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Abstract

It is essential to encourage worldwide pro-environmental behaviors among an increasingly urban population. Understanding the gap between intended and actual pro-environmental behavior is crucial for developing effective intervention measures. The present study aimed to identify a variable that could serve as a proxy for urban individuals' overall competence to fill this gap. Data was collected from 366 residents living in highly urbanized Japanese municipalities with a population density of 7088/km^2 or higher. It found that community ties, as measured by Theodori's (2004) community attachment scale, moderated the intention-behavior gap. This was also true when only resource-saving behavior, conventionally regarded as being in the private sphere, was considered when scoring individuals' pro-environmental behavior, which suggests that this behavior is much more social than previously realized. The practical implications of these findings are also discussed.

Key words: pro-environmental behavior; intention-behavior gap; place attachment; community attachment; urban living.

1. Introduction

Over half of the world's population (54%) now lives in urban areas (UN Population Division, 2015) and consumes large amounts of resources while conducting their economic activities, including gasoline and electricity (Lombardi et al., 2017). For example, urban areas account for around 70% of global energy use (IPCC, 2014; Kennedy et al., 2015). Such consumption has a large negative impact on the global environment. Approximately 80% of the greenhouse gases are emitted through processes of urban areas such as generating electricity and transporting people and goods (Kalmykova et al., 2015; Sovacool and Brown, 2010). Scholars focusing on material flow are also concerned about urban areas' incapacity to assimilate their waste within their own borders (Hodson et al. 2012; Chrysoulakis et al. 2013), resulting in an environmental burden on the hinterlands and beyond (Goldstein et al. 2017). Since continuing urbanization and the overall growth of the world's population will add 2.5 billion people to the urban population by 2050 (UN Population Division, 2015), it is crucial to understand why some people are engaged in pro-environmental behavior more than others in the *urban* (rather than general) setting. This would help develop intervening measures to help the latter to behave more pro-environmentally.

The need for research specific to urban residents is also warranted by psychological studies of the intention-behavior gap (Conner et al., 2016; Inauen et al., 2016; Sheeran & Webb, 2016; Sheeran, 2002; Sheeran et al., 2017; Rhodes & Yao, 2015; Wood et al.,

2016; Echegaray & Hansstein, 2016; Kollmuss & Agyeman, 2002). A meta-analysis of studies on a variety of behaviors (e.g., consumer and leisure decisions, physical activities, academic activities) shows that overall intention-behavior correlations are no more than 0.53 (Sheeran, 2002). Therefore, interventions meant to enhance people's intentions to engage in specific behaviors (e.g., pro-environmental ones) will not necessarily be effective. Earlier studies in both general and environmental psychology have discussed the barriers between individual intent and behavior. They are often called external, contextual, or situational factors. For example, Kollmuss and Agyman (2002) list what they call institutional[1], economic, social, and cultural factors[2]. Sheeran (2002) listed factors such as knowledge[3], opportunity[4], resources[5], availability[6], cooperation[7], and unexpected situations. Steg and Vlek (2009) described contextual factors moderating the relationship between motivation and actual pro-environmental behavior, such as reduced car use only when alternative transportation is available for those with environmental concerns, and argued that contextual variables have rarely been investigated systematically. Gifford (2011) listed as many as 30 psychological barriers to behavioral change for climate change mitigation and adaptation, some of

[1] This factor is determined by whether the infrastructure (e.g., provision of the public transportation services) necessary for a specific behavior (e.g., avoidance of private cars for environmental protection) is provided or not.
[2] Social norms, for example.
[3] Knowledge necessary to translate intention into actual behavior.
[4] For implementing the condom use, one needs a sexual partner to realize the intention to use one.
[5] Money to buy a condom in the example of footnote 3.
[6] Availability of a condom in the example of footnote 3.
[7] Cooperation with one's partner in the example of footnote 3.

which might be considered external or contextual factors.

Determining which external barriers are more relevant and how these barriers are best overcome may depend on the surrounding environment's characteristics. Thus, interventions to narrow the gap between pro-environmental intentions and behavior in urban settings must be different from those in rural settings, especially when the barriers are social, i.e., characterized by an individual's relationships with others or the community. The literature on the difference in social capital between rural and urban communities supports this argument (e.g., Hofferth & Iceland, 1998; Ziersch et al., 2009).

