

---

University of California Transportation Center  
UCTC Research Paper No. 888

**Exploring Sense of Place Attitudes as Indicators of Travel Behavior**

Kate Deutsch, University of California, Santa Barbara,  
Konstadinos Goulias, University of California, Santa Barbara  
Fall 2009

## **Exploring Sense of Place Attitudes as Indicators of Travel Behavior**

### **Kate Deutsch**

University of California, Santa Barbara  
Department of Geography  
1832 Ellison Hall  
Santa Barbara, CA 93106  
Phone: 805-893-4519  
Fax: 805-893-3146  
E-mail: [deutsch@geog.ucsb.edu](mailto:deutsch@geog.ucsb.edu)

### **Konstadinos Goulias**

University of California, Santa Barbara  
Department of Geography  
1832 Ellison Hall  
Santa Barbara, CA 93106  
Phone: 805-893-4190  
Fax: 805-893-3146  
E-mail: [goulias@geog.ucsb.edu](mailto:goulias@geog.ucsb.edu)

June 7, 2009

Number of Words, Abstract = 204  
Number of Words, Body = 5,619??  
Number of Tables = 3 (x 250) = 750  
Total Words = ??

Paper submitted for presentation and publication for the 89<sup>th</sup> annual Transportation Research Board Meeting.

## **ABSTRACT**

Researchers in travel behavior have explored attitudes as important determinants since the 1980s. However, with recent increased frequency, researchers are broadening the use of attitudinal data in models to explain behavior. Much of the application however has focused on attitudes about entities such as lifestyles and attributes of different transport modes. Little focus has been placed on attitudes related to places and attributes of human- place interaction. Much theorizing has taken place in the past forty years focusing on this human-place interaction, which has been formalized into the theory of sense of place. This paper discusses the quantification of this theory, and the implementation of this attitudinal information into travel behavior modeling. To do this a survey was conducted in Santa Barbara, California to measure sense of place and estimate model of travel behavior. Patrons of two outdoor shopping malls in Santa Barbara were questioned about place attitudes, socio-demographic information and details regarding their activity and travel of the day. Alternate regression model specifications are employed here to examine differences between the two study locations, the use of mode for arrival, and the timing of the activity pointing out the value of the sense of place construct as a determinant of travel behavior.

## INTRODUCTION

Recent advances in travel behavior modeling and simulation have greatly increased our ability to successfully understand, analyze, and predict human behavior as it pertains to travel. The introduction of the activity-based approach has provided a new foundation for modeling practices (*Ettema and Timmermans, 1997*). In conjunction with the implementation of the activity based approach, the field is recognizing and responding to the necessity to integrate land use patterns and transportation into a comprehensive model, which accounts for interactions between the two (*Timmermans, 2003*). These two advances along with several additional advancements to modeling have increased the accuracy and reliability of prediction and simulation efforts. Improvements of traditional discrete choice methods include latent variables and classes (*Ben Akiva et al. 1999, Ben Akiva et al. 2002*), enriching traditional models with personality indicators (*Prevedourous 1992, Steg et al. 2001, Kostyniuk et al, Goulias/Henson 2006*), social networking information (*Molin 2008, Aerentz, Timmermans- Survey meth conference*), and activity scheduling and planning intentions (*Clark/Doherty 2008, Auld et al 2008, Timmermans IATBR 2006, Ruiz/Roorda 2008, Auld/Williams/Mohamadian/Neilson-Trans Letters*). In fact, attitudinal variables have been proven to be valuable in increasing the fit and explanatory power of regression models. For instance, Kitamura et al. found that attitudes are more strongly associated with travel behavior than land use characteristics (*Kitamura, Mokhtarian, Laidet, 1997*). Some of these studies have focused on choices individuals make about vehicle type choice (*Choo, Mokhtarian, 2002*), mode choice with respect to attitudes about mode performance (*Kuppam, Pendyala, Rahman, 1999, and Sunkanapalli, Pendyala and Kuppam, 2000*), and mode choice with respect to attitudes about urban design and practicality of modes (*Dill, 2004*) and urban design as well as environment and time use attitudes (*Kitamura et al, 1997*). Although attitudinal determinants have been proven to be advantageous to modeling travel behavior, their use has been limited in practice. Moreover, attitudes regarding places and respondents views toward specific places, to the authors' knowledge, have never been explored and applied to travel behavior.

At the foundation of attitudes about places is *sense of place* that is defined as a person's "affective ties with the material environment" (*Tuan, 1974*). Tuan, like many others in the field of Geography claim that sense of place is a phenomenological process and must be treated as a highly individualized experience, and is therefore a fuzzy concept and very difficult to quantify. However, others claimed that sense of place can and should be quantified and applied to various research endeavors (*Golledge and Stimson, Bolton*). Work in several fields has collectively improved the theoretical framework of sense of place and related concepts. Places, as theorized by Canter represent "a confluence of cognitions, emotions and actions organized around human agency" (*Canter 1991*). Work conducted by Jorgensen and Stedman in quantifying sense of place based on the theory set forth by Canter and attributed to each of the three commonly cited concepts a three-part attitudinal structure to represent cognitive, affective and conative processes. These three concepts are **Place identity**, which is "a person's identity with relation to the physical environment" (*Proshansky 1978*), **Place**

**attachment**, which is defined as “the positive bond that develops between a person and their environment” (*Altman and Low 1992*), and **Place dependence**, which is defined as the “perceived strength of association between a person and a place” (*Stokols and Shumaker 1981*). Jorgensen and Stedman juxtapose these concepts with the three components of attitude previously mentioned; place attachment being matched with the affective or emotional portion, place identity with the cognitive portion as it relates to the dimensions that build one's sense of self, and place dependence equating with the conative domain (dependence for a place is expressed in actions at that location, Jorgensen and Stedman 2001). In addition to this work, several researchers have quantified place concepts and applied them to education (*Semken/Freeman*), psychology (*Lewicka*), forestry (*Smaldone et. al.*), architecture (*Giuliani/Feldman, Manzo*), computer science/Geographical Information Science (*Agarwal, 2005*), sociology (*Gustafson*) and geography (*Hay*). Most recently, this theory has been quantified and correlated to travel behavior (*Deutsch Thesis 2008, Brown/Werner, 2009*). The remainder of this paper discusses in detail the data collection and analysis of sense of place as it relates to travel behavior in Santa Barbara, CA.

