$$\mu_j = \sum_{i=1}^{N} \frac{\left| \frac{\alpha Fij + \alpha Mij}{2} - \alpha Cij \right|}{N}$$

μ_j	: the difference of the attitude question of parents and the child
αFij	: the attitudinal answer of the father on question j
αMij	: the attitudinal answer of the mother on question j
αCij	: the attitudinal answer of the child on question j
N	: the number of the samples

Identifying the relationship between parents' and child's car attitudes: For long-term management of car ownership

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Abstract

Most research on individual car ownership decision have always asked an individual about their attitudes and norms. Mostly those questions are focused on perceived expectation of others instead of asking the significant others whether they do influence the individual him/herself.

In this research, we explore whether the significant others, in this case, parents, influence the decision of students to buy a car or not. We collect data by finding sets of respondents which consist of father, mother and the child. All three answer questions on attitudes towards car ownership. In Japan, for the pilot study, we have collected 300 sets of respondents.

We found that the parents' car attitudes and the respect for their parents strongly influence the attitudes of the children. We also found that mother attitudes toward the car are overall less positive than those of the fathers. However, mother attitudes can explain the child's attitude significantly better than father attitudes. This suggests that possibly influencing mothers' attitudes will also influence the children in the long term. Other potential future work, is to compare attitudes of parents and possibly significant others in different countries. Since different context might have different social norms that influence person's behavioral intention.

Keywords

Car ownership – Influence of parents – Parents' car attitude – Child's car attitude

1. Introduction

There is a rich body of literature on factors that explain car ownership. Those research can be categorized into two levels, aggregate or disaggregate. The aggregate model uses the accumulation of household decisions at different geographic scales such as traffic analysis zone, region, state, or even country level to explain car ownership whereas disaggregate model uses individual or household as the basic unit of analysis. Several researchers have made reviews and comparison on previous car ownership research (Anowar et al., 2014; De Jong et al., 2004). Anowar et al. (2014) distinguished car ownership research into four type of categories i.e.: exogenous static models, endogenous static models, exogenous dynamic models, and endogenous dynamic models. Exogenous static models consider that the decision process is in isolation of other choices, whereas endogenous static models explore the joint nature of the relationship between car ownership and other decision process accommodating potential endogeneity issues. The other two types of models (dynamic exogenous and endogenous) analyze car ownership as a behavioral process that evolves over time. While there are many ways to distinguish or categorize previous car ownership, in this paper, we categorize car ownership based on three categories i.e. at the aggregate level, at the disaggregate level, and at the disaggregate level with psychological factors (attitudes and norms). Our focus in this paper is the third category that is disaggregate car ownership with psychological factors.

In the psychological theory, according to the theory of planned behavior (Ajzen, 1991), "behavior" is constructed by "intention." Intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control; and these intentions, together with perceptions of behavioral control, account for considerable variance in actual behavior. Attitude is defined by Eagly and Chaiken (1993) as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor and disfavor." In short, attitudes is coming from the person himself. While "social norms," one of its definition refers to one's perceptions of the expectations of others regarding the behavior in question, which also means that norms factor is coming from outside the person and be internalized by him/her.

Regarding psychological factors in car ownership, some studies have pointed out attitude as an important determinant of car ownership (Belgiawan et al., 2014; 2016; Gatersleben, 2011; Weinberger and Goetzke, 2010; 2011; Wu et al., 1999). Some describe the importance of attitude factors towards vehicle mode choice (Beck et al., 2013; Bolduc et al., 2008; Choo and Mokhtarian, 2004; Galdames et al., 2011; Johansson et al., 2006; Parkany et al., 2004). While others discuss about the relation between attitudes and car use (Steg, 2003; 2005; Steg et al., 2001).

Norming effects have been described in various studies with different terms such as mass effects, herd behavior, peer effects, fashion or conformity (Abou-Zeid et al., 2013). In transportation research there have been several studies incorporating norms for different behaviour such as commuting decision (Dharmowijoyo et al. 2015; Muñoz et al., 2016; Thøgersen, 2006), car use reduction (Jakobsson et al. 2000) and intention to use certain mode (Bamberg et al. 2007; Belgiawan et al. 2017; Zhang et al. 2015). Most research mentioned above especially related to "social norms" are only asking respondents about their perceived expectations about what others expect them to do instead of asking the significant others whether they do influence the individual him/herself. Therefore in this paper, our focus is to explore whether the significant others, in this case, parents, really influence the decision of students to buy a car or not.

In Section 2 we review the literature on the influence of the others on person decision in general. Section 3 presents the implementation of the survey conducted to describe the influence of the parents on car attitude of children. In Section 4, we discuss the obtained data. In Section 5, we discuss the possibility of conducting surveys in other countries. Finally, in Section 6 we conclude this study with a discussion on implementation and future possibility.

2. Influence of others on person decision in general

The influence of the others on person decision, in general, have been discussed widely in the various fields. For example the case of smoking, it is often taken as the example as a habit which is influenced by the others, and especially, the act of the initiation of the smoking is influenced by the parents indirectly (Flay et al., 1994).

Another example is related to the environmental concern of a child. It is also well known that influence of parents plays a big role. The environmental concern of mothers has an effect on that of children at any age, especially those who force the children to follow up the environmentally friendly action of mothers, such as picking up a trash can on the road, recycling the bins or cans (Nakamura, 2003). The interesting thing is the creation of environmental attitude is directly influenced by the gender difference of the influencer. There is the other study about the environmental concern with the focus on the gender difference of the person influenced. According to Casaló and Escario (2016), girls' creation of concerns is more sensitive to the effect of both mothers and fathers than that of boys.

Another example of influence of others for human decision is the so-called field effect (social influence). We can find some example of the use of field effect in the evacuation decision model due to fire (Helbing et al. 2000) or tsunami (Slucki and Nielek, 2015). The incorporation of field effect raises some endogeneity issues. Therefore, some attempts have been made to correct the endogeneity and applied them for transportation research. We can find example in Dugundji

and Walker (2005), where they tried to understand the effect of surrounding population on people's commuting behavior. Goetzke and Rave (2011) also tested field effects for explaining the modal share of bicycles in German cities. For mode choice decision, Walker et al. (2011) also incorporates field effect where they also tried to correcting for endogeneity issues.

