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Psychological effects of travel behavior on preference of residential location choice

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Abstract

The objective of this exploratory research is to investigate psychological effects of travel behavior on residential location choice by commuters. Structural equations were developed based on 176 samples from two cities in Thailand, namely, Bangkok and Ubon Ratchathani. Empirical results revealed that preference regarding residential location was significantly affected by behavioral intention towards car usage. Those who preferred life with frequent car use in the future would be less likely to stay in an environment with convenient public transport. In addition, individual's moral obligation of car use reduction was found to be a significant determinant for behavioral intention for frequent use car. In other words, respondents who thought they should refrain from car use would possess lower intention for a future life with frequent use car. Several socio-economic variables and psychological images regarding modes of transport were investigated in the present study. Respondents' gender and current residential location were among the main factors that significantly linked to future residential preference. Furthermore, some psychological aspects towards modes of transport were found to be important determinants for respondents' choice of future residential area.

Keywords: Residential preference; Car use reduction; Moral obligation; Behavioral intention; Travel demand management

1. Introduction

Motorization is growing at an alarming rate particularly in developing countries. Its detrimental effects are apparent, not only for traffic congestion but also for several aspects related to local and global environments, which ultimately lead to the global warming issue. Therefore, to cope with the rapid rise of motorized vehicles, there is an urgent need to implement appropriate transportation demand management measures. Depending

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on circumstances, such measures may cover a broad variety of actions ranging from "push" measures to "pull" measures (cf. Gärling and Fujii, 2006). In addition, it is desirable for transport planners to fully understand fundamental characteristics of commuters' residential choice behavior. This is essential because residential choice may have a strong and long-term effect on travel mode choice. For example, individuals who choose a residential location without any mobility of public transportation would use private cars more frequently than those who opt for a residential location with high level mobility of public transportation. Therefore, if transportation planners could successfully influence people's residential choice behavior, their travel behavior would be substantially changed in the long-run.

Residential location choice has long been interested by researchers in various aspects, including transportation, economics, urban planning, etc. In particular, the issue of the relationship between residential location choice and travel behavior has been extensively investigated in the past. From literatures, it has been demonstrated that residential location choice, to some extent, affected commuter's travel behavior (e.g. Srinivasan and Ferreira, 2002; Kitamura et al., 1997; Bagley and Mokhtarian, 2002; Sermons and Koppelman, 1998). Srinivasan and Ferreira (2002), for instance, studied travel behavior choices of household in Boston Metropolitan Area. Certain relationships between household type, residential location, and travel behavior were investigated. Utilizing modeling approach, it was found that mode choice was related to residential location types. In California, Kitamura et al. (1997) examined the effects of land use and attitudinal characteristics on travel behavior. It was found that measures of residential density, public transit accessibility, mixed land use, and the presence of sidewalks were significantly related to travel behavior. In addition, attitudes were found to be more strongly associated with travel than land use characteristics. In a similar vein, Sermons and Koppelman (1998) applied factor scores from the factor analysis of socioeconomic status and family status variables to incorporate taste variation in a household residential choice model. Such a method was concluded to be advantageous in explaining the relative importance of different attributes to household types and the desire to reside in areas with others with similar social characteristics.

In recent papers, Næss (2005) investigated several aspects on how residential location could affect travel behavior. Based on an interview of residents in Copenhagen region, rationales for travel mode were identified to be composed of constraints and possibilities set by the person's mobility resources, time consumption, monetary costs, bodily constraints and a wish to avoid physical efforts, flexibility and freedom, a wish for physical exercise, environmental considerations, lifestyle signaling, habits and customs inherited through adolescence, and social norms. The study applied casual models and concluded that the direct effects of residential location on the proportion of car travel are relatively modest. Bhat and Guo (2006) examined the impact of the built environment, transportation network attributes, and demographic characteristics on residential choice and car ownership decisions. Utilizing a developed methodology to control for the self selection of individuals into neighborhoods, it was found that built environment attributes, those related to land-use, urban form, and street network attributes, could affect residential choice decisions and car ownership decisions.

Although the impact of residential location choice on travel behavior is mainly of focus in literatures, the reverse effect, i.e. the potential influence of travel behavior on residential location, has not been well studied. Still, if travel behavior could affect residential location choice, such an effect would have a large significance on the relationship between transport policy and land use policy. This is simply because if there were to be such an effect, transportation measures that aim to alter people's travel behavior, such as mobility management (cf. Gärling and Fujii, 2006), would have long-term effects on people's residential choice, and thus would be able to impact urban structure as well. In other words, if commuters' heavy dependency on car use could be successfully weakened by means of mobility management measures, residential places of which rather high accessibility to public transport would be chosen, and therefore such places would not necessarily be suburban at the opportunity of residential choice.