## **DATA COLLECTION**

Two shopping malls in Santa Barbara, were chosen as study sites for this research. Both malls are outdoor malls and are located minutes off of highway 101 (a North-South high level facility connecting Los Angeles to San Francisco in California). Paseo Nuevo is a mall that is situated in the middle of downtown Santa Barbara and abuts State Street, a well known and common tourist destination. Parking structures are located in several areas surrounding the mall, and there is limited street parking. Architecture in the downtown area of Santa Barbara is mostly Spanish influenced with common characteristics carried throughout the city blocks. La Cumbre is located on upper State Street in a more residential area. La Cumbre is surrounded by surface parking lots and has a more traditional suburban mall appearance. The architectural style of the upper state street is not as unified as that of the lower State Street area. A more complete description of the study areas and the survey process can be found in Deutsch and Goulias 2009 and **Deutsch, 2008**).

### **Survey Process**

The sample of this study was collected from an intercept survey process. Patrons were surveyed at each shopping mall during five days out of a one-week period at each location. The resulting sample size of this survey was 823 respondents. The resulting sample is 55.8% female of an average age of 37.7 years. Additionally, 76.1% of the respondents were residents of Santa Barbara, 3.6% were residents of Ventura County (immediately south of Santa Barbara County), 7.7% from neighboring counties such as Los Angeles and San Luis Obispo, and 4.6% from other counties in California. The remaining 8% of the respondents were from out of state, another country or had multiple residences. When broken into disaggregate samples at each mall, the resulting sample size was 320 for Paseo Nuevo and 503 for La Cumbre. The Paseo Nuevo sample had an average age of 34.75 years with 41.5% of the respondents being females. Of the sample, 69.7% were residents of Santa Barbara County, and 20.3% came from a household with

one or more persons under the age of 18. The La Cumbre sample had an average age of 39.69 years with 64.8% of the respondents being females. Of the sample, 80.1% were residents of Santa Barbara County, and 27.8% came from a household with one or more persons under the age of 18.

Following the work of Jorgensen and Stedman (2003), sense of place is treated as a set of attitudinal components. In addition to *place dependence*, *place identity* and *place attachment* as discussed above, an additional element of sense of place; *place satisfaction* was also measured. Place satisfaction is defined as “a person’s level of satisfaction with the services, environment and needs provided for by a specific place” (Stedman 2003). In addition, attitudinal measures of aesthetic quality, atmosphere, and cultural and social associations were included in the questionnaire. A list of sense of place related concepts, from which questions were developed, is provided in table 1.

**Table 1: SENSE OF PLACE CONCEPTS AND RELATED SURVEY TOPICS**

SOP Concepts	Related Topics
Place Attachment	Ability or likelihood of relaxing, happiness due to place, importance of existence, level of importance compared to other places
Place Dependence	Needs met, diversity, underlying existence of reasons for trip
Place Identity	Identification with atmosphere, place as a reflection of the individual, level of freedom to be self
Place Satisfaction	Satisfaction with: food, products, parking, level of service, entertainment, crowd size
Aesthetics	Views on: architecture, beauty of place, balance of decorative and functional attributes, artistic value, peaceful and relaxing atmosphere
Social/Cultural	Social atmosphere, reflects culture of Santa Barbara, risk of unpleasant encounters, level of crowdedness, amount of activity, safety of walking around, family and kid friendly, level of friendliness of people

## SENSE OF PLACE AS A DETERMINANT OF TRAVEL BEHAVIOR

In order to determine the benefit of sense of place indicators in travel behavior modeling, several models were constructed utilizing a nested specification. The nesting and comparison of several models allows for analysis of the cost (of using more degrees of freedom) versus the benefit (improvement of fit) with the addition of place indicators while at the same time considering if the models thus derived were reasonable and in agreement with past findings. Regression models were created to investigate differences between respondents at each location, the modal split of the observed data, and characteristics of the trip such as timing of the activity.

To examine the impact of sense of place on travel behavior, models were built using location as the dependent variable. A location dummy variable was used as the dependent variable (1 for La Cumbre, 0 for Paseo Nuevo) and a binary Logit model used to explain the latent propensity of traveling to either mall. This analysis provides insight into the differences between people at each location as well as their attitudes toward the place and its attractiveness as an activity center. Comparisons among different models in the nested specification is used to examine the impacts of the addition of sense of place indicators to a travel behavior model containing only socio-demographic information. The initial model containing only socio-demographic information can be seen in Table 1.

Results for indicators with significance at a .05 level or better are shown in black. Indicators that were bordering on significance (better than significance at .1) are also shown as well, but in gray.

Results indicate that age has significance when examining the differences between locations, with younger age groups being less likely to frequent La Cumbre (i.e., the suburban like mall). Perhaps the most noteworthy aspect of age is the result of the college age group (ages 18-24), which indicates a considerably larger aversion toward traveling to La Cumbre, with greater significance than the other age groups. The results however indicate that age does not have a very significant contribution to the overall log odds (column labeled Exp (B)) of one choosing La Cumbre over Paseo Nuevo. Gender likewise, has significance, with a negative coefficient for males, indicating that males are less likely to travel to La Cumbre than Paseo Nuevo. This indicator again contributes less to the overall probability of frequenting La Cumbre. Residency in Santa Barbara is also significant when examining location, with higher contribution (1.856), which can most easily be explained by the tourist nature of Paseo Nuevo and its proximity to numerous other tourist attractions. People who are married or domestic partnered also have a higher propensity to travel to La Cumbre, as well as people who have one child in the household, and people with two cars. All of these indicators also have higher contribution to the probability of one choosing to travel to La Cumbre.