When we consider the influence of the others on car ownership, the factor discussed often is called norms. The norms can be separated into four groups so far. Firstly the norms are categorized into two groups. One of them is called Descriptive norms, and the other is Injunctive norms (Cialdini et al., 1990). The descriptive norms are the norms simply related to what the other people do in certain social context. On the other hand, the injunctive norms are the norms based on what people think the person should do. The extension of the injunctive norms mentioned as the Social Subjective norms is related to the expectation of others on certain behavior but restricted to the close relationship (Belgiawan et al., 2017). Finally, the personal norms refer to the moral obligations that people feel on the behavior in social context (Biel & Thøgersen, 2007).

Belgiawan et al. (2017) presented different approaches to incorporate norms factor into the hybrid choice model framework. They asked their respondents, students in 7 different countries, whether their significant others (parents, siblings, friends, peers at university, etc.) expect them to/ not to buy a car in the future. This question becomes the "expectation" variable. They also asked to what extent their respondents comply with the expectation of their significant others. Then they construct *subjective social norms* variable by interacting those two "expectation" and "motivation" variables. They found that the "expectation of others" especially from parents and peers at university significantly influence car ownership intention. They also reveal the fact that over seven countries the parent's influence is commonly effective on the person influenced. However, they do not explore well enough how to optimize the influence of the person. Therefore, another focus of this paper is to put on the relationship between the parents and the children on the attitude toward cars as the factor of the influence.

3. The survey of influence of others

The targets of this survey were families with a child whose age is between 18 to 25 years. We collect data by finding sets of respondents which consist of father, mother and the child. The survey was done by firstly approaching the father and then asking him to pass on the survey to his family members. The survey was conducted as a web survey that has three parts that required to be answered separately and independent by the father, the mother, and the child. The number of the respondents was 200 samples from the metropolitan areas and the 100 samples from the "rural areas in Japan." We defined "rural areas" as areas which have population fewer than 400

thousand. We set a minimum age for children as 18 years old since, in Japan, 18 years old is the minimum age to obtain the driver license. Therefore, this age is the entry level for considering owning a car by themselves. The survey in Japan is initially intended for the pilot study before we gather more data from many different countries.

The questionnaire is composed of three section. The first is the father's section. The second is the mother's section. And the final is the child section. The section of father and the mother is quite similar except the father part has two more questions about the price and the type of the car which the household currently owns. The remaining questions are the same for both the father and the mother.

The respondents were asked to express their agreement with 19 statements regarding their attitudes toward cars. The scale of the agreement was on a seven-point Likert scale with verbally defined endpoints (fully disagree – fully agree). It was emphasized that they should consider "cars in general" when they expressed their agreement. The first three items: *cars allow to express oneself, cars allow to distinguish oneself from others*, and *cars allow to do adventurous things* are taken with some adjustment from Steg (2005) who finds that they load high in the symbolic/affective construct. Four further statements: *cars are cool*, *cars are expensive to own and maintain*, *cars are fun to have*, and *cars give an arrogant impression* are taken from the attitudinal questions in Van et al. (2014) who also classified these items as symbolic/affective. The latter statement did not load as high in Van et al. (2014) as the other three factors, possibly because "arrogance" is often perceived negative, whereas "cool" or "fun" have positive connotations.

A further item *cars are comfortable* is used in both Steg (2005) and Van et al. (2014) where Steg (2005) classifies this item into her instrumental factor in contrast to Van et al. (2014), who find that this factor correlates more with the symbolic/affective factor. The statements *cars allow one to travel safely*, *cars allow one to pick up or see off others* (Steg, 2005), and *cars are convenient* (2011) are all classified as instrumental factors in the previous research. Further statements taken from Steg (2005) are *cars allow one to travel anytime*, *cars allow one to be independent*, and *cars help one to save time for travel*, which are found to form a factor referred to as independence. As mentioned above, Van et al. (2014) propose that there is an additional attitudinal factor referred to as social-orderliness. To verify its importance, questions on whether respondents consider that *cars are environmentally friendly*, *cars allow one to care about others*, and *cars are disturbing one's neighborhood* are also included. A final item *cars are trendy* is included by Weinberger and Goetzke (2010; 2011) who find that people are influenced in their transportation decision by social peers and neighbors.

The next questions are attitudes toward Public Transportation (PT). For the first part, the respondents were asked about their agreement with these statements: *PT is comfortable, PT is safe, PT is convenient, PT is reliable,* and *PT is expensive*. The following question is about the car experience and PT experience where in general the respondents were asked about the frequency of using both modes. Then as the final part of the questionnaire for the parents, the questions about the environmental concerns are asked. There are seven items that were taken respectively from Choocharukuland and Fujii (2007), Garling et al. (2008), and Kim et al. (2014). Those seven items are: *I feel that I should protect the environment*, *I feel it is important that people, in general, protect the environment*, *our environmental problems can not be ignored*, *Climate change seriously damage our society*, *CO_2 that you produce in your daily life will contribute to climate change and negatively influence the society,* and *I feel a moral obligation to protect the environment*.

Additional questions for children part are the question about the current situation on the car such as access to the car, the price (the most expensive one if multiple cars are owned) and the type of car if they own them are provided. For the indirect influence of the parents, the question about the SSN, first introduced in Belgiawan et al. (2017) are also asked. Further, we also asked questions regarding the relationship with parents to ensure the importance of the parent's when it comes to decision making. These questions are: *the opinion of father/mother is important for car purchase*, *you trust your father/mother*, *when you make an important decision in your life, you consult it with your mother/father*, *you trust your mother/father*, and *your mother/father is socially respected.* are