It is therefore the main purpose of our study to investigate any potential impact of travel behavior on preference of residential choice behavior, while accounting for the effects of attitudes towards travel behavior. Essentially, if consequences from travel behavior on residential choice behavior are proved to be of validity, policies that attempt to attenuate urban suburbanization and shape urban structure into a more "compact" and more sustainable one could include travel behavior modification policy from private car use to other sustainable travel modes such as train, bus, bicycle and walking, as detailed in mobility management concepts.

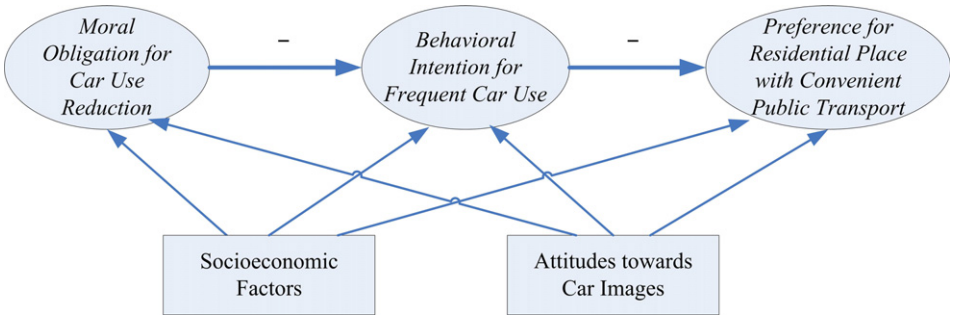

Fig. 1. Proposed modeling framework for determinants of residential choice.

Fig. 1 illustrates the proposed modeling framework of the present study, where direct paths represent assumed causal relations, if any. We hypothesized that residential preference, whether an environment with convenient public transport (such as city center or area with railway stations) is desirable for a commuter, can be determined from commuter's behavioral intention (cf. Fishbein and Ajzen, 1975) towards frequent car use. This is because those who will use car frequently are expected to have less motivation to live in a place with convenient public transport, since they would not strongly need to use public transport. On the other hand, those who intend not to use car frequently are expected to have larger motivation to live in such a place with convenient public transport, since they need public transport rather than car.

In addition, moral obligation (cf. Schwartz, 1977) for car use reduction, an obligation arising out of consideration of private car use refrainment, was hypothesized to be a determinant for such an intention. Moral obligation for car use reduction is considered as an important psychological determinant of behavioral intention of car use. In past studies, Taniguchi et al. (2003), for instance, found the moral obligation for implementing pro-environmental travel behavior as a significant determinant of behavioral intention for pro-environmental travel behavior.

In our study, the effects of two groups of explanatory variables, socioeconomic factors and attributes towards car images, on the abovementioned psychological variables were investigated. The socioeconomic factors refer to individual's characteristics such as gender, availability of driver license, vehicle ownership, etc. while the attributes towards images of car signify relevant psychological dimensions of attitudes for cars from an individual's perspective.

Fig. 1 also shows our expectation on the proposed relationships. It is expected that the moral obligation for car use reduction will affect negatively on the behavioral intention for future life with frequent car use. In addition, such an intention should exhibit as a negative determinant for the preference for residential place with convenient public transport. The proposed sequential model in Fig. 1 can be systematically investigated by means of structure equation modeling. Therefore, in this study LISREL 8.53 software (Jöreskog and Sörbom, 1993) was selected as an appropriate tool for analysis.

2. Method

2.1. Sample

A total of 176 observations from engineering students were randomly surveyed from two cities in Thailand, namely Bangkok (Chulalongkorn University) and Ubon Ratchathani (Ubon Ratchathani University) during October 2005. Bangkok, the capital city, may be considered one of the most rapid motorizing cities, while Ubon Ratchathani, another yet-to-be motorized city in Thailand located about 500 km north-eastern from Bangkok, was chosen for comparative purpose. The underlying reason why university students were selected in the present study is that most of them were expected to make a decision on commuting modes and residential places after their graduation from university.

