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The effects of demography and personality on urban travel habits

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Abstract

In the present study we examine the influence of personality and demography on travel habits, such as car driving, usage of public transportation and cycling. Demography was defined by age, gender, income and presence of children at home. Personality was defined as the Big Five personality factors (i.e. Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism) and as Environmental personality (i.e. low degree of pro-environmental behavior). Data were collected through the Citizen Panel, a Web-based panel encompassing over 58,000 Swedes. A sample of 1 631 members, aged 18 – 74 years in the area of Gothenburg in Sweden, received a survey invitation in September 2018. The participation rate was 65 %. Our result shows that car driving is predicted by being male, being older, having children at home, low degree of Openness, high degree of Conscientiousness and low degree of Environmental personality. High-frequent usage of public transportation is predicted by being female, being younger, not having children at home, low degree of Conscientiousness, high degree of Agreeableness and high degree of Environmental personality. High-frequency of cycling is foremost predicted by an Environmental personality. Our result should provide useful information to psychologists, policy-makers and transportation planners developing sustainable transportation systems.

Keywords: Travel habit, transportation mode, demography, personality, the Big Five

1. Introduction and Research Questions

The variables that have strongest effect on consumers´ transport behavior are travel time and cost (Yazdanpanah & Hosseinlou, 2017). The present study will go beyond such objective and well-studied variables and instead focus on travel habits in relation to individual differences, such as the consumers´ demography and personality.

Demographic variables, especially gender and age, but also income and presence of children, have widely been studied in relation to preferences and usage of different transportation modes, for instance car, bike and public transportation (see for instance Nordlund & Westin, 2013; Statistics New Zealand, 2007; Statistics Sweden, 2017). However, psychological personality variables have been less studied in relation to these transportation modes, especially to public transportation and cycling. Related to driving behavior, personality has been used in order to predict driving style and risky behavior, as well as choices of different car brands. Almost all of these studies conclude that assessing personality factors (such as Openness, Conscientiousness, Extraversion, Agreeableness and

Neuroticism) is useful in predicting driving behavior. Therefore, it is surprising that there are so few studies that use personality to predict transport behavior in relation to different transportation modes. Especially since transportation behavior is mostly habitual, which implies that it is repeated and take place in a stable context (Brette, Buhler, Lazaric & Marechal, 2014; Dill, Mohr & Ma, 2014; Gardner & Abraham, 2007; Gärling, Fuji & Boe, 2001; Klöckner & Matthies, 2004). When it comes to consistent patterns of behaviors, personality psychologists are in general accurate at predicting behavior (Chamorro-Premuzic, 2011). However, there might also be individual differences in habitual behaviors. Personality psychologists propose that some individuals are more able to break out from their everyday habits and routines than other people, these people have so-called high degree of Openness. People with a high degree of Openness are more creative and imaginative and appreciate change and variation in life, while people low on Openness are more conservative and cautious and keep their habits in order to reduce uncertainty and new decisions.

Personality is an unexplored but promising area to consider when it comes to transport habits and chooses of different modes. The purpose of the present study is to examine to what extent travel habits can be explained by individual differences in demography and personality. We formulated three research questions:

Research Question 1: To what extent does demography and personality predict frequencies in car driving?

Research Question 2: To what extent does demography and personality predict frequencies in usage of public transportation?

Research Question 3: To what extent does demography and personality predict frequencies in cycling?

2. Theories on Personality and Their Relations to Demography

2.1. The Big Five personality factors

First, let us introduce the personality concept. Years of research show that people's behavior related to a variety of domains are driven by a relatively stable set of psychological characteristics: their personality (Chamorro-Premuzic, 2011; Larsen & Buss, 2005). Personality is a pattern of relatively permanent factors that give both consistency and individuality to a person's behavior (Feist & Feist, 2009). Many personality factors have been identified, but this study focuses on the so-called Big Five model, the most widely accepted personality model (Goldberg, 1990; Costa & McCrae, 1992). It posits that there are five major and universal factors of personality; Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism.

Openness (sometimes referred to as Openness to experiences) is associated with behavioral flexibility, intellectual curiosity, aesthetic sensitivity, vivid imagination and unconventional attitudes (Costa & McCrae, 1992). People high on Openness are open for innovations, different cultures and emotions of other people. They have broad interests and are imaginative. People low on Openness are cautious and conservative (Chamorro-Premuzic, 2011; Larsen & Buss, 2005). Openness is negatively related to age and positively related to income (McCrae et al., 1999; Kajonius & Carlander, 2017)

Conscientiousness is associated with responsibility, self-discipline, order, competence and dutifulness (Costa & McCrae, 1992). People high on Conscientiousness are thorough and efficient. They are forward thinking, self-controlled and plan their lives. The order facet of Conscientiousness is positively related to traditionalism (Markowitz, Goldberg, Ashton & Lee, 2012). People low on Conscientiousness are easy-going, impulsive and lazy. They usually act on the spur of the moment (Chamorro-Premuzic, 2011; Larsen & Buss, 2005). Conscientiousness is positively related to age (McCrae et al., 1999).