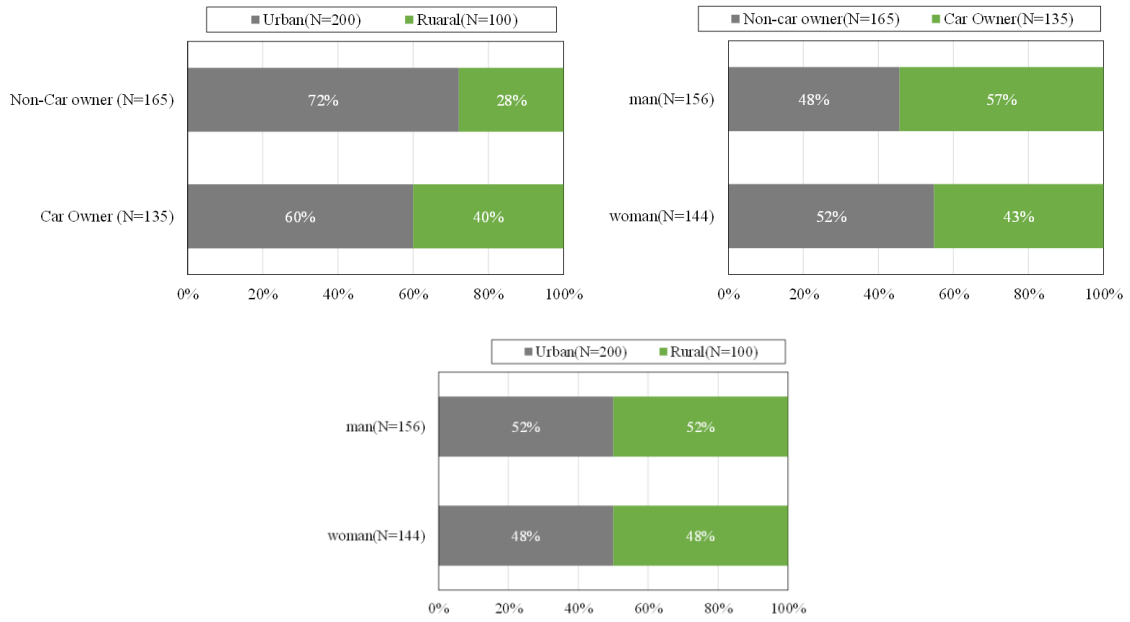
The family relationship is often measured by those questions taken from Family Environment Scale (FES) (Moos & Moos, 1994). However, due to the low reliabilities of this scales, these questions were usually not asked in western countries. For Japan case, 13 items of Brief Family Relationship Scale (BFRS) (Fok et al., 2014) is incorporated in this study. To summarize these 13 items include questions whether each family members support each other, they are getting along well, argue a lot, easily discuss problems, etc. Some additional socio-demographic questions including the children annual income, jointly with the scholarship income obtained from the parents are introduced. Five annual income scale is provided: under 1.3 million yen, 1.3-3million yen, 3-7 million yen, 7-9 million yen, and above 9 million yen. These categories refer to the progressive taxes in Japan. In order to know the residence location, some questions like "how far is it to get to the nearest train station/bus stop," and "how many trains or buses are coming to the nearest train station/bus stop on the morning of the weekdays" are provided in this part.

4. Data description

4.1 Socio-demographic

As the left side of Figure 1 indicates, in urban areas, non-surprisingly the number of non-car owning children is larger than the number of children owning their car by themselves. On the other hand, in the rural area, the number of the non-car owners is less than the number of the car owner.

Figure 1 car ownership of child and residential area of parents



Comparing the percentage of the car owner in each area, in a rural area (54.0%), we can see the more percentage of children have a car than the urban area (40.5%). The right side of Figure 1 shows the car owner and the gender of the children. In line with our expectation, we find that more men are the car owner than the women. The bottom part of Figure 1 shows the area and the gender of the children. We have an almost equal share of male and female.

4.2 Attitudinal factors

Whether there is significant differences in attitudes toward cars among the group of the father, the mother, and the children are analyzed in the entire sample first. Later, we check if there is a significant difference between the each conditional group such as the rural and urban area group or the car owner and the non-car owner group. Firstly, those groups with the different

roles, fathers, mothers and the children are analyzed. Since these are the three groups and the answers are ordinal, the ANOVA test is used. As be seen in Table 1, there are some significant differences between the three groups. 15 out of 19 variables are showing 1% level difference. Two variables are showing 5% difference while one variable is showing the 10% difference. Only one variable that shows no significant different.

Table 1 Mean, standard deviation, and ANOVA

	Variables	Father		Mother		Child		ANOVA
		Mean	St.d	Mean	St.d	Mean	St.d	
1	Cars are comfortable	2.24	1.08	2.54	1.13	2.41	1.24	0.01 ***
2	Cars allow one to care for others	2.86	1.33	3.10	1.22	3.20	1.45	0.01 ***
3	Cars are convenient	1.93	0.84	2.34	1.06	2.31	1.11	0.00 ***
4	Cars allow one to travel anytime	1.96	0.87	2.37	1.09	2.35	1.17	0.00 ***
5	Cars are environmentally friendly	4.09	1.24	4.43	1.23	4.78	1.23	0.00 ***
6	Cars allow one to travel safety	3.63	1.31	3.88	1.26	3.50	1.34	0.00 ***
7	Cars are cool	3.16	1.35	4.05	1.27	3.27	1.32	0.00 ***
8	Cars allow to do adventurous things	2.90	1.39	3.59	1.46	3.09	1.38	0.00 ***
9	Cars are distributing ones neighborhood	4.48	1.43	4.45	1.44	4.48	1.51	0.98
10	Cars allow to express yourself	3.70	1.51	4.36	1.40	3.88	1.49	0.00 ***
11	Cars help one to save time for travel	2.94	1.25	2.97	1.23	2.77	1.24	0.01 ***
12	Cars are giving arrogant impression	4.31	1.34	4.42	1.31	4.12	1.45	0.03 **
13	Cars allow one to be independent	2.58	1.02	2.88	1.27	2.77	1.24	0.01 ***
14	Cars are trendy	4.50	1.35	4.71	1.43	4.38	1.54	0.02 **
15	Cars allow one to pick up or see off others	2.48	1.01	2.66	1.17	2.67	1.23	0.09 *
16	Cars are fun to have	3.50	1.35	4.28	1.45	3.73	1.45	0.00 ***
17	Cars are expensive to own and maintain	1.99	0.94	2.07	1.18	2.35	1.28	0.00 ***
18	Cars allow to distinguish ones from others	4.14	1.41	4.46	1.42	3.94	1.41	0.00 ***
19	Cars bring prestige	4.29	1.48	4.55	1.46	4.16	1.38	0.00 ***

Note: * = 0.1 significance level; ** = 0.05 significance level; *** = 0.01 significance level

Generally speaking, the fathers are showing positive attitudes toward the cars comparing mothers and the children. The generation difference could explain this positive attitudes. Father's generation thinks of cars as "good" because they are more accustomed to using cars. On the other hand, the children generation have fewer cars comparing with those fathers were at the same age, which means they have less opportunity to experience cars. That could have an effect on the children attitudes toward the cars less positively.