Table 1 presents the corresponding descriptive statistics of the sample. In general, characteristics of respondents from Bangkok did not differ remarkably from Ubon Ratchathani sample. The majority of the respondents

Table 1
Sample descriptive statistics

	Bangkok	Ubon Ratchathani	Total
Gender (% men)	87.0	86.7	86.9
Age (years)	$M = 21.1$	$M = 21.0$	$M = 21.1$
	SD = 1.7	SD = 1.4	SD = 1.6
Driver license (% own)	75.0	76.0	75.4
Car ownership (% own car)	53.5	31.1	43.9
N	100	76	176

were male aged roughly 21 years old. Approximately three-quarter of the respondents had driver license. The major difference between the two samples lied on the car ownership rate, in which the proportion of Bangkok respondents possessed a car was found to be relatively higher than those in Ubon Ratchathani. This simply reflects the fact that Bangkok respondents typically relied more on private vehicles.

2.2. Survey questionnaire

The original survey questionnaire contained several sections. Only sections pertinent to the present study will be discussed. Moral obligation for car use reduction, behavioral intention for life with frequent car use, and future residential choice preference were measured based on the five-point Likert scale with verbally defined at midpoint and endpoints (−2 = not at all, 0 = neutral, 2 = yes-strongly). Responses from a question asked, "*Do you think that you should refrain from using car?*" was taken as a variable for moral obligation to reduce use car. Similarly, a question asked, "*Do you want to have a life with frequent car use in future?*" was used to represent behavioral intention to use car. To measure the future residential location preference, respondents were asked, "*Do you dislike to live in a place with inconvenient public transport thus you can use only car?*" It should be noted that due to some difficulties in local translation, we instead asked the above sentence, "*Do you like to live in a place with inconvenient public transport thus you can use only car?*" and later reversed the order of the responses for our analysis to represent the preference towards residential place with convenient public transport.

Psychological images of car were measured in form of pairs of opposite adjectives. Examples of beliefs utilized in the survey are "austere–luxury", "cheap–expensive", "inconvenient–convenient", "useless–useful", "destructive–constructive" and "negative–positive". Referred to Appendix A, these belief pairs were thoroughly selected such that several dimensions of attitudes towards travel modes can be comprehensively investigated.

3. Results

3.1. Descriptive statistics

Table 2 presents the mean and standard deviation values for three attitudinal variables used in this study, including moral obligation for car use reduction, behavioral intention for future life with frequent car use, and preference regarding residential place with convenient public transport, classifying by cities. It can be observed that, on the average, the moral obligation for car use reduction for Bangkok sample is slightly higher than those in Ubon Ratchathani. In terms of behavioral intention, the Bangkok respondents exhibited a lower intention for future life with frequent car usage than Ubon Ratchathaini respondents. Lastly, for the residential location choice, it can be denoted that the preference for residential place with convenient public transport for both samples is quite similar.

In recent years, psychological determinants affecting attitudes towards travel modes have been investigated. Steg et al. (2001) and Steg (2005) classified such determinants into three functions, namely, *symbolic*, *affective* and *instrumental* factors. The symbolic and affective factors were, however, shown to have a strong correlation (Hiscock et al., 2002). Later, based on a comparative study of commuter's attitudes towards transportation modes across several Asian countries, including Thailand, China, Vietnam, Indonesia, and the Philippines, Van and Fujii (2006) proposed another attitudinal aspect of travel modes, *social orderliness*, to reflect certain

Table 2
Statistics for attitudinal questions

Variable	City	Statistics	
		M	SD
Moral obligation for car use reduction	Bangkok	−0.24	1.01
	Ubon Ratchathani	−0.47	1.04
	Total	−0.34	1.03
Behavioral intention for future life with frequent car use	Bangkok	0.37	1.11
	Ubon Ratchathani	0.66	0.93
	Total	0.50	1.04
Preference for residential place with convenient public transport	Bangkok	0.98	1.20
	Ubon Ratchathani	0.92	1.25
	Total	0.95	1.22

Table 3
Statistics for attitudinal aspects of car

Attitudinal aspects	Mean	Standard deviation
Symbolic/affective	0.602	0.571
Instrumental	0.701	0.472
Social orderliness	0.474	0.463

traffic situations in developing countries that seem to be "chaotic" rather than orderly when compared against other developed countries.

To investigate psychological images of car in the present study, three new image variables for car images were created. The generated variables were based on principal component analysis with varimax rotation and were in accordance with Choocharukul et al. (2006). These image variables include *symbolic/affective*, *instrumental*, and *social orderliness* attitudinal-aspects. Components for each image variable are shown in Appendix B. Table 3 summarizes the corresponding statistics with the corresponding mean and standard deviation values. In this study we will utilize these three variables, along with socioeconomic variables, as exogenous variables in order to form a set of independent variables in the structural equation modeling described in the subsequent section.