Beliefs about the ease or difficulty of performing the behavior (i.e., self-efficacy and perceived behavioral control) might also explain the intention-behavior gap, but they are unfortunately known not to moderate the intention-behavior relationship consistently (Armitage & Conner, 2001; Sheeran, 2002). This may be due to people's general underestimation of difficulty (DiBonaventura & Chapman, 2008; Sheeran et al. 2003; Sheeran & Webb, 2016). Therefore, it is better to investigate the variable(s) associated with the urban individuals' competence to translate their intentions into actual pro-environmental behaviors.

Against this background, the present study aims to explore an individual characteristic of urban residents moderating the association between pro-environmental behavior intent and actual behavior in the urban setting. The urban residents' attachment

to their community or place of residence is considered as the candidate moderator of this association. This should enable us to identify urbanites who have greater difficulty in translating their intentions into pro-environmental behavior than others, and to develop measures that help them implement actual pro-environmental behavior.

2. Literature review

Place attachment, defined as the bond between individuals and their meaningful environments (Scannell and Gifford, 2010), has attracted scholars' attention in various disciplines. Objects of attachment to place are usually classified into two categories: the physical aspects (i.e., natural and built environments) and the social aspects (i.e., social arena and social symbol) (Scannell and Gifford, 2010; Trentelman, 2009). Place attachment of the latter type can be broken down to two sub-dimensions: place identity[8] and place dependence[9].

It is intuitive to assume that place attachment positively affects people's pro-environmental behaviors so they contribute to the protection of the place, and a number of studies have investigated how place attachment affects people's pro-environmental behavior or attitudes. Budruk, Thomas, and Tyrrell (2009) found that, among urban green space users, place attachment was significantly associated with

[8] In this perspective, place is considered to define who we are as people connected with the place either as residents or visitors.
[9] This refers to the functional or goal-directed connections to a setting.

greater agreement about the balance between humans and nature. Halpenny (2010) found that, among national park visitors, place attachment not only positively influenced place-related pro-environmental intentions but also mediated the effect of place dependance on intent to behave pro-environmentally in everyday life. Scannell and Gifford (2010) collected data in the cities of Trail and Nelson[10] in Canada and found that natural place attachment[11], but not civic place attachment[12], predicted everyday pro-environmental behavior. Ramkisson, Smith, and Weilder (2013) found that, among national park visitors, place attachment was positively associated with intent to behave pro-environmentally in the park. Takahashi and Selfa (2015) collected data from small, rural US communities and found that the social aspect of community attachment predicts everyday pro-environmental behaviors. Tonge at al. (2015) collected data from visitors of a natural area and found that place attachment to the area positively influenced intent to behave pro-environmentally, both in general and for area conservation.

In spite of these authors' contributions, there is room for further research. Most of these studies targeted either residents in rural/ less urbanized areas or visitors to natural areas (although the latter may well include urban residents). Very few research studies collected data from people residing in areas so urbanized that questionnaires measuring

[10] As of 2016, the population of these two cities were 7,709 and 10,230, respectively, and the population densities were 220.7/km^2 and 857.5/km^2, respectively.
[11] A type of physical attachment directed toward the natural aspects of a place.
[12] An instance of group-symbolic place attachment that occurs at the city level.

the biophysical aspects of place attachment no longer make sense. This may be partly because civic place attachment is known not to influence people's pro-environmental behavior (Scannell and Gifford; 2010), suggesting that in highly urbanized areas, place attachment has no role in shaping residents' pro-environmental behaviors.

However, the present study explores the possibility that urban residents' attachments to place plays a crucial role in implementing everyday pro-environmental behaviors. Unlike previous studies, we focus on the crucial role of place attachment in highly urbanized areas, not as a *predictor* of behavior, but as a *moderator* of the intention-behavior relationship.

3. Conceptual framework and hypotheses

The present study has adopted the model developed by Kaiser, Wolfing, and Fuhrer (1999) as a basic conceptual framework. The model of Kaiser, Wolfing, and Fuhrer (1999) is based on the theory of reasoned action (Ajzen & Fishbein, 1980) and its developed version, the theory of planned behavior (Ajzen, 1985). Kaiser, Wolfing, and Fuhrer (1999) assume that ecological behavior intention (EBI) to perform pro-environmental behavior is the immediate antecedent of general ecological behavior (GEB), and that EBI is a function of environmental knowledge[13] and value. The present

[13] This should not be confused with the knowledge to fill the intention-behavior (Sheeran,2002).

study slightly modifies this framework by adding general competence[14] to fill the intention-behavior gap as a moderator, rather than as a predictor, of EBI or GEB. Furthermore, the present study assumes place attachment (specifically, attachment to the social aspect of places) approximates this general competence in an urban context. This would be expected to relate to the way individuals interact with their community. Those who are highly active in this variable would be more competent in filling the intention-behavior gap.