Interesting to observe is that the children have similar attitudes with the father on the instrumental and image represented questions such as “cars are cool”, ”cars are trendy”, “cars allow to do adventurous things”, “cars are fun to have”, “cars allow to distinguish oneself from others”, or “cars bring prestige”. On the other hand, there is obvious similarities between children and mothers attitudes on the socially-orderliness and utility questions such as “cars are comfortable”, ”cars allow one to care for the others”, “cars are convenient”, “cars allow one to travel anytime”, “cars are environmentally friendly”, “cars allow one to pick up or see off others”. Comparing the car owner and non-car owner of children, the car owner entirely shows the positive attitudes toward the cars as well as the mothers and the fathers.

From the observation between the rural areas and the urban areas, rural areas people overall have more positively taken the car than the urban areas. This could be explained that in the urban area, the public transportation system is more developed than rural areas and the uses of the cars are not often, whereas, in a rural area, the needs of the cars use tends to be more often. More research is needed for the influence of the parents on the each question. Further discussion about this is not conducted here.

4.3 Attitudes difference over different conditions

In this section, we discuss the attitudinal difference between parents and child based on two conditions, residential and car ownership of the child respectively. Then the difference fixed with the family relationship is discussed with the same conditions later. There are two hypotheses for the attitudes difference.

H1: The difference between the child and the parents on car attitude is smaller in rural than in urban area

This hypothesis is based on the cultural background of Japan. The typical rural family is taking the family occasion more important than urban. Therefore, they spend time more together, which leads this hypothesis.

H2: The difference between the child and the parents on car attitude is smaller if the child is the car owner than that is not.

This hypothesis is based on the idea that those children who have cars are easier to talk about the car those who not because the car is picked up as the interesting topic and discussed more often. In order to clarify the attitudinal difference between the parents and the children, an equation below are introduced here:

$$\mu_j = \sum_{i=1}^{N} \frac{\left| \frac{\alpha F_{ij} + \alpha M_{ij}}{2} - \alpha C_{ij} \right|}{N} \quad (1)$$

where, μ_j : the difference of the attitude of parents and the child

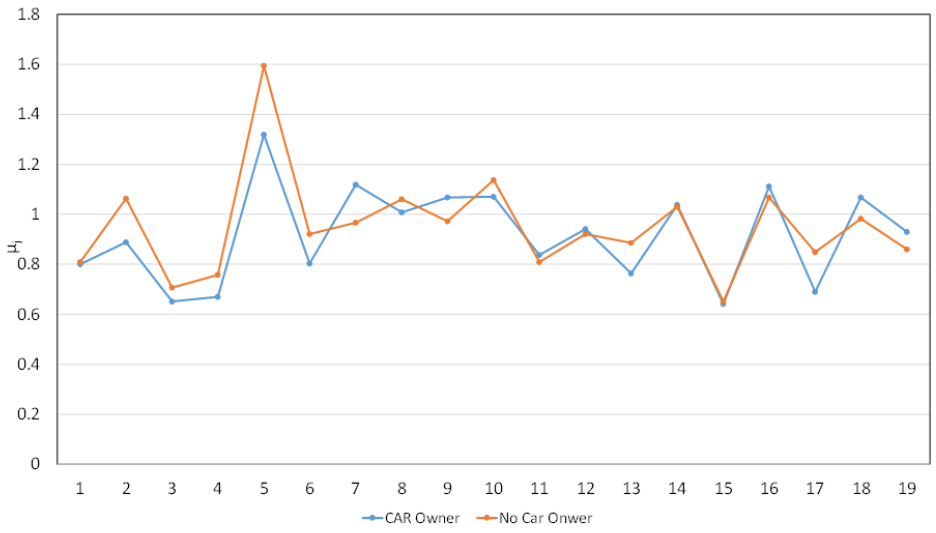
αm_{iq} : attitudinal response of family role m in family i to item j

m : indicates family role with F, M, C denoting father, mother, and child respectively

N : the number of samples

As introduced in the previous section, there are 19 attitudinal statements. If μ_j returns a large number that means the difference of the attitude toward the car of parents and the child is larger. The discussion is continuing following procedure. Firstly the comparison between the difference of the attitude in the rural area and urban area is discussed. Secondly, the comparison between the car owner and the non-car owner of a child is discussed. Figure 2 indicates the difference of the attitude for each question.

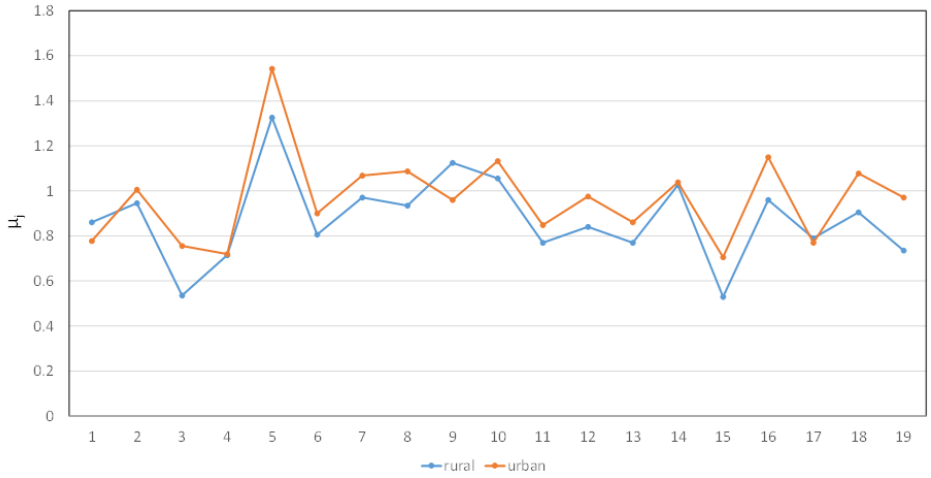
Figure 2 attitudinal difference for 19 items between car owner and non-car owner