3.2. Structural equations

Fig. 2 presents the estimated coefficients and *t*-statistics for casual relationships of moral obligation for car use reduction, behavioral intention for life with frequent car use in the future, and future residential choice preference. With the significant *t*-statistic value, it is obvious that there is a strong relationship between moral obligation for car use reduction and behavioral intention for future life with frequent car use. Similarly, statistical significance was found for the path between behavioral intention for frequent car use and preference

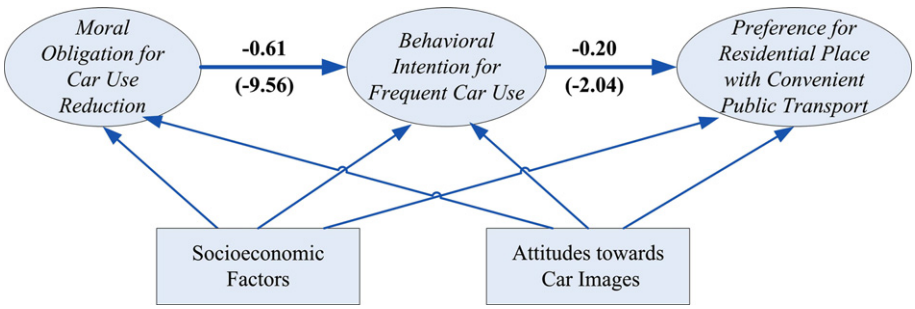

Fig. 2. Estimation results for casual relationships (figures along paths represent estimated coefficients with *t*-statistics in parentheses).

Table 4
Model estimation results

Variables	Estimated parameters	*t*-Statistic
For moral obligation for car use reduction		
City dummy (1 = Bangkok; 0 = Ubon Ratchathani)	0.30	1.97^{+}
Gender (1 = male; 0 = female)	0.06	0.30
Driver license (1 = own; 0 = not own)	0.27	1.51
Car ownership (1 = own car; 0 = not own)	−0.18	−1.08
Symbolic/affective attitudinal-aspect of car	−0.47	−3.30***
Instrumental attitudinal-aspect of car	−0.35	−1.68^{+}
Social orderliness attitudinal-aspect of car	−0.19	−0.95
For Behavioral intention for future life with frequent car use		
Moral obligation for car use reduction	−0.61	−9.56***
City dummy (1 = Bangkok; 0 = Ubon Ratchathani)	−0.10	−0.79
Gender (1 = male; 0 = female)	0.46	2.63**
Driver license (1 = own; 0 = not own)	0.20	1.37
Car ownership (1 = own car; 0 = not own)	−0.13	−0.97
Symbolic/affective attitudinal-aspect of car	0.01	0.11
Instrumental attitudinal-aspect of car	0.37	2.19*
Social orderliness attitudinal-aspect of car	−0.05	−0.33
For preference for residential place with convenient public transport		
Behavioral intention for future life with frequent car use	−0.20	−2.04*
City dummy (1 = Bangkok; 0 = Ubon Ratchathani)	−0.05	−0.28
Gender (1 = male; 0 = female)	−0.16	−0.57
Driver license (1=own; 0 = not own)	0.16	0.71
Car ownership (1 = own car; 0 = not own)	0.24	1.12
Symbolic/affective attitudinal-aspect of car	0.09	0.47
Instrumental attitudinal-aspect of car	−0.26	−0.97
Social orderliness attitudinal-aspect of car	0.15	0.60

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
$^{+}$ $p < 0.10$.

for residential place with convenient public transport. This finding was observed to be basically consistent with the proposed hypotheses that individual's moral obligation to reduce car use has an impact on intention for frequent use car, and such an intention is considered to be a determinant for future residential preference.

The full model estimation results with socioeconomic factors and attitudes towards car use can be found in Table 4. From the table, it can be observed that only certain variables were found to be of statistical significance. The overall goodness of fit of the model appeared to be acceptable ($\chi^2[\mathrm{df} = 1;\ n = 172] = 1.61$, CFI = 1.00, NNFI = 0.90, and RMSEA = 0.060). These results will be discussed in the following section.

4. Discussion

From the analysis, it is apparent that our empirical results support the proposed model in Fig. 1. Residential location preference was significantly affected by behavioral intention towards car usage. Those who preferred frequent car use in the future would be less likely to stay in an environment with convenient public transport. Additionally, individual's moral obligation towards car use reduction was found to be a significant determinant for behavioral intention towards car usage. In other words, respondents who thought they should refrain from car use would possess lower intention for future life with frequent car use.