A number of instruments have been proposed to measure social place attachment (see the studies cited in section 2). The present study has adopted Theodori's (2004) community attachment scale, which focus on the individual's attachment to others in the community. Thus, this instrument assesses those qualities that are very similar to civic place attachment proposed by Scannell and Gifford (2010). Theodori's (2004) instrument has been adopted because high internal consistency has been reported (Cronbach's alpha = 0.93) and it is positively associated with community-level social interactions with local people, such as participating in any type of community development activity.

The present study assumes that the above argument applies to pro-environmental behaviors not only in the so called public sphere but also in the private sphere. Since

[14] We call this general because this refer to the overall competence of filling the gap between the general ecological behavior intention and a variety of pro-environmental behaviors.

Stern (2002), pro-environmental behavior researchers have noted the difference between the pro-environmental behaviors in the private and public spheres (e.g., Larson et al. 2015; Erts, Karakas, & Sarigollu, 2016; Tam & Chan, 2018). While behaviors in the private sphere include those such as the purchase of environment friendly household goods and services, behaviors in the public sphere are more organized and social in nature, such as participation in protests. Pro-environmental behaviors in the private sphere noted by earlier studies include (i) recycling glass, tin, plastic, and newspapers, (ii) buying fruits and vegetables grown without pesticides or chemicals or buying ones locally grown, (iii) refraining from driving cars, (iv) reducing energy or fuel at home, (v) purchasing eco-friendly products while avoiding purchasing specific items, and (vi) using reusable shopping bags, among others. It is true that these behaviors are private in the sense that they are implemented by each individual. However, this does not necessarily mean that those who have pro-environmental intentions can always proceed to actual behavior without others' support. In fact, in Japan, where this study was conducted, one of the major recycling outlets is community recyclable waste collection boxes. These are regularly prepared (once per month, for example) by the neighborhood associations which some residents might have difficulty accessing, especially in urban areas. Additionally, most of the behaviors listed above require some knowledge (Sheeran, 2002) in order for the behavioral intention to be translated into action; including knowing where environmentally friendly products are available, the velocity

range for efficient driving on highways, and how one can save fuel and energy at home. If the knowledge required for implementation is location-specific (e.g., shops where specific products are available), the community is even more important as the knowledge provider.

To summarize, the present study hypothesizes the following three propositions. Hypothesis **H3** was introduced to validate the Scannell and Gifford (2010)'s findings that civic place attachment does not predict pro-environmental behaviors.

H1: The association between EBI and GEB is stronger when place attachment is higher.

H2: Hypothesis **H1** holds true even when GEB in the private sphere is considered.

H3: After controlling for EBI, place attachment does not significantly influence GEB.

4. Materials and methods

4.1 *Sample*

Research data was collected via the largest internet research company in Japan, Cross Marketing, Inc., with 1,800,000 registered members as of March 2016. The members were asked to participate in online surveys conducted by the company's clients, and they were offered an incentive to complete each questionnaire. The company's main clients, including the author, are university researchers and individuals who work for private companies' marketing departments. These clients pay commission

fees to the company, which collects data from its registered members who satisfy the client-defined eligibility criteria.

In this research, the company's registered members were all over Japan, aged between 20 and 79, and not students. They were invited by email to participate in a preliminary online survey, which asked questions such as whether they were registered residents of an urban municipality, among others. Those from areas with a population density of 7088/km^2 (i.e., the density of the third largest city in Japan, Nagoya City) or higher were defined as urban. Of the 1741 municipalities in Japan, 69 satisfied this condition. These municipalities had an average population of 601,666 (SD = 425,194) and an average population density of 11,628/km^2 (SD = 4,296/km^2).

Those passing this preliminary survey proceeded to the main survey. The data was collected in such a way that the six (= 2 × 3) subgroups defined by gender (male or female) and three age categories (34 or less, 35–49, and 50 or more) were as similar in size as possible. For more details of the random sampling strategy, see the appendix.

4.2 *Measures*

Sociodemographic and other questions were included in the questionnaire to determine: (i) respondents' individual characteristics (i.e., gender, age, employment status, and occupation); (ii) family characteristics (i.e., annual household income and marital status); and (iii) psychological and behavioral characteristics (i.e., ecological

intentions and behavior and place attachment to their urban neighborhood of residence).