Overall the child has the closer attitude with the parents in rural areas than those in urban areas. This is consistent with the hypothesis (a). Figure 3 shows the comparison between the car owner and the non-car owner. From the graph, it is a little bit hard to see the validity of the hypothesis. However, the comparison of the mean value of the μj indicates that car owner(mean=0.926) has more close attitudes than those who are not. (mean=0.945) Since the questions consist as reversed Likert-7 scales, this is consistent with the hypothesis (b). At this point, the effect of residential area of the parents and the car ownership of the car of the child are confirmed on the

similarity of the attitude of the parents and the children. However, it is natural to consider the similarity can also be influenced by the relationship between the parents and the children. Therefore, the additional hypothesis needs to be discussed.

Figure 3 attitudinal difference for 19 items between rural and urban residents of parents



H3: The difference between the child and the parents on car attitude is smaller if the relationship between the parents and the child is better.

To test this hypothesis, an equation including the factor of the family relationship is introduced here.

$$\delta b_i = 1 + b_i - \bar{b} \tag{2}$$

where, b_i : the family relationship of household i

$\bar{b}$: the mean value of the family relationship

$$\mu_j^{family} = \sum_{i=1}^{N} \delta b_i \frac{\left| \frac{\alpha F_{ij} + \alpha M_{ij}}{2} - \alpha C_{ij} \right|}{N} \tag{3}$$

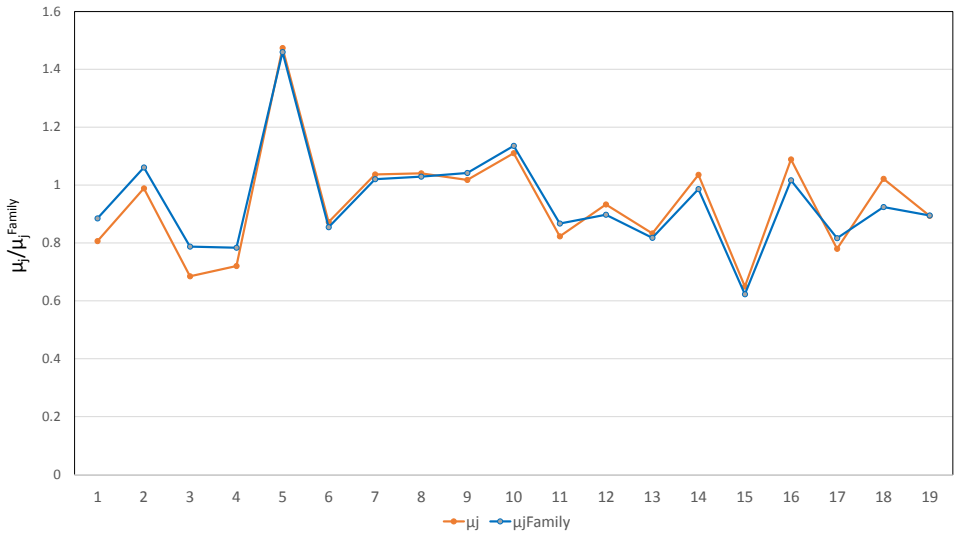
As introduced, the family relationship is measured by 13 items with three scale, cohesion, expressiveness, and conflict. Table 2 shows the latent value of these three factors is taken as the family relationship in this study.

Table 2 Cronbach alpha of a family relationship

	Variable	Factors	Cronbach alpha
1	In our family, we really help and support each other		
2	In our family, we spend a lot of time doing things together at home		
3	In our family, we work hard at what we do in our home		
4	In our family, there is a feeling of togetherness	Cohesion	0.92
5	My family members really support each other		
6	I am proud to be a part of our family		
7	In our family, we really get along well with each other.		
8	In our family, we can talk openly in our home		
9	In our family, we sometimes tell each other about our personal problems	Expressiveness	0.91
10	In our family, we begin discussion easily		
11	In our family, we argue a lot		
12	In our family, we often put down each other	Conflict	0.86
13	My family members sometimes are violent		

In order to make the discussion easier, firstly this effect was tested on the entire group. The two lines showed in Figure 4 indicate the difference in the attitudes between the attitudes considering the family relationship and the one not considering in entire 300 samples.

Figure 4 comparison between μ_j and μ_j^{family}



It seems there are no huge differences between μ_j and μ_j^{family}. The mean value of the one with the family relationship is 0.942, and the other one without is 0.940. Therefore, the hypothesis is rejected for the entire group. Secondly, the comparison was conducted based on the group created in the hypothesis (H1) and (H2). Four groups, rural, urban, car owner, and the non-car owner are tested here. We introduce a new notation η_k to represent the average effect of the family relationship on the attitudes of each group as shown in Eq.4.

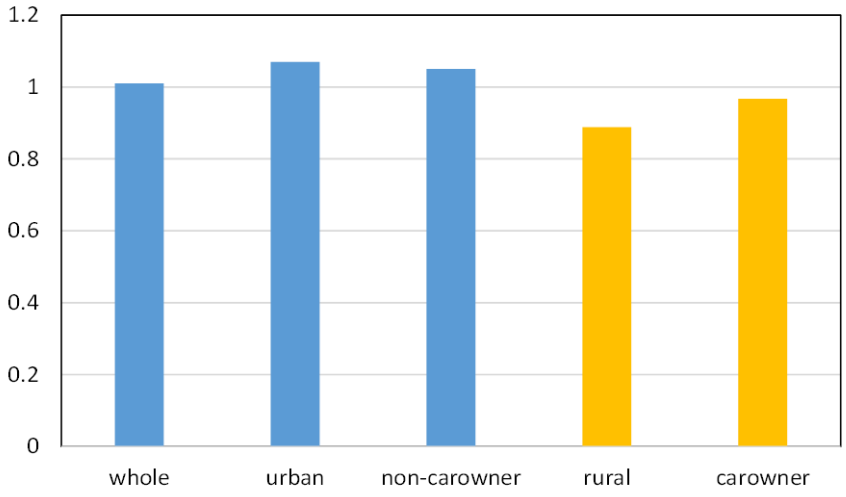
$$\eta_k = \frac{\overline{\mu}_k^{family}}{\overline{\mu}_k} \tag{4}$$

where k indicates the group.(rural, urban, car owner, non-car owner).