To examine the use of sense of place indicators to this model, the initial model was built upon with additional indicators. The resulting model can also be seen in Table 1. These variables indicate the respondent's views regarding aspects of sense of place with respect to the mall that he or she was visiting at the time of the survey. Appropriate dummy indicators were created for sense of place questions using the distributions of each question. Indicators are again shown for a .05 significance level or better, and in gray for 0.1 significance level or better.

**TABLE 1: Binary Logit Location Model**

*indicates question was recoded in inverse	Socio-Demographic					Socio-Demographic/ Sense of Place				
	B	S.E.	T-stat	Sig.	Exp(B)	B	S.E.	T-stat	Sig.	Exp(B)
<b>Constant</b>	.300	.298	1.008	.313	1.350	1.318	.674	1.956	.050	3.737
<b>MALE</b> (1 if male; 0 otherwise)	-.874	.159	5.505	.000	.417	-.682	.255	2.672	.008	.505
<b>AGE_18_24</b> (1 if age 18 to 24; 0 otherwise)	-1.177	.399	2.951	.003	.308					
<b>AGE25_29</b> (1 if age 25 to 29; 0 otherwise)	-.704	.424	1.662	.097	.495	-1.010	.632	1.599	.110	.364
<b>AGE30_39</b> (1 if age 30 to 39; 0 otherwise)	-.882	.387	2.278	.023	.414	-1.070	.588	1.818	.069	.343
<b>AGE40_65</b> (1 if age 40 to 65; 0 otherwise)	-.666	.320	2.086	.037	.514					
<b>SBRES</b> (1 if home in Santa Barbara cnty; 0 otherwise)	.618	.183	3.382	.001	1.856					
<b>INCMID</b> (1 if annual hhold income is between \$40,000 and \$99,999; 0 otherwise)										
<b>INCHIGH</b> (1 if annual hhold income is higher than \$100,000; 0 otherwise)						-1.130	.366	3.091	.002	.323
<b>MARRIED_DP</b> (1 if married or domestic partnered; 0 otherwise)	.586	.269	2.182	.029	1.797					
<b>SINGLE</b> (1 if single; 0 otherwise)										
<b>EMPSTUD</b> (1 if student; 0 otherwise)	.532	.330	1.613	.107	1.703					
<b>EMPFULL</b> (1 if employed full time; 0 otherwise)										
<b>EMPPART</b> (1 if employed part time; 0 otherwise)	.527	.335	1.575	.115	1.694	1.059	.520	2.036	.042	2.882
<b>ONEKID</b> (1 if 1 kid in the household; 0 otherwise)	.449	.262	1.716	.086	1.567	.957	.432	2.213	.027	2.603
<b>KIDS2_MORE</b> (1 if 2 or more kids in the household; 0 otherwise)	.368	.259	1.418	.156	1.444	1.001	.401	2.498	.012	2.722
<b>CARS1</b> (1 if one car in household; 0 otherwise)										
<b>CARS2</b> (1 if 2 cars in household; 0 otherwise)	.819	.253	3.233	.001	2.268					
<b>CARS3UP</b> (1 if 3 or more cars in household; 0 otherwise)										
<b>"I am satisfied with the products"</b> (1 if strongly dis, dis or slightly dis; 0 otherwise)						.797	.376	4.485	.034	2.219
<b>"I am satisfied with the products offered"</b> (1 if neutral; 0 otherwise)						1.002	.322	9.692	.002	2.725
<b>"I am satisfied with the parking"</b> (1 if strongly dis, dis or slightly dis; 0 otherwise)						-2.797	.400	48.934	.000	.061
<b>"I am satisfied with the parking"</b> (1 if neutral; 0 otherwise)						-1.746	.445	15.416	.000	.174
<b>"I am satisfied with the parking"</b> (1 if slightly agree or agree; 0 otherwise)										
<b>"I am satisfied with the service"</b> (1 if st. dis, dis, sl. dis or neutral; 0 otherwise)										
<b>"I am satisfied with the service"</b> (1 if slightly agree or agree; 0 otherwise)						-1.012	.417	5.890	.015	.364
<b>"I am satisfied with the entertainment"</b> (1 if str. dis, dis or sl. dis; 0 otherwise)						2.043	.477	18.317	.000	7.715
<b>"I am satisfied with the entertainment"</b> (1 if neutral; 0 otherwise)						1.565	.449	12.148	.000	4.781
<b>"I am satisfied with the entertainment"</b> (1 if slightly agree or agree; 0 otherwise)										
<b>"[loc.] has beautiful architecture"</b> (1 if st. dis, dis, sl. dis or neutral; 0 otherwise)						1.463	.414	12.509	.000	4.320
<b>"[loc.] has a definite social atmosphere"</b> (1 if agree; 0 otherwise)						-1.669	.282	34.907	.000	.188
<b>"[loc.] makes me feel relaxed"</b> (1 if agree.; 0 otherwise)										
<b>"[loc.] makes me feel happy"</b> (1 if neutral; 0 otherwise)						.890	.303	8.659	.003	2.436
<b>"[loc.] is kid friendly"</b> (1 if strongly disagree, disagree or slightly dis; 0 otherwise)						-1.475	.492	9.004	.003	.229
<b>"[loc.] is kid friendly"</b> (1 if neut. or slightly agree; 0 otherwise)						-.677	.280	5.861	.015	.508
<b>"[loc] does not involve the risk of unpleasant encounters"</b> (1 if strongly disagree, disagree, or slightly disagree; 0 otherwise)*						-.981	.339	8.371	.004	.375
<b>"[loc] does not involve the risk of unpleasant encounters"</b> (1 if neutral or slightly agree; 0 otherwise)*										
<b>"[loc] is not overcrowded"</b> (1 if agree; 0 otherwise)*						.851	.279	9.300	.002	2.343
<b>"[loc] is not overcrowded"</b> (1 if strongly agree; 0 otherwise)*						1.754	.426	16.997	.000	5.780
<b>"[loc] makes me feel comfortable because I identify with the atmosphere"</b> (1 if neutral; 0 otherwise)						.802	.306	6.884	.009	2.230
<b>Sample size= 823, X<sup>2</sup> improvement (model 1 to 2)= 503.759, change in df= 21</b>	<b>-2 LL= 986.336, df= 18, X<sup>2</sup>= 113.551</b>					<b>-2 LL= 482.577, df= 39, X<sup>2</sup>= 617.310</b>				