Ecological Behavior Intention (*GBI*)

The measure developed by Kaiser et al. (1999) was adopted. It includes eleven items such as "I support raising parking fees in cities," "I am ready to pay environmental taxes (e.g., raising fuel or automobile taxes)," and "I support speed limits on freeways [100km/h and 80km/h where freeways cross residential areas]. A 5-point Likert scale that ranged from 1 = "agree totally" to 5 = "strongly disagree" was used.

General Ecological Behavior (*GEB*)

Again, the measure developed by Kaiser et al. (1999) was adopted. It originally included 30 items such as "I collect and recycle used paper" and "I bring empty bottles to a recycling bin." The authors agreed that the following three of the 30 items did not fit into the Japanese context, and therefore were not utilized in the survey:

Item 12) I use an oven-cleaning spray to clean my oven.[15]

Item 19) In supermarkets, I usually buy fruits and vegetables from the open bins.[16]

Item 27) I do not know whether I may use leaded gas in my automobile.[17]

[15] Such sprays are rarely used in Japan, and thus the Japanese participants did not seem to make sense of this item.
[16] In Japanese supermarkets, open bins are rarely utilized, and thus the Japanese participants did not seem to make sense of this item.
[17] More than 30 years have passed since Japan completed zero use of leaded gas for automobiles ahead of the other countries, and this item no longer seems to be useful in distinguishing those who are more engaged with pro-environmental behaviors than others, at least in Japan.

The response categories of each item were 1 = “No” and 2 = “Yes”. The Rasch approach (e.g., Wright & Masters, 1982; Kaiser, 1998) was adopted in calculating individuals’ GEB scores, instead of simply summing the 27 item scores (i.e., 1 or 2). The package eRm of statistical software R (ver. 3.3.2) was utilized in this calculation.

Place Attachment

Theodori’s (2004) community attachment scale was adopted. It includes eleven items such as “overall, I am very attached to this community,” “I feel like I belong in this community,” and “the friendships and associations that I have with other people in this community mean a lot to me.” Response categories included (1) strongly agree, (2) agree, (3) disagree, and (4) strongly disagree.

4.3 *Factor Analysis of GEB Items*

To identify items that are more likely to be in the public (private) sphere, a factor analysis was conducted. Considering that each of the 27 GEB items were measured on a two-point scale (i.e., yes or no), the polychoric correlation matrix was calculated and factor analysis was conducted. The calculation was implemented on R for Windows version 3.3.2.

4.4 *Regression Analysis*

Multivariate linear regression analysis was individually applied to explain the 27-item GEB and its three subscales, as defined based on the factor analysis result, in terms of (1) place attachment, (2) EBI, and (3) their interaction, in addition to socioeconomic and demographic variables. The calculation was implemented on Microsoft Excel 2013.

5. Results

5.1 Demographic and Psychological Characteristics of the Sample

The sample characteristics are summarized in Table 1. There were 366 respondents; 194 (53.0%) were male and 172 (47.0%) were female. The respondents' ages ranged from 23 to 79 years, with a mean age of 45.8 and SD of 12.6 years. Respondents with an annual household income in the range of 401–600 million yen or more were the majority, N= 92 (25.1%). The analysis of psychological and behavioral variables revealed that Cronbach's alpha of place attachment and EBI were 0.92 and 0.82, respectively, suggesting a high level of internal consistency. The GEB analysis revealed that the alpha for the 27 items was insufficiently low (i.e., 0.54); however, the subscales defined later in this manuscript had acceptable internal consistency levels. Specifically, the alpha of face-to-face, chemical protection, and resource-saving subscales were 0.69, 0.64, and 0.67, respectively. When reassessed as a Rasch scale, the

separation reliability of the 27-item GEB and the three subscales were 0.52, −0.25[18], 0.62, and 0.64, respectively.

(Tables 2 inserted about here.)

5.2 *Factor Analysis for GEB Items*

These results are summarized in Table 2. The procedure has extracted three components. The percentage of variance explained was 8.9%, 8.2%, and 7.1%, respectively. For each component, the top six factor loading items of each component were selected to comprise a subscale unless the items had higher loadings than other components. However, to secure the interpretability of the components, items 17 and 18 were excluded from factors 2 and 3, respectively, and the items with the seventh largest factor loadings were included. Consequently, the three components were interpreted as "face-to-face behaviors," "chemical protection behaviors," and "resource-saving behaviors," respectively. According to the conventional classification adopted by the literature, the first component falls into the public sphere, while the second and third components fall into the private sphere. Cronbach's alpha for the three subscales were 0.69, 0.64, and 0.67, suggesting that they have acceptable (although not very high) levels of internal consistency.