If the η_k is less than 1, that means hypothesis (H3) is right because this guarantees the family with the good relationship gets closer their attitudes.

Figure 5 shows the family effect on the each group. As the table indicates, for the entire group the effect is not seen. However, in a rural area, the family effects have more influence on the difference in the attitudes in the way to get the attitudes closer as well as the car owners.

Figure 5 μ_j^{Family} in different conditions



On the other hand, the effects are not seen in urban either the non-car owners are. From this overall analysis of the attitudinal influence of the parents on the children over the different conditions, the overview of the influence is captured. In the next section, the influence of each attitudinal factor on the car attitude of the children is discussed.

4.4 Principal component analysis

In order to reduce the uncorrelated factors of the attitudes toward cars, a principle component analysis (PCA) with Varimax rotation is performed on the 19 items of the attitudinal questions. The PCA is the methodology to keep integrating the correlated factors until the each created factor is uncorrelated. (Fabrigar et al., 1999; Wright & Villalba, 2012). After some trials, we remove variables that do not give sufficient factor scores. Finally, we obtain 14 items for PCA. The results of PCA can be seen in Table 3.

Table 3 Principal component analysis

	Variables	Factors		
		Usefulness	Image	Environmental/ Safety
1	Cars are convenient	0.88		
2	Cars allow one to travel anytime	0.88		
3	Cars are comfortable	0.80		
4	Cars allow one to pick up or see off others	0.74		
5	Cars allow one to be independent	0.72		
6	Cars help one to save time for travel	0.61		0.25
7	Cars allow to distinguish ones from others		0.88	
8	Cars bring prestige		0.85	
9	Cars allow to express yourself	0.24	0.78	
10	Cars are trendy		0.72	0.26
11	Cars are fun to have	0.25	0.70	
12	Cars are giving arrogant impression		0.63	0.23
13	Cars are environmentally friendly		0.24	0.85
14	Cars allow one to travel safety	0.36	0.28	0.69

The first factor accounts for 28% of the variance. This factor mainly refers to the utility of the car such as traveling anytime, picking up and seeing off others, or the comfort of the cars. Therefore, this factor is named usefulness. This factor is in line with Independence (Steg, 2005) and Instrumental (Steg, 2005; Van et al. 2014). Those variables loaded on the second factor accounts for 26.6% of the variance. This factor mostly refers to the Image of cars such as bringing prestige, allowing express yourself. This factor is in line with Symbolic/Affective and Arrogant Prestige (Belgiawan et al., 2016). The final factor accounts for the 10.3% and is named Environmental/Safety. Surprisingly, there is the consistency of this results with the fact that which role of parent influences on each factor. As the similarity of the attitude with the mother is closer on the certain question, the factor is categorized into usefulness. On the other hand, as

the similarity with the father is closer, the factor is categorized into Image. To conclude this validity, we need to confirm the correlation between each role of the parents and the children on each factor. This is discussed in the subsequent section.

5. Attitudinal factors and the effect of environmentally friendly cars

In this section, we analyze the attitudes in more detail. The father and the mother effect is seen as the effect of the parents. At the end of this Section, the discussion of car preference type and the attitudinal effects of other variables such as environmental concern and family relationship is discussed to see the possibility of the whole family approach toward the mobility management scheme.

5.1 The parent's effect

Firstly the correlation of the factor of attitudes is shown in Table 4.

Table 4 Correlation analysis of car attitudes and other variables

Variables	Child Usefulness	Child Image	Child Env. / Safety	Parent Usefulness	Parent Image	Parent Env. / Safety	FRS	T&R	ENVC	ENVP	Child Gender
Child Image	0.11										
Child Env./ Safety	-0.23***	-0.28***									
Parent Usefulness	0.65***	-0.05	-0.08								
Parent Image	-0.13**	0.57***	-0.11	-0.13**							
Parent Env./ Safety	0.01	0.25***	0.27***	0.10	0.23***						
FRS	0.33***	-0.07	0.03	0.34***	-0.18***	0.02					
T&R	0.41***	-0.08	0.02	0.40***	-0.14**	0.08	0.64***				
ENVC	0.36***	-0.07	-0.23***	0.33***	-0.14**	-0.25***	0.27***	0.39***			
ENVP	0.39***	-0.05	-0.20***	0.40***	-0.10	-0.24***	0.32***	0.37***	0.74***		
Child Gender	0.03	0.28***	-0.01	0.02	0.14**	0.13**	0.03	0.01	0.05	0.05	
Child non-car owner dummy	-0.01	-0.26***	-0.01	0.07	-0.15***	-0.17***	0.02	0.04	0.03	0.01	-0.09

Note: **=0.05 significance level; ***=0.01 significance level

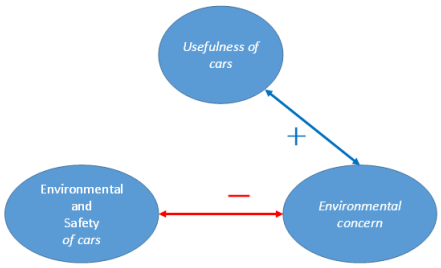
The results indicate each factor of the child is highly correlated with the each factor of the parents. Therefore the propagation of the attitudes between the parents and the children can be seen. As the family effect is discussed in the last Section, the family relationship (FRS) and trust and the respect (T&R) are also compared. The FRS and T&R can be dealt as the same kinds because those two variables are highly correlated, and the correlation with the other

factors indicate the almost same. In this Section, T&R can be used as the representative of the FRS.

The results also show child usefulness is positively highly correlated with T&R, the environmental concern of child (ENVC), the environmental concern of the parents (ENVP), and negatively correlated with environmental/safety. The high correlation with the family relationship is because when the relationship with the parents is good, they have more occasion to use the car together. In other words, they tend to use the car as the bond of the family occasion. In fact, some of the components of the usefulness are "Cars allow one to pick up or see off others" and "Cars allow one to care for the others." On the other hand, the correlation with the environmental concern is very interesting results. The assumption is though there is the environmental concern as moral. Still, the usefulness of the car cannot be taken away from their lives. This explanation can be clearer with the correlation with environmental/safety.

