simulation, and used to identify urban designs that are both attractive to people and environmentally sustainable. The use of structural equation modeling with latent variables allows us to examine further the structure of measured sense of place by verifying previously identified dimensions and identifying new dimensions. In addition to this, we use several sense of place indicators in travel behavior models to pilot test its worthiness as an explanatory variable. Although some authors have examined specific attributes such as place identity and its relation to destination choices (Zandvliet et al., 2006), we are not aware of any other papers on this subject investigating sense of place in its many dimensions applied to travel behavior. In addition, this cognitive aspect of behavior is still lacking in recognition. For example, Buliung and Kanaroglou (2006) provide a useful GIS toolkit for understanding behavior; however, they do not mention any of the cognitive aspects associated with places. Although spatial and temporal models are important in understanding behavior, there is still an element of behavior that is lacking. In our previous paper (Deutsch and Goulias, 2010) we used answers to attitudinal questions directly as explanatory variables and found them to explain significantly three important travel behavior facets: arrival mode to the shopping center, arrival time at each location, and the location itself. That work did not explore the relationship between the variables used to quantify sense of place, and the underlying latent constructs that are contributing to the observed attitudes, which we attempt in this paper. In addition, in this paper we also attempt to understand the relationship between socio-demographic attributes of an individual and sense of place. Moreover, using structural equations, we bring all these components together in the same covariance matrix and estimate relationships among them.

2. Data description

A sample of 719 persons from an intercept survey conducted at two outdoor shopping centers (malls) in Santa Barbara, California, was used for this analysis. The two malls are within the city of Santa Barbara, both less than a mile and a half from highway 101, which is a major North–South highway between San Francisco and Los Angeles. Both malls are situated along one of Santa Barbara's main arterial streets, State Street, one being downtown and one uptown. Both offer two anchor big box stores, and a variety of smaller retail stores. In addition, both places offer restaurants and additional nearby shopping. Among major differences is the setting, as Paseo Nuevo is situated within the core of the downtown area, and La Cumbre is located in a residential setting. While both malls have additional nearby opportunities, the landscape and surroundings of the two locations are vastly different. Details of the study areas and data collection process and instrument are discussed in Deutsch (2008) and Deutsch and Goulias (2009).

The survey consisted of questions developed to capture the respondents' sense of place views toward each mall. Following work conducted by Jorgensen and Stedman (2001), and Stedman (2003), a series of questions were adapted to this study that focused on the respondents' place attachment, place identity and place dependence. In addition, several additional questions examined other aspects of sense of place. All sense of place questions were asked on a seven-point likert scale ranging from strongly disagree to strongly agree. Additionally, several socioeconomic and demographic questions were included as well as questions about travel behavior before, during, and after the visit to the shopping mall. Because of the intercept format of the survey, travel behavior variables are limited to a small snapshot of the day's activities.

Data collection involved five days of on-site recruitment at each location, conducted during identical time periods. Respondents were asked to fill out a booklet style survey on site, which took on average between 10 and 15 min. Of the 719 respondents, 38.7% were surveyed at Paseo Nuevo and 61.3% at La Cumbre. Of these respondents, 43% are male, 78% are residents of Santa Barbara County and three percent are residents of Ventura County, directly south of Santa Barbara. The respondent pool is of average age of 37 years, with a minimum of 18 years and maximum of 88 years.

3. Structural equation model

As mentioned, measurement tools, as well as the definition of the structural equation model (SEM), rely heavily on work measur-