[18] This unreasonable value is perhaps because the six items in this category were very difficult to implement, and thus the mean and SD of the raw scores (theoretical range = 6—12) were only 6.4 and 1.0, respectively.

5.3 Regression Analysis Results

The results of the regression analyzes to explain GEB are summarized in Table 4. The objective variable and independent variables were standardized before calculating the regression coefficients. When the 27-item GEB was chosen as the objective variable, EBI and its interaction with place attachment were significant positive predictors at the 0.1% and 5% level, respectively. This means that the association between EBI and the 27-item GEB is stronger when place attachment is higher. Thus, the result was consistent with hypothesis **H1**. With regard to sociodemographic or socioeconomic variables, age (*beta* = 0.18; $p < 0.001$) and being high in educational background (*beta* = 0.13; $p < 0.05$) were significant positive predictors. The significance of age as a predictor seems consistent with the literature suggesting that older people report engaging in more pro-environmental behaviors than younger people (e.g., Swami et al. 2011; Pinto et al. 2011).

When factor 1 of GEB (face–to-face behaviors) was taken as the objective variable, neither EBI nor its interaction with place attachment were significant predictors. This suggests that EBI did not predict actual pro-environmental behaviors in the public sphere. It might be that regardless of the community attachment level (and thus tie to the community), individuals always encounter difficulties translating intent into action in the public sphere. No sociodemographic or socioeconomic variables were

significantly associated with the objective variable.

When factor 2 of GEB (chemical protection) was taken as the objective variable, no interactive terms were significant predictors, suggesting that EBI did not affect actual pro-environmental behaviors, regardless of the community attachment level. Perhaps this type of pro-environmental behavior requires specific knowledge for implementation that is not transferred inside the communities to which Theodori's (2004) instrument refers. The analysis of the socioeconomic and sociodemographic variables revealed a single significant predictor: being married (*beta* = 0.19; $p < 0.01$). Perhaps those who are not married cannot afford to install a variety of chemical products with specific purposes (e.g., pesticides, bath cleaners, and toilet cleaners) due to awkwardness.

When factor 3 of GEB (resource-saving activities) was taken as the objective variable, EBI (*beta* = 0.38; $p < 0.001$), place attachment (*beta* = −0.09; $p < 0.05$) and their interaction (*beta* = 0.10; $p < 0.01$) were all significant predictors. In Figure 1, the estimated association between EBI and factor 3 of GEB is plotted for various values of place attachment ranging between −0.20 and +0.20, suggesting that the association is stronger when place attachment is stronger. This result is consistent with hypothesis **H1**.

(Figure 1 inserted about here.)

This finding also supports hypothesis **H2** and thus our speculation in section 3 that pro-environmental behaviors not only in the public but also private spheres are difficult to implement for people lacking strong ties to the community. The analysis of

demographic and socioeconomic variables revealed that female gender (*beta* = 0.14; $p < 0.001$), as well as age (*beta* = 0.22; $p < 0.001$), was a significant positive predictor, which is consistent with the literature suggesting that women tend to report stronger environmental attitudes, concern, and behaviors than men (Gifford and Nilsson, 2014).

Note that while place attachment was not associated with 27-item GEB after controlling for its interaction with EBI, the same variable was weakly associated with factor 3 of GEB (*beta* = −0.09; $p < 0.05$)[19]. Thus hypothesis **H3** was only partly supported.

6. Discussion

This study aimed to discover variables that explain individuals' competency to fill the gap between pro-environment behavioral intentions and actual behavior in urban settings. There were two major findings.

First, as hypothesized, ties to the community, as measured by Theodori's (2004) scale of community attachment (a component of place attachment), was a moderator of the relationship between intent and general pro-environmental behaviors. While recent

[19] Although the *beta* value was negative, the net effect of this variable on factor 3 of GEB is not always so. In fact, the last three terms of the estimated regression model (i.e., −0.09×"Place Attachment" + 0.38×"EBI" + 0.10×"Place Attachment"×"EBI") can be rewritten as (−0.09 + 0.10 ×"EBI")×"Place Attachment" + 0.38×"EBI", suggesting that sign of "Place attachment" depends on whether "EBI" is larger than 0.9. This complexity might have prevented earlier studies (e.g., Scannell & Gifford; 2010) from identifying a significant association between civic place attachment and pro-environmental behaviors.