The model resulting from the addition of attitudinal indicators presents many interesting results, both in analyzing the resulting significant attitudinal variables, but also in exploring both the attrition and addition of some key socio-demographic information. Interestingly, all age group dummy variables became insignificant with the addition of attitudinal information (at a .05 level), with the exception of the 30 to 39 years age group. This may be due to the strong correlation between sense of place attitudinal variables and age, e.g., specific attitudes are formed at specific stages in life and those are captured by the age variables in one model and the attitudinal variables in the other. In addition to the loss of age indicators, Santa Barbara residency also fell out of the resultant regression model. This is yet another aspect of sense of place that is worth investigating. People who are residents of Santa Barbara might have similar opinions and attitudes, possibly shifting the explanatory power attributed to the residency indicator to several sense of place indicators. A further investigation into the relationship between sense of place and level of familiarity or experience with the location would need to be conducted to determine whether this possible explanation is accurate. Additionally, indicators for student status and number of cars were also among those indicators that were no longer significant in the model. With the addition of sense of place indicators, variables indicating children in the household increased in contribution, and in the case of the indicator for 2 or more children, increased in significance. Both of these indicators lead to a positive affinity towards traveling to La Cumbre. High-income households also became significant with the addition of attitudes, with a negative coefficient (indicating a lower likelihood to travel to La Cumbre, but a relatively low overall contribution to the probability).

Several attitudinal variables were determined to be significant in predicting location. Several indicators measuring the respondent's satisfaction with several aspects of the location were found to be significant. People at Paseo Nuevo for instance have a higher tendency to be unsatisfied to some degree or have no opinion with respect to the products offered at the mall. This might suggest that there are other factors of Paseo Nuevo that act to bring people. Variables indicating product satisfaction have a similar contribution to the overall probability as several socio-demographic indicators. Additionally, the La Cumbre patrons were more likely to be dissatisfied to some degree with the entertainment options, with a very large contribution to the overall probability of one traveling to La Cumbre as indicated by the log odds (7.715 for disagreeing). These results suggest that there might be a lack of entertainment outside of shopping. This is justified by several qualitative comments offered in an open ended section of the survey

- "Paseo Nuevo is more of a hang out La Cumbre is for specific shopping,"
- "Paseo has a lot more entertaining and more enjoyable to come to than La Cumbre."
- "La Cumbre allows for wandering and shopping. Paseo Nuevo seems fun, but because of parking limits, I feel rushed."
- "No movies at La Cumbre. No live theater either."
- "La Cumbre is more for locals and people who just want to shop for a specific thing, and they can just get in and get out. They don't have to deal with traffic or parking. Paseo Nuevo is more for going out downtown for the night so it's more for an occasion."

In addition, several other aspects of sense of place are shown to be significant. Differences in attitudes about the amount of people at each location are also shown to be significant. Those who disagree with the statement "[mall of patronage] is too overcrowded" are more likely to be at La Cumbre. The distributions of responses at each location indicate a definite disagreement with the statement at La Cumbre, but a bimodal distribution at Paseo Nuevo of either

disagreement or indecisive attitudes. In addition, those who agree with the statement that “[Paseo Nuevo/ La Cumbre] involves the risk of unpleasant encounters” (or again the inverse for the sake of consistency), are more likely to travel to Paseo Nuevo than La Cumbre. Both of these aspects of sense of place might be attributed to the locality of the mall, Paseo Nuevo being surrounded by the downtown area, and La Cumbre being somewhat isolated and surrounded by large parking lots, and a more suburban design to the neighborhood. In addition, people who disagree that the location that he or she is at is kid friendly are less likely to travel to La Cumbre. It can thus be determined through these indicators that respondents at Paseo Nuevo view the location to which they traveled as a social environment with good entertainment but more risky and perhaps less car friendly when compared to those who traveled to La Cumbre.

To determine the appropriateness of the addition of attitudinal variables, a chi squared analysis was conducted. Table 2 (at the very bottom) provides model fit results for each of the models previously discussed, as well as a difference in chi square statistics and degrees of freedom. In order to test the influence of the additional sense of place indicators, a null hypothesis assuming no influence of the attitudinal indicators was established. This null hypothesis would statistically be true until the threshold value of 46.80 for a change in chi square given the change of 21 degrees of freedom. The change in chi square of 503.759 provides statistical grounds to reject the null hypothesis.