Although the discussion of the environmental/safety is conducted later, concisely by looking at the correlation between the ENVC and the environmental/safety, the positive correlation is seen. These three correlations indicate the dilemma of the children. Although they perceive the cars are environmentally unfriendly and there is the perception of the environmental problems, still the perception of the cars as being useful cannot be taken away from them, this can be seen in Figure 6. We suggest this has implications for mobility management as will be discussed in the conclusions.

Figure 6 the dilemma of ENVC, *Environmental/Safety*, and *Usefulness*



Secondly, child image is correlated with the gender of the child and the car ownership of the child. The gender is related to the image of the car because men tend to think the car as the symbol or the instrument. The reason the car ownership is related because as the children own

cars by themselves, the concrete image of the car is realized by themselves. The image is composed of those questions like "Cars bring prestige" or "cars are fun to have." Therefore, the children who own the car easily take the benefit of them. Finally, the environmental/safety is negatively correlated the ENVP and ENVC as mentioned before.

Based on this correlation analysis, taking the each attitudinal factor of children as the dependent variable. The results can be seen in Table 5. We present the standardized version of the parameter so that we can compare the magnitude of the influence. Note that we only present the variables which statistically significant.

Table 5 Child attitudes regression models (effect of parent's attitudes combined)

Variables	Usefulness of child		Image of child		Env. Safety of child	
	Est. (Std.)	t-stat	Est. (Std.)	t-stat	Est. (Std.)	t-stat
Parent usefulness	0.55	11.57				
Parent image			0.52	10.91	-0.19	-3.45
Parent environment/safety			0.19	2.34	0.26	4.57
T&R	0.15	3.02				
ENVC	0.12	2.59			-0.19	-3.37
Child gender (male)			0.11	4.08		
Model fit (R^2)	*0.46*		*0.38*		*0.13*	

Usefulness of child factor is as explained by the three factors i.e., parent's usefulness, T&R, and the ENVC general. R square is 0.46, which means that the model seems to fit well. The only difference between the groups is that the gender of the child has influence for the car owner group and the non-car owner group but the influence on both groups is moderate. The parameter signs for Image of a child are also as expected, for example, the factor of the parents and the gender are significant. This effect of the gender can be explained by the fact that the men are more paying attention to the cars as the status symbol. The R-square of the model fit is 0.38, which is also well fit.

The environmental/safety are overall explained by the attitude of the parent's image and parents environmental friendly. In some group, as expected, the negative influence of the ENVC or ENVP is observed because as the either parents or children care about the environment more, since ENVP and ENVC are highly correlated, the children tend to think the car is environmentally unfriendly.

We also perform another regression analysis with the same dependent variable. The only difference is that in this model, the attitudes of parents is separated into attitudes of fathers and attitudes of mothers. The results can be seen in Table 6. Similar to Table 5, we only present the statistically significant variables and their standardized parameters.

Table 6 Child attitudes regression models (effect of parent's attitudes separated)

Variables	Usefulness of child		Image of child		Env. Safety of child	
	Est. (Std.)	t-stat	Est. (Std.)	t-stat	Est. (Std.)	t-stat
Father usefulness	0.10	2.04				
Father environmental safety					0.27	5.01
Mother image			0.51	11.34	-0.19	-3.43
Mother usefulness	0.53	10.41				
Mother environmental safety			0.15	3.15		
Mother T&R	0.15	3.23				
ENVC	0.10	2.12			-0.22	-3.91
Child gender (male)			0.19	4.23		
Child non-car owner dummy			-0.13	-2.83		
Model fit (R^2)	*0.497*		*0.424*		*0.150*	

Apparently, the separation of parent's attitudes increases the model fit for all three models. The Usefulness factor is explained by mother's Usefulness most significantly, as follow, T&R of mothers, ENVC, and Usefulness of father. This is so far, as imagined, one thing to highlight here is the mother's effect is the most effective comparing with the father. Therefore, the parent's effects of Usefulness is turned out to be more from mothers. The Image factor is explained by mother's Image most significantly as well, then the gender of the child, mother's Environmental/Safety and the car ownership of the child as follow. It seems consistent with the results of the first factor, and the results of the parent's factor. The mother's effect seems more effective here as well.

The Environmental/Safety is mostly explained by surprisingly father's Environmental/Safety factor. It might be because mother usually cares about the safety or environment more. Therefore, as the father is more care about the environment or safety, the child also pays attention their action more. In conclusion of this section, each parent's car attitudinal factor significantly influences each car attitude of children. Therefore, in line with Section 4 analysis, the influence of the attitude of the parents are confirmed in details with the fact that each factor is influenced by mostly each factor.

5.2 Parents influence on the preference of the car type

Correlation between the types of cars with these variables is shown in Table 7. The high correlation between is the intention to buy the Kei-car (Japanese type of small car), and the small type of car and another is the high correlation between the foreign and sports cars, and the other is the electric vehicle and the hybrid car. Therefore, to make discussion clearer, the types are renamed as Kei-small, foreign-sports, and eco-friendly car respectively as the new variables.