studies have found that self-efficacy predicts pro-environmental behaviors (e.g., Tang, Chen, & Luo, 2011; Taberneo & Hernandez, 2011; Erts, Karakas, & Sarigollu, 2016) or that this construct predicts the intent to do so (e.g., Lauren et al. 2016; Steinhorst, Klockner, & Matties, 2015; Han, 2015), few succeeded in identifying its moderating role of the intention-behavior relationship. Thus the present study sought to identify a construct that could serve as a moderator of this relationship, and then found that ties to the community was a candidate for such a construct, although it is seemingly unrelated to self-efficacy or behavioral control. It seemed promising to avoid relying on self-efficacy or perceived behavioral control to explain the intention-behavior gap, especially with individuals who intended to behave pro-environmentally but could not articulate what external or contextual hurdles they needed to overcome to implement such behavior. A few recent studies adopted a similar strategy to the present study. For example, Walton and Austin (2011) found that the availability of a curbside pick-up of recyclable material was a significant predictor of recycling behavior. However, as they admit, by greatly narrowing the focus of the social structural context down to one aspect, it is difficult to affirm pro-environmental behaviors other than recycling. The construct we identified (i.e., tie to the community) seemed applicable to a wider range of resource-saving behaviors.

The second major finding of the present study is that pro-environmental behaviors which many earlier studies located in the private sphere (e.g., Stern, 2002; Larson et al.

2015; Erts, Karakas, & Sarigollu, 2016; Tam & Chan, 2018) are actually much more social in nature. In fact, our construct (i.e., tie to the community) played a crucial role in individuals' translation of intent into pro-environmental behavior.

These two findings have important practical implications. The regression model for resource-saving behaviors had a higher value of R-squared (i.e., 0.26); therefore, it seems that practitioners' attempts to enhance peoples' intentions to engage in pro-environmental behaviors[20] are likely to lead to the expected outcomes. However, such attempts are expected to be more fruitful if accompanied by other attempts to encourage those with weaker ties to the community to translate their intentions into behavior, even when it is conventionally located in the private sphere. For example, Walton and Austin (2011) introduced the case of the Louisville metropolitan area where the public and private sectors' attempts to enhance curbside recycling availability led to a prevalence of recycling activities. Such attempts might be more effective if citizens with weaker community ties could access these services, and if measures to overcome community access hurdles could be developed for such people. In doing so, it would be useful to note that, in the present study sample, community attachment was positively associated with age ($r = 0.23$, $p < 0.01$) (this is not shown in results section of the present study), suggesting that younger people have weaker community ties.

[20] This attempt seems to be enabled in terms of letting them acquire environmental knowledge and values, according to the conceptual framework of Kaiser, Wolfing, and Fuhrer (1999).

To conclude, the present study attempted to identify a factor associating with individuals' overall competence to fill the gap between their intended and actual pro-environmental behavior.

There are three important limitations to the present study. First, the present study only collected data from highly urban Japanese cities. It will be important to verify whether these findings can be generalized to samples of rural residents. Second, while the two models used in this study, incorporating (i) all of the 27 items, and (ii) six items associated with resource-saving behavior, seem to have a sufficient level of R squared, the remaining items (i.e., face-to-face behaviors and chemical protection behaviors) had surprisingly low levels of R squared, despite the fact that these models included EBI as a predictor. This may be due in part to the adopted instrument of intention, developed by Kaiser, Wolfing, and Fuhrer (1999), asking about individuals' willingness to accept inconvenience in exchange for conserving the environment in the context of transportation. Thus, it will be important to adopt measures of behavioral intentions more appropriate for face-to-face and chemical protection behaviors, respectively, and to test whether community ties fill the intention-behavior gaps. It may turn out that community ties do not fill the gap; therefore, it will also be important in the future to explore other constructs that may serve as proxies for translating intent into pro-environmental behavior.

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Figure 1: The relationship between behavioral intention and factor 3 of GEB. (The contributions of the sociodemographic or socioeconomic variables are neglected.)