To further test the benefit of adding sense of place indicators, an examination of mode was also conducted. For this analysis, a stepwise nesting procedure was again utilized. A model of modal split using only socio-demographic information was estimated first and can be seen in Table 2. Model results indicate that Santa Barbara residency, age, gender, marital status (at a .1 significance level) and car ownership all have an impact on walking. Being a resident of Santa Barbara has a negative impact on ones likelihood to walk, as does being female, however car ownership, being between the ages of 40 and 65 and being married or domestic partnered have positive impacts. Interestingly, having 2 cars has the least positive impact on an individual’s likelihood to walk within the car ownership indicators. All three indicators for car (with the reference indicator being zero cars in the household) have a relatively high log odds ratio, meaning that they contribute significantly to the overall probability of one walking. Additionally, indicators for being married and also for being between 40 and 65 contribute significantly to the overall likelihood of a person walking. Car as a mode also had several significant indicators. Indicators with highest contributions continued to be car ownership dummy indicators. Comparison of log odds show that household car ownership contributes more significantly to the likelihood of arriving by car, compared to foot. In addition to these, being married also positively and greatly contributes to the overall probability to use car over other modes of transportation. Indicators for 2 or more kids in the household, and Santa Barbara residency all negatively impact the likelihood for car use. The negative contribution of Santa Barbara residency might be due to the number of students who ride the bus or downtown residents who use alternative modes to travel to Paseo Nuevo. The resulting negative contribution of those who come from households with more than 2 children is an interesting result. Perhaps this is due to one of the members of the house being on a lunch break or running errands from work downtown and walked to the mall location, or people who were on vacation and staying in a hotel close to the Paseo Nuevo area. Of the 26 respondents who had more than 2 children in the household and did not drive, 17 visited Paseo Nuevo and 9 visited La Cumbre. About half of these 26 people were working the day of the survey. Of those who were not

working, (15 people in total), 7 of them were from another county of residence besides Santa Barbara or Ventura.

**Table 2: Modal Split Model**

		Socio-Demographic					Socio-Demographic/ Sense of Place				
		B	S.E.	T-stat	Sig.	Exp(B)	B	S.E.	T-stat	Sig.	Exp(B)
*indicates question was recoded in inverse, reference category is "other"											
Walk	Intercept	.383	.432	0.888	.375		.486	.656	0.741	.459	
	FEMALE (1 if female; 0 if male)	-.630	.318	3.926	.048	.532	-.569	.334	1.702	.089	.566
	AGE40_65 (1 if age 40 to 65; 0 otherwise)	.887	.389	5.203	.023	2.428	.848	.404	2.100	.036	2.335
	SBRES (1 if residence in Santa Barbara county; 0 otherwise)	-1.078	.440	5.996	.014	.340	-1.026	.459	2.234	.026	.358
	MARRIED_DP (1 if married or domestic partnered; 0 otherwise)	.752	.444	1.692	.091	2.120					
	KIDS2_MORE (1 if 2 or more kids in the household; 0 otherwise)										
	CARS1 (1 if one car in household; 0 otherwise)	1.416	.408	12.047	.001	4.120	1.376	.426	3.233	.001	3.960
	CARS2 (1 if 2 cars in household; 0 otherwise)	1.086	.480	5.112	.024	2.963	1.052	.496	2.119	.034	2.862
	CARS3UP (1 if 3 or more cars in household; 0 otherwise)	1.176	.463	2.541	.011	3.241	1.137	.477	2.385	.017	3.117
	"I am satisfied with the parking" (1 if slightly agree or agree; 0 otherwise)										
	"I am satisfied with the parking" (1 if strongly agree; 0 otherwise)										
	"I am satisfied with the entertainment" (1 if neutral; 0 otherwise)										
	"I am satisfied with the people" (1 if agree or strongly agree; 0 otherwise)						1.084	.360	9.043	.003	2.956
	"[Loc] has a peaceful and relaxing atmosphere" (1 if sl. ag or ag; 0 otherwise)						-.588	.35	2.802	.094	.556
	"[Loc] has a definite social atmosphere" (1 if agree; 0 otherwise)						-.929	.373	6.198	.013	.395
	"[Loc] makes me feel relaxed" (1 if agree; 0 otherwise)										
"[Loc] makes me feel happy" (1 if neutral; 0 otherwise)											
"I am not afraid to walk around at [Loc]" (1 if slightly disagree, neutral or slightly agree; 0 otherwise)*						.823	.497	2.744	.098	2.277	
Car	Intercept	1.294	.380	3.404	.001		1.538	.567	2.713	.007	
	FEMALE (1 if female; 0 if male)										
	AGE40_65 (1 if age 40 to 65; 0 otherwise)										
	SBRES (1 if residence in Santa Barbara county; 0 otherwise)	-1.235	.398	3.106	.002	.291	-1.445	.416	3.476	.001	.236
	MARRIED_DP (1 if married or domestic partnered; 0 otherwise)	1.326	.389	3.410	.001	3.764	1.109	.399	2.775	.006	3.030
	KIDS2_MORE (1 if 2 or more kids in the household; 0 otherwise)	-1.008	.396	2.544	.011	.365	-1.002	.411	2.435	.015	.367
	CARS1 (1 if one car in household; 0 otherwise)	1.631	.340	4.792	.000	5.111	1.549	.358	4.324	.000	4.707
	CARS2 (1 if 2 cars in household; 0 otherwise)	1.934	.400	4.836	.000	6.914	1.734	.416	4.165	.000	5.664
	CARS3UP (1 if 3 or more cars in household; 0 otherwise)	1.990	.379	5.256	.000	7.314	2.019	.397	5.092	.000	7.532
	"I am satisfied with the parking" (1 if slightly agree or agree; 0 otherwise)						.951	.333	8.177	.004	2.588
	"I am satisfied with the parking" (1 if strongly agree; 0 otherwise)						.846	.352	5.766	.016	2.330
	"I am satisfied with the entertainment" (1 if neutral; 0 otherwise)										
	"I am satisfied with the people" (1 if agree or strongly agree; 0 otherwise)										
	"[Loc] has a peaceful and relaxing atmosphere" (1 if sl. ag or ag; 0 otherwise)										
	"[Loc] has a definite social atmosphere" (1 if agree; 0 otherwise)						-1.349	.316	18.231	.000	.259
	"[Loc] makes me feel relaxed" (1 if agree; 0 otherwise)										
"[Loc] makes me feel happy" (1 if neutral; 0 otherwise)						.624	.366	2.912	.088	1.867	
"I am not afraid to walk around at [Loc]" (1 if slightly disagree, neutral or slightly agree; 0 otherwise)*											
Sample size= 823, X <sup>2</sup> improvement (model 1 to 2)= 84.725, change in df= 18		-2LL(0)=470.658, -2 LL(β)= 339.427, df= 16, X <sup>2</sup> = 131.256					-2LL(0)=1.099E3, -2 LL(β)= 482.577, df= 34, X <sup>2</sup> = 215.981				