Table 7 Correlation Preference type of car of Child and parents type of cars

Variables	Kei-car	Small	Middle	foreign	sports	SUV	Hybrid	Electric Vehicle	Manual gear
Small	0.51***								
Middle	0.18	0.59***							
foreign	-0.10	0.29**	0.56***						
sports	-0.08	0.36**	0.61***	0.70***					
SUV	-0.12	0.36**	0.72***	0.68***	0.67***				
Hybrid	0.29**	0.70***	0.64***	0.37**	0.32**	0.49***			
Electric Vehicle	0.37**	0.71***	0.55***	0.33**	0.31**	0.37**	0.90***		
Manual gear	-0.18	0.12	0.45***	0.53***	0.40***	0.55**	0.38***	0.36**	
Second hand car	0.32**	0.29**	0.12	-0.05	0.19	0.08	0.09	0.12	-0.02

Note: **=0.05 significance level; ***=0.01 significance level

We perform the regression model to investigate the intention to buy each type of the car in next couple years. The results, standardized version and significant variables only, are shown in Table 8

Table 8 Child intention to buy types of cars (effect of parent's attitudes combined)

Variables	Kei-small		Foreign-sport		Eco-friendly car	
	Est. (Std.)	t-stat	Est. (Std.)	t-stat	Est. (Std.)	t-stat
Parent image			0.20	3.62		
Parent environmental/safety	0.13	2.25	0.17	3.09	0.13	2.26
Parent ownership of EV					0.18	3.22
Distance to nearest convenience store	-0.12	-2.09				
ENVP					0.19	3.36
Child gender (male)	-0.18	-3.12	0.17	3.34		
Model fit (R^2)	*0.06*		*0.14*		*0.08*	

These results indicate that the intention to buy Kei-small car is explained by the positive attitude of Environmental/Safety and gender of the child and negatively by "how far from your house to the nearest convenience store." This means as their parents think the car is safety, or they are female, or the convenience store is far from their house, they are more likely intend to buy a car. As the data shows, attitudes parents of Image, gender and the attitudes of the Environmental/Safety are significant. This indicates as the image of their parents toward the car is better, or they are male, or the parent's attitude toward Environmental/Safety is better, they have strong intention to buy the foreign sports car. The fact that the parents think cars are cool, then the children have stronger intention to buy the foreign sports car makes sense because the child is exposure to the coolness of the car which drives their desire too. The factor of gender is not surprising. However, the factor of the Environmental/Safety is a bit difficult to explain, but it might be because the parents think the car is safety, the child doesn't care a risk to drive the dangerous car like foreign or sports car.

The results of eco-friendly car model show the ownership of the parents of the environmentally friendly car is the most significant, and following the environmental concern of parents and the parent's attitude of Environmental/Safety. The Image or the Usefulness is not significant for the intention for the intention to purchase an environmentally friendly car. However, for all of the models above the model fit is quite low (R^2 below 0.2). Since the model fits are quite low, we perform another regression analysis to confirm father and mother's influence toward child intention. Once again, the attitudes of father and mother enter the model separately. The result can be seen in Table 9.

Table 9 Child intention to buy types of cars (effect of parent's attitudes separated)

Variables	Kei-car		Middle size		Foreign car		Sports car	
	Est	t-stat	Est	t-stat	Est	t-stat	Est	t-stat
Environmental safety father					0.15	2.28		
Environmental safety mother	0.15	2.30					0.12	1.76
Image mother			0.20	2.71	0.27	3.70	0.25	3.40
Child gender (male)	-0.25	-4.34	0.12	2.12	0.12	2.06	0.22	3.82
Child non-car owner dummy	-0.14	-2.44	-0.14	-2.31			-0.09	-1.59
Urban dummy					-0.10	-1.74		
ENVC			0.16	2.30				
Parents have kei-car	0.17	2.83					-0.10	-1.57
Parents have middle size car			0.18	2.99				
Parents have foreign car			-0.14	-2.29	0.12	1.94		
Parents have sports car			0.13	1.88				
Model fit (R^2)	*0.24*		*0.21*		*0.20*		*0.21*	

For the type of Kei-car, middle size car, and sports car, the fitness of model are above 0.200. The findings are except Kei-car, the Image of the mother, the gender of the child and the ownership of the same type of the car of parents give significant positive effect on the intention to buy the cars. Gender gives significant positive influence, which means men are more intended to buy those types of cars. For the Kei-car, the Environmental/Safety of the mother, and the ownership of the Kei-car of parents give positive influence. In conclusion, the mother's attitude toward the car is influencing the intention of the child significantly depending on the type of the car. Therefore, the mobility management scheme with the whole family is effective, especially with mothers.

6. Conclusion

This study looked at car attitudes of young adults aged 18 to 25 across Japan and in particular the influence of parents on these. It is suggested that there are some important outcomes that have implications to design more effective mobility management strategies.

Firstly, the findings confirm a significant influence of the parents on the attitude of the children toward the cars. This is in line with the findings of Belgiawan et al. (2017) and suggests the importance understand parents' attitudes when aiming to influence children's attitudes. In this research, it is further found that mother attitudes toward the car are overall less positive than those of the fathers. However, mother attitudes can explain the child's attitude significantly better as shown in Section 5. Image attitude for mother compares to for fathers is in many cases closer child's image attitude. This suggests that possibly influencing mothers' attitudes will also influence the children in the long term. Further in this research, the role of trust and the respect, and the family bond are confirmed to explain the attitudinal differences between children and parents. Families that have a closer bond tend to have closer attitudes towards the car in the rural areas, or the children own his/her car. To change the attitudes of children independently in urban families is easier, but especially for a "whole family mobility management approach" the rural area is easier to change.

It is further suggested that some of the relationships between attitudinal factors of the children are noteworthy. One of them is as discussed in Section 5, where we observe a dilemma of the correlation among the usefulness of the car, the environmental concern of children, and environmental/safety. A young generation of children age is more educated on the environmental problem, and they think the car is environmentally unfriendly. However, still, they think it is hard to take away the cars from them because of the usefulness. This can be one of the points where the mobility management scheme can stimulate as the resolution of this. Furthermore, this suggests that in general promotion of eco-friendly cars might be easier than the promotion of public transport considering that cars are considered as useful.

We discuss car type desire preference distinguishing in particular small cars, sports/foreign cars, and environmentally friendly cars. It is found that depending on these types, the attitudes influence differently. The small and sports/foreign car can be explained to some degree by the attitudes of parents to cars. But the attitude of the child to eco-friendly car appears to be better explained by the general environmental concern of parents. Our conclusion is that eco-friendly cars are still not considered as attractive considering their image as well as their perceived usefulness. Improving these aspects appears to be important to promote eco-friendly cars more. There are some further work directions that need to be explored. The other factors not yet used in this paper such as the travel pattern of the people, impact of accessibility to locations as well as attitudes towards public transportation. Other potential future work, is to compare attitudes of parents and also possibly significant others (friends, partner, siblings) in different countries. Since different context might have different social norms that influence person's behavioral intention.

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