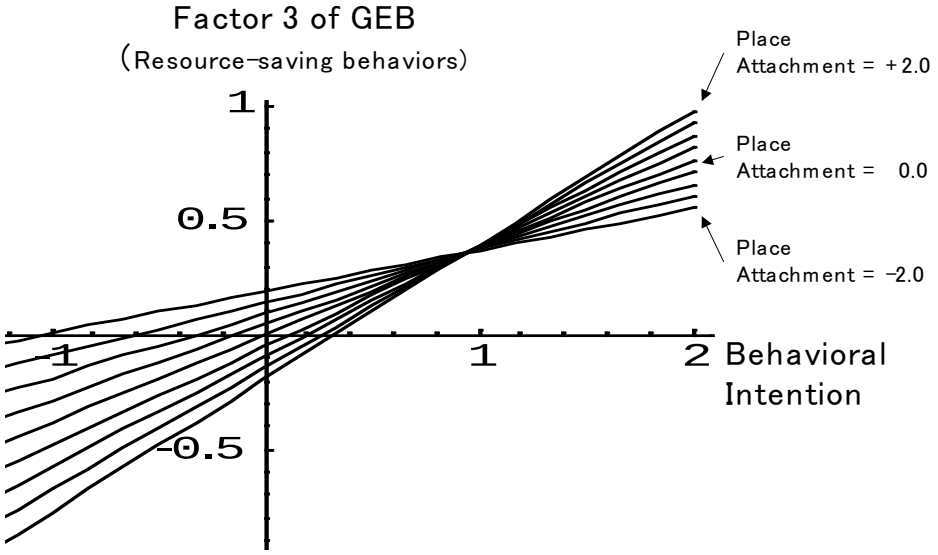

Table 1: Sample Characteristics

	n	%	*M*	*SD*	Cronbach's alpha
Gender					
Male	194	53.0			
Female	172	47.0			
Age			45.8	12.6	
Marital Status					
Yes	163	44.5			
No	203	55.5			
Education					
Low	169	46.2			
High	197	53.8			
Employment Status					
Full time & Permanent	200	54.6			
Other	166	45.4			
Annual Household Income					
≦ 200 Million Yen	53	14.5			
201-400 Million Yen	67	18.3			
401-600 Million Yen	92	25.1			
601-800 Million Yen	56	15.3			
801-1000 Million Yen	31	8.5			
1001-1200 Million Yen	27	7.4			
≧1201 Million Yen	40	10.9			
Place Attachment[1]			26.9	6.4	0.92
Econogical Behavior Intention[2]			34.1	7.1	0.82
General Econogical Behavior					
Factor 1 (Face-to-face behaviors; 6 items)[3]			6.4	1.0	0.69
Factor 2 (Chemical protection behaviors; 6 items)[3]			8.6	1.7	0.64
Factor 3 (Resource-saving behaviors: 6 items)[3]			9.0	1.8	0.67
27-item GEB[4]			38.3	3.0	0.54

Noes. 1: Theoretical range = 11-44. 2: Theoretical range = 11-55. 3: Theoretical range = 6-12. 4: Theoretical range = 27-54.

Table 2: The General Ecological Behavior Items

No	Item	Factor 1 (Face-to-face behaviors)	Factor 2 (Chemical pro-tection behaviors)	Factor 3 (Reseouce-saving behaviors)
1	I put dead batteries in the garbage.*[5]			
2	After meals, I dispose of leftovers in the toilet.*[5]			
3	I bring unused medicine back to the pharmacy.	0.47		
4	I collect and recycle used paper.	0.23	-0.14	0.28
5	I bring empty bottles to a recycling bin.	0.13	-0.37	0.31
6	I prefer to shower rather than to take a bath.	0.18		0.19
7	In the winter, I keep the heat on so that I do not have to wear a sweater.*		0.17	
8	I wait until I have a full load before doing my laundry.	0.22		0.16
9	In the winter, I leave the windows open for long periods of time to let in fresh air.*	-0.30	0.13	
10	When using a washing machine, I carefully choose the number of rinsing to save water.[1]	0.28	-0.32	0.22
11	I use fabric softener with my laundry.*		0.55	
12	I use an oven-cleaning spray to clean my oven.[2]*			
13	If there are insects in my apartment I kill them with a chemical insecticide.*		0.26	
14	I use a chemical air freshener in my bathroom.*		0.55	
15	I use chemical toilet cleaners.*		0.67	-0.15
16	I use a cleaner made especially for bathrooms rather than an all-purpose cleaner.*		0.60	-0.12
17	I use phosphate-free laundry detergent.[3]	0.19	-0.32	0.26
18	Sometimes I buy beverages in cans.[4]*	-0.12	0.28	
19	In supermarkets, I usually buy fruits and vegetables from the open bins.[2]*			
20	If I am offered a plastic bag in a store I will always take it.*		0.19	
21	For shopping, I prefer paper bags to plastic ones.			
22	I usually buy milk in returnable bottles.	0.23		
23	I often talk with friends about problems related to the environment.	0.39		
24	I am a member of an environmental organization.	0.70		
25	In the past, I have pointed out to someone his or her unecological behaviour.	0.58		
26	I sometimes contribute financially to environmental organizations.	0.51	-0.30	
27	I do not know whether I may use leaded gas in my automobile.[2]*			
28	Usually I do not drive my automobile in the city.			0.70
29	I usually drive on freeways at speeds under 100 k.p.h.		-0.13	0.39
30	When possible in nearby areas around 30 km, I use public transportation or ride a bike.			0.84
	Eiven Value	2.22	2.04	1.78
	% Variance Explained	8.9	8.2	7.1
	Cumulative % Variance	8.9	17.1	24.2