To examine the impact of sense of place indicators on the models, a new model was estimated using the same sociodemographic indicators as the initial model with added sense of place variables. Results of this model can also be seen in Table 2. Consistently, car ownership indicators remained significant for all modes, and had large contributions to the likelihoods as indicated by the log odds ratios. Additionally, Santa Barbara residency also remained significant for all modes, probably indicative of either a higher percentage of groups such as students using the bus, or because of the lack of tourists utilizing alternatives other than walking. Several other indicators remained significant as discussed previously, which are also reported in the table. The use of attitudinal indicators provides insight and value for the resulting model and significant attitudes that can predict mode. Satisfaction with the amount of people has a positive impact to the likelihood of one walking to the destination. Interestingly, disagreement with the statement about feeling safe to walk around the location also has a negative impact on the use of walking. Perhaps this is because walkers are absorbing both positive and negative aspects of the atmosphere around them. Another explanation is that people who work in the area are walking to run errands or go to lunch and might have a less idyllic or leisure oriented view of the place. Likewise, agreeing with the fact that there is a social or a peaceful and relaxing atmosphere causes one to be less likely to walk to the location. This result indicates that the use of walking as a mode is not necessarily linked to leisure or social trips. When examining indicators significant in explaining car usage, as expected, positive attitudes toward the satisfaction of parking contributes positively to the probability of one using an auto to travel. Additionally, agreeing with the social nature of the atmosphere contributes negatively towards car usage, and possessing an indifferent opinion on whether the mall gives makes the individual happy contributes positively towards using an auto (although only at a .1 significance level). Again several indicators of sense of place proved to be significant, but to test the value of the additional data to the model a chi squared comparison was again used. Table 2 provides the goodness of fit statistics for the aforementioned models as well as the resulting improvement in chi squared by adding sense of place variables to the model specification. With a threshold of change in chi squared of 42.31 (from a chi squared table) for a change of 18 degrees of freedom, we are again able to see that sense of place indicators are found to enhance the explanatory power of the model. The difference in chi squared compared to the threshold value for the modal split model (84.725 vs threshold of 42.31) was not as large as that of the location model (503.759 vs. threshold of 46.80).

To further explore the use of sense of place indicators, an analysis of arrival time at the location was conducted to understand which aspects of sense of place were important in explaining variation in time allocation and activity planning. Results of this model can be found in Table 3. The dependent variable (arrival time) is reported in minutes.

**Table 4: Regression of Arrival Time**

	Coeff	SE(HC)	t	P> t
<b>Constant</b>	656.234	24.694	26.575	.000
<b>MALE</b> (1 if male; 0 otherwise)	23.229	11.340	2.048	.041
<b>SBRES</b> (1 if Santa Barbara res; 0 otherwise)	54.648	14.671	3.725	.000
<b>INCHIGH</b> (1 if annual hhold income is higher than \$100,000; 0 otherwise)				
<b>EMPFULL</b> (1 if employed full time; 0 otherwise)	48.465	13.561	3.574	.000
<b>EMPPART</b> (1 if employed part time; 0 otherwise)				
<b>CARS1</b> (1 if one car in household; 0 otherwise)	51.168	18.551	2.758	.006
<b>CARS2</b> (1 if 2 cars in household; 0 otherwise)	49.907	17.727	2.815	.005
<b>CARS3UP</b> (1 if 3 or more cars in hhold; 0 otherwise)	46.840	17.293	2.709	.007
<b>WORKDY</b> (1 if work day; 0 otherwise)				
<b>VACDY</b> (1 if vacation day; 0 otherwise)				
<b>HOME_BFR</b> (1 if respondent came from home; 0 otherwise)	-27.466	12.245	-2.243	.025
<b>WORK_BFR</b> (1 if respondent came from work; 0 otherwise)	35.191	17.954	1.960	.050
<b>I am satisfied with the products offered</b> (st. dis, dis, sl.dis, neutral)				
<b>"I am satisfied with the parking"</b> (st. dis dis sl.dis no op)	-27.255	15.543	-1.754	.080
<b>"I am satisfied with the parking"</b> (st ag)				
<b>"I am satisfied with the entertainment options"</b> (st. dis. dis. sl dis.)	32.037	19.470	1.645	.100
<b>"I am satisfied with the entertainment options"</b> (no. op)	41.478	19.018	2.181	.030
<b>"I am satisfied with the entertainment options"</b> (sl sat)				
<b>"[Loc] makes me feel relaxed</b> (ag)				
<b>"[Loc] does not involve the risk of unpleasant encounters</b> (no op, sl ag)	27.932	11.804	2.366	.018
<b>"[Loc] does not make me feel too self conscious"</b> (st dis. dis. sl dis)	38.174	20.167	1.893	.059
<b>"[Loc] does not lack specific things"</b> (st dis)	40.342	23.912	1.687	.092
<b>"[Loc] does not lack specific things"</b> (dis, sl dis)	25.099	14.187	1.769	.077
<b>"[Loc] does not lack specific things"</b> (no op)				