It should be noted that none of the socioeconomic variables as well as the psychological images towards car use were found to directly affect the residential location preference, as can be seen in Table 4. However, we found these variables as direct determinants of moral obligation for car use reduction and behavioral intention for future life with frequent car use. In terms of socioeconomic variables, gender and current residential location were indicated to be among the main factors that significantly and indirectly linked to future residential

preference. Specifically, commuters in Bangkok would have a higher tendency to refrain from using car, and male commuters would have a higher preference to have a future life with frequent car use. The former statement can be potentially explained by the fact that commuters in Bangkok are usually faced with daily traffic congestion; therefore, avoiding car usage was presumably thought to be a sound notion that could alleviate such a problem. On the other hand, the latter statement implies the level of automobile dependency for male commuters, which was found to be higher than those in female.

The estimated model shown in Table 4 also reveals the significance of some psychological attitudes towards car usage. The instrumental attitudinal-aspect for car, i.e. those related with instrumental benefit of automobiles, was shown to be an important determinant for both moral obligation for car use reduction and behavioral intention for future life with frequent car use. The negative sign in moral obligation for car use reduction basically indicates that commuters with positive instrumental values of car would not believe they should refrain from car use, while the positive sign in behavioral intention reflects the preference towards frequent car usage in the future for those who possessed positive attitudes of instrumental aspects of car.

According to Table 4, the symbolic/affective attitudinal-aspect for car was a significant determinant of moral obligation for car use reduction. Those who enjoyed the symbolic and affective utilities of car tended to have a good attitude towards car, thereby believing that they should not refrain from car use. Surprisingly, the social orderliness aspects of car were found to be statistically insignificant in our model and were not the determinants for future residential preference in Thailand, although such aspects had significant effect on travel mode choice in literature (Van et al., 2006).

It can be implied from the findings of the present study that since the residential location preference for commuters in Thailand can be potentially determined from their moral obligation for car use reduction, followed by the behavioral intention for frequent car use, it is necessary for transport planners to select appropriate measures in order to divert potential automobile users to other environmental conscious travel modes such as public transport. Mobility management (MM) measures have been proved to reduce car use in other countries through the modification of psychological variables regarding car use (see for example, Fujii and Gärling, 2005; Fujii and Taniguchi, 2005). The current finding therefore implies that these measures could be promoted in Thailand. For example, if we could successfully attenuate peoples' symbolic/affective attitudinal-aspect or instrumental attitudinal-aspect of car by means of public campaign regarding mobility management, their moral obligation to reduce car use would potentially increase, and that would eventually strengthen their preference for residential location with high accessibility to public transportation. Commuters who select such places as a residential place might use private vehicles less frequently and utilize public transportation more frequently. In addition, such a residential location might be less-suburban, leading to a more "compact" and more environmentally desirable urban area development.

Still, several issues are yet to be addressed in the present study. As noted earlier, our samples were limited to university students. Further variant samples are necessary to obtain general conclusion. Another important limitation of this study is the fact that what we observed with respect to residential choice behavior was merely stated preferences. Actual residential choice behavior should be analyzed in the future study. Finally, future research could be considered on the impacts of several MM measures that could possibly affect future residential choice preference. Thus, further research is needed in order to reinforce the validity of our findings in this study, which lied into the potential effects on the residential location choice of travel behavior and transportation policy to change travel behavior such as MM.

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Appendix A

Belief pairs used in questionnaire survey

Poor–rich	Stressful–relaxed
Austere–luxurious	Uncontrollable–controllable
Inferior–superior	Unfree–free
Uncool–cool	Modest–arrogant
Cheap–expensive	Negative–positive
Vulgar–aristocratic	Useless–useful
Traditional–advanced	Inconvenient–convenient
Dirty–clean	Complicate–simple
Unattractive–attractive	Unfriendly–friendly
Uncomfortable–comfortable	Environmental damaging–environmental friendly
Outdated–fashionable	Risky–safety
Public–personal	Egoistic–altruistic
Bored–excited	Destructive–constructive
Unpleasant–pleasant	Aggressive–unaggressive
Non-esteemed–esteemed	Boisterous–quiet
Slow–fast	Unsocial–social

Appendix B

Image components for car (Referred to Choocharukul et al., 2006)

Variables	Images
Symbolic/ affective	Luxurious, superior, fashionable, rich, advanced, expensive, aristocratic
Instrumental	Pleasant, useful, attractive, friendly, convenient, esteemed
Social orderliness	Quiet, safety, non-aggressive, environmental friendly, clean, altruistic, non-arrogant, controllable

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