Notes. 1: The original item was "I wash dirty clothes without prewashing", which was replaced to fit into the Japanese context. 2: Not measured in the survey because they did not fit into the Japanese context. 3: Not included in Factor 2 due to the difficulty in interpertation. 4: Not included in Factor 3 due to the difficulty in interpretation. 5: These items were not included in the analysis because a preliminary factor analysis revealed that these items were positively associated with none of the three factors. *: Reversed items. Answerers of these items were reversed before the calculation. Items decided to be included in the three subscales are highlighted in grey.

Table 3: Regression Analysis Results

	27-Item GEB		Factor 1 of GEB (Face-to-face behaviors)		Factor 2 of GEB (Chemical protection behaviors)		Factor 3 of GEB (Resource-saving behaviors)	
	beta [1]	*s.e.*	*beta* [1]	*s.e.*	*beta* [1]	*s.e.*	*beta* [1]	*s.e.*
1) Gender = Female	0.09	0.05	0.05	0.06	-0.06	0.06	0.14 ***	0.05
2) Age	0.18 ***	0.05	0.09	0.06	-0.06	0.06	0.22 ***	0.05
3) Marital Status = Yes	0.08	0.06	0.01	0.06	0.19 **	0.06	-0.05	0.05
4) Education = High	0.13 *	0.05	0.10	0.06	0.07	0.06	0.03	0.05
5) Employment = Full time & Permanent	-0.03	0.06	0.09	0.06	-0.10	0.06	0.01	0.05
6) Income	-0.07	0.05	0.02	0.06	-0.05	0.06	0.00	0.05
7) Place Attachment	0.01	0.05	0.07	0.05	0.10	0.05	-0.09 *	0.05
8) Behavioral Intention	0.34 ***	0.05	0.02	0.05	0.08	0.05	0.38 ***	0.05
9) 8) × 9)	0.08 *	0.04	0.06	0.04	0.00	0.04	0.10 ***	0.04
Model Statistic								
R2		0.19		0.04		0.07		0.26
R2 (Adjusted)		0.17		0.02		0.04		0.24

Notes. *: $p < 0.05$. **: $p < 0.01$. ***: $p < 0.001$. 1: Coefficients of the regression analysis where independent and objective variables were standardized.

Appendix: The Random Sampling Strategy of the Present Study

As shown in section 4.1, the present study collected data via an internet research company. This study was conducted as part of a research project investigating the pro-environmental behaviors of urban residents who also regularly stay in rural residences, compared to those who do not. (The results have not been published yet). In order to eliminate or reduce sampling bias, the below procedure was followed.

First, registered adult members (excluding students) of the company residing in municipalities with 7088/km^2 or greater population densities were randomly selected and invited to participate in the preliminary survey. They were requested to answer the following questions, among others.

Q1: Do you have another residence in a rural area (including residences of your parents and your partner's parents) and regularly stay there (regardless of the frequency)? [Options = (A) Yes; (B) No.]

Q2: If the answer is "No," have you ever thought about doing so? [Options = (a) Have never thought about it; (b) Other.]

Second, a total of 10,956 people participated in the preliminary survey, from which 7488, 1084, and 2384 people chose (B) & (a), (B) & (b), and (A), respectively. Hereafter they are called P, Q, and R.

Third, each individual completing the preliminary survey was allowed to proceed to the main survey in such a way that the sizes of the three groups (i.e., P, Q, and R) were

as similar as possible. The six (=2*3) subgroups, as defined by the gender (male or female) and the three age categories (34 or less, 35–49, and 50 or more) in each group, were as similar as possible, and those in group R were restricted to individuals regularly residing in municipalities with 500/km^2 or less of population densities (to secure rurality).

Fourth, the sizes of the three groups (i.e., P, Q, and R) were 250, 211, and 191, respectively (652 in total).

Fifth, to reproduce the proportions of those satisfying conditions P, Q, and R from the 10,956 people (i.e., 7488: 1084: 2384 = 1: 0.14: 0.32), respondents were randomly selected among groups Q and R so that the sizes of the three groups were 250, 36, and 80, respectively (366 in total). Data from these 366 people were utilized in the statistical analysis.