**R<sup>2</sup> = 0.1538 df = 24**

Results of this regression model indicate that there are several sense of place indicators that are significant in explaining variation among respondents. As indicated in the regression model, the intercept of the model is approximately 10:30am. Being male, full time employed, and having 1, 2 or 3 or more cars in the household all contribute to a later arrival to the location. With the exception of being male, all of the aforementioned indicators contribute approximately one hour to the arrival time. This might be a product of those who are on their lunch break coming to the location for food or to run errands. This theory can be further supported by the significance (and contribution of approximately 35 minutes to the arrival time) of the dummy indicator for a person coming from work before his or her arrival. In addition to this, people coming from home are more likely to arrive to the location earlier in the day. Sense of place indicators also show significance in explaining arrival time. For instance, variables indicating satisfaction with the entertainment options, no perceived risk of any negative encounters, and self consciousness elicited while visiting the location all contribute to a later arrival time. Several indicators are also significant at a 0.1 level or better. For instance, negative attitudes of parking satisfaction contribute negatively to the arrival time, meaning that people are more likely to come in the morning. In addition, people with opinions that the locations are lacking also arrive later in the day.

## CONCLUSION

This research was designed to examine the use of sense of place attitudinal indicators in explaining several aspects of travel behavior. A survey was conducted to collect data about

sense of place views and travel behavior. Sense of place questions were used as indicators in several models of behavior. First, analysis on the two locations and respondents at each location indicate clear differences in socio demographics as well as sense of place attitudes at each location. In addition to this analysis, models were built to analyze the influence of sense of place indicators on the mode used to arrive at each location. Sense of place indicators were again found significant and added to the explanatory power of the models. Further testing of the log likelihoods indicating goodness of fit show that the attitudinal place information is of value. The omission of this data in modeling efforts might be detrimental to our ability to explain variation in observed behavior. An additional model examining timing of the activity was conducted to further understand how sense of place indicators further explain observed behavior. Results indicate that sense of place indicators again increase the ability of models to explain differences in observed behavior and can thus predict with higher accuracy.

The research conducted in this study presents promising futures for the use of sense of place in travel behavior as well as urban design. Its proven significance and valuable contribution in modeling provides support for further research into its application. Examining the impact of sense of place in the choice process is a natural direction following this study. The interplay of exposure, familiarity and overall cognition of a place with the development of sense of place should be explored, as it possibly provides insight into the development of preferences and choices of short-term destination and long-term locations. Future research is also needed to determine the interplay of sociodemographic cohort and place attitudes and how people choose activity locations.

Integrated transportation land use models have previously used measurements of accessibility and several physical attributes of a place to explain behavior. These details are essentially a partial measure of the attraction of a place, mode or trip. This practice can be enhanced with the addition of psychological attributes as well. In addition, the quantification of sense of place attitudes can provide understanding of the psychological differences in people who gravitate towards different aspects of design. The use of sense of place factors can introduce additional aspects of design and the latent appeal that these aspects have for different people. In addition to this, sense of place factors have the potential to further explain reasons for possible successes and failures of land use policies in changing travel behavior. These latent psychological reasons have the potential to explain in greater detail the motivation or lack thereof for various behavioral phenomena. As previously mentioned, the process of changing one's sense of place must also be considered in land use and design policy changes. Expectations and past experiences as well as design elements all weigh in on a person's sense of place, which as seen in this research project have an influence on behavior.

The interplay of the development of sense of place with experience, the influence of sociodemographic characteristics with sense of place development as well as the employment of sense of place attitudes on informing behavior is certainly a complicated web. However, the value and richness of the information provided by these personal details is promising and has been proven effective in enriching the explanatory power of behavior models. Successful quantification and application of this research into several key transportation areas offers exciting and useful results.

## Acknowledgments

Funding for this research was provided by the University of California Transportation Center and University of California Office of the President. The study described in this paper is not a policy or regulation of any public or private agency or organization. Any errors are the sole responsibility of the authors.

## REFERENCES

Ettema, D. and Timmermans, H. J. P. *Activity-based approaches to travel analysis*. Pergamon, 1997.

Timmermans, H. The Saga of Integrated Land Use-Transport Modeling: How Many Dreams Before We Wake Up? Paper presented at 10th International Conference on Travel Behavior Research, Lucerne, Switzerland, 2003

Ben-Akiva, M., McFadden, D., Gärling, T., Gopinath, D., Walker, J., Bolduc, D., Börsch-Supan, A., Delquié, P., Larichev, O., Morikawa, T., Polydoropoulou, A. and Rao, V. Extended Framework for Modeling Choice Behavior. In *Marketing Letters*, 10, 3, 1999, 187-203.

Ben-Akiva, M., McFadden, D., Train, K., Walker, J., Bhat, C., Bierlaire, M., Bolduc, D., Boersch-Supan, A., Brownstone, D., Bunch, D. S., Daly, A., De Palma, A., Gopinath, D., Karlstrom, A. and Munizaga, M. A. Hybrid Choice Models: Progress and Challenges. In *Marketing Letters*, 13, 3, 2002, 163-175.

Prevedouros, P. D. Associations of personality characteristics with transport behavior and residence location decisions. In *Transportation research. Part A, Policy and practice.*, 26A, 5, 1992,

Steg, L., Vlek, C. and Slotegraaf, G. Instrumental-reasoned and symbolic-affective motives for using a motor car. In *Transportation Research Part F: Traffic Psychology and Behaviour*, 4, 3, 2001, 151-169.

Kostyniuk L., and Eby, D. Toward A Model Of Risky Driving Using Objective Measures of Driving Behavior. Presented at the 11<sup>th</sup> International Conference on Travel Behavior Research, Kyoto, August 2006.

Goulias K., and Henson, K. On Altruists and Egoists In Activity Participation and Travel: Who Are They and Do They Live Together? In *Transportation*, 33,5, 2006, 447-462.

Molin, E., Theo, A. and Timmermans, H. Eliciting Social Network Data. Paper presented at International Conference on Survey Methods in Transport, Annecy, France, 2008

Clark, A. and Doherty, S. Examining the Nature and Extent of the Activity-Travel Preplanning Decision Process. In *Transportation Research Record: Journal of the Transportation Research Board*, 2054, -1, 2008, 83-92.

Auld, J., Mohammadian, A. and Doherty, S. Analysis of Activity Conflict Resolution Strategies. In *Transportation Research Record: Journal of the Transportation Research Board*, 2054, -1, 2008, 10-19.

Timmermans, H. Analysis and Models of Household Decision Making Process. Presented at the 11<sup>th</sup> International Conference on Travel Behavior Research, Kyoto, August 2006.

Ruiz, T. and Roorda, M. Analysis of Planning Decisions During the Activity-Scheduling Process. In *Transportation Research Record: Journal of the Transportation Research Board*, 2054, -1, 2008, 46-55.

Auld J., Williams C., Mohammadian, A, and Nelson, P. An Automated GPS-based Prompted Recall Survey With Learning Algorithms. In *Transportation Letters*, 1,1,2009, 59-79.

Kitamura, R., Mokhtarian, P. L. and Laidet, L. A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area. In *Transportation*, 24, 2, 1997, 125-158.

Choo, S. and Mokhtarian, P. The Relationship of Vehicle Type, Choice to Personality, Lifestyle, Attitudinal, and Demographic Variables. In Report number UCD-ITS-RR-02-06, 2002,

Kuppam, A. R., Pendyala, R. M. and Rahman, S. Analysis of the role of traveler attitudes and perceptions in explaining mode-choice behavior. In *Transportation research record.*, 1676, 1999,

Sunkanapalli, S., Pendyala, R. and Kuppam, A. Dynamic Analysis of Traveler Attitudes and Perceptions Using Panel Data. In *Transportation Research Record: Journal of the Transportation Research Board*, 1718, -1, 2000, 52-60.

Dill, J. Travel Behavior and Attitudes: New Urbanist vs. Traditional Suburban Neighborhoods. Presented at the Transportation Research Board Conference, January 2004.

Tuan, Y.-f. *Topophilia: a study of environmental perception, attitudes, and values*. Prentice-Hall, Englewood Cliffs, N.J., 1974.

Golledge, R. G. and Stimson, R. J. *Spatial behavior : a geographic perspective*. Guilford Press, New York, 1997.

Bolton, R. (1989) An Economic Interpretation of a "Sense of Place. Department of Economics, Williams College

Canter, D. (Ed.). *Understanding, Assessing, and Acting in Places: Is an Integrative Framework Possible*. Oxford University Press, 1991.

Proshansky, H. M. The City and Self-Identity. In *Environment and Behavior*, 10, 2, 1978, 147-69.

Altman, I. and Low, S. M. *Place attachment*. Plenum Press, New York, 1992.

Stokols, D. and Shumaker S. People in Places: A Transactional View of Settings. In *J Harvey (Ed) Cognition, Social Behavior and the Environment*. NJ: Erlbaum, 1981.

Semken, S., and Freeman, C. Sense of Place in the Practice and Assessment of Place-Based Science Teaching. In *Wiley Periodicals*.

Lewicka, M. Place Attachment, Place Identity and Place Memory: Restoring The Forgotten City Past. In *Journal of Environmental Psychology*, 28, 2008, 209-231.

Smaldone, D., Harris, C., and Sanyal, N. An Exploration of Place As A Process: The Case of Jackson Hole, WY. In *The Journal of Environmental Psychology*, 25, 2005, 397-414.

Giuliani, M., and Feldman, R. Place Attachment In a Developmental and Cultural Context. In *The Journal of Environmental Psychology*, 13, 1993, 267-274.

Manzo, L. C. Beyond house and haven: toward a revisioning of emotional relationships with places. In *Journal of Environmental Psychology*, 23, 1, 2003, 47-61.

Agarwal, P. Operationalizing 'Sense of Place' as a Cognitive Operator for Semantics in Place-Based Ontologies. In A.G Cohn and D.M. Mark (Eds): COSIT 2005, LNCS 3693, 2005, 96-114.

Gustafson, P. E. R. Meanings of Place: Everyday Experience and Theoretical Conceptualizations. In *Journal of Environmental Psychology*, 21, 1, 2001, 5-16.

Hay, R. Sense of Place in Developmental Context. In *The Journal of Environmental Psychology*, 18, 1998, 5-29.

Deutsch, K. What's So Special About This Place? An Examination of Sense of Place and It's Correlation to Travel Behavior, 2008, Geography, University of California at Santa Barbara. Advised by:K. Goulias

Brown, B. B. and Werner, C. M. Before and After a New Light Rail Stop: Resident Attitudes, Travel Behavior, and Obesity. In *Journal of the American Planning Association*, 75, 1, 2009, 5-12.

Deutsch, K. and Goulias, K. Investigating the Impact of Sense of Place on Travel Behavior Using an Intercept Survey Methodology. Presented at the 88<sup>th</sup> Annual Meeting of the Transportation Research Board, January 2009.

Jorgensen, B. and Stedman, R. Sense of Place as an Attitude: Lakeshore Owners Attitudes Toward Their Property. In *The Journal of Environmental Psychology*, 21, 3, 2003, 233-248.

Stedman, R. Is It Really Just a Social Construction? The Contribution of the Physical Environment to Sense Of Place. In *Society & Natural Resources*, 16, 8, 2003, 671-685.