Extraversion is associated with social behavior, high activity, experience of positive affect, well-being, impulsiveness and assertiveness (Costa & McCrae, 1992). People high on Extraversion are sociable and outgoing. They have a greater impact on their social environment. People low on Extraversion are reserved and withdrawn. They tend to be more like wallflowers (Chamorro-Premuzic, 2011; Larsen & Buss, 2005). Extraversion is negatively related to age and positively related to income (McCrae et al., 1999; Kajonius & Carlander, 2017)

Agreeableness is associated with prosocial behavior, friendliness, trust, altruism and tender-mindedness (Costa &

McCrae, 1992). People high on Agreeableness are compassionated, trusting and forgiving. They are good negotiators to solve conflicts and strive for agreements in which all get along. People low on Agreeableness are suspicious and argumentative. They are antagonistic and aggressive and seem to get themselves into a lot of social conflicts. They assert their authority and power to solve social conflicts (Chamorro- Premuzic, 2011; Larsen & Buss, 2005). Females are generally scoring higher on Agreeableness than male (Costa, Terracciano & McCrae, 2001). Agreeableness is positively related to age and negatively related to income (McCrae et al., 1999; Kajonius & Carlander, 2017).

Neuroticism is associated with anxiety, vulnerability, tension, worrying and low self- confidence (Costa & McCrae, 1992). People high on Neuroticism are anxious and nervous. They experience a lot of mood-swings and feel anxious, tensed and stressed. People low on Neuroticism are emotionally stable. They are composed, relaxed and calm (Chamorro-Premuzic, 2011; Larsen & Buss, 2005). Females are generally scoring higher on Neuroticism than male (Costa, Terracciano & McCrae, 2001). Neuroticism is negatively related to age and negatively related to income (McCrae et al., 1999; Kajonius & Carlander, 2017).

2.2. Environmental personality

Environmental psychologists have attempt to characterize the "pro-environmental individual", sometimes referred to as the "Environmental personality trait" (Johansson, Heldt & Johansson, 2006). This is the person who demonstrates a pattern of pro-environmental action across time, space, and different domains, such as energy use, water consumption, transportation, waste reduction, composting and recycling habits (Johansson, Heldt & Johansson, 2006; Markowitz, Goldberg, Ashton & Lee, 2012). Many of these behaviors have been discussed in relation to an empathic or altruistic personality (Markowitz, Goldberg, Ashton & Lee, 2012). Environmental personality is associated to being female, younger and to higher socioeconomic status (Hines, Hungerford & Tomera, 1986/87; Markowitz, Goldberg, Ashton & Lee, 2012). Previously reported findings have suggested that Environmental personality is positively associated with a number of Big Five personality factors, including Openness, Agreeableness, Neuroticism and Conscientiousness (Hirsh, 2010; Hirsh & Dolderman, 2007; Swami et al., 2010).

3. Previous Research on Demography and Personality Related to Travel Habits

3.1. Car usage

Previous research have found that males are using cars more than females, and that car usage is positively related to age (Johansson, Heldt & Johansson, 2006; Transportation analysis, 2017). It is also found that people with children in their household use cars more than people without children in their household (Johansson, Heldt & Johansson, 2006; Ruud & Nordbakke, 2005).

3.2. Usage of public transportation

Women use public transportation more than men (Transport analysis, 2017). Usage of public transportation is negatively related to age (Noble, 2005; Ruud & Nordbakke, 2005) and negatively related to income (Noble, 2005; Ruud & Nordbakke, 2005, Yazdanpanah & Hosseinlou, 2017). Previous research on the Big Five and public transportation has found that frequencies in usage of public transportation is positively related to high degree of Extraversion and high degree of Neuroticism (Yazdanpanah & Hosseinlou, 2017).

3.3. Bicycle usage

Regarding usage of bicycles, frequencies in usage is higher among male than female and among younger people than older people (Statistic New Zealand, 2007).

Johansson, Heldt & Johansson (2006) have found that a high degree of Environmental personality increases the likelihood of choosing an environmentally friendly mode, for instance cycle over public transportation and public transportation over car.

4. Methods

4.1. Sample and procedure

The online panel survey, the Citizen Panel at the University of Gothenburg, was used for data collection. The panel is run by the Laboratory of Opinion Research (LORE). LORE provides an infrastructure for multidisciplinary research and provides an efficient facility for collecting data from web surveys. In November 2018, there were over 58,000 registered members. The panel is not representative for the Swedish population, it is over-represented by men, older people and well-educated people (Martinsson et al., 2018). Each year, members of the panel are invited to 2 -3 surveys (for more information, see www.lore.gu.se).

For this particular study on travel habits, 1 700 members were selected to be invited as respondents. A two-stage sampling procedure was used for the data collection. In the first stage, 9 of 13 municipalities in the area of Gothenburg were selected (i.e. Ale, Gothenburg, Härryda, Kungsbacka, Kungälv, Lerum, Mölndal, Öckerö, Partille). In the second stage, an invitation to 1 700 panel members between 18 – 74 years of age were distributed. About 4% of the gross sample turned out to have invalid or undeliverable e-mail addresses; hence, there were 1 631 individual who received the survey invitation by e-mail. In total, 1 068 respondents answered the survey, giving a participation rate of 65 %.

The web-survey was collected between 12 September and 7 October 2018. In total, two reminders were sent, 12 and 18 days, respectively, after the survey was first sent to the respondents. The average time respondents spent answering the survey was 6.9 minutes (SD 4.4) (Martinsson et al., 2018).

4.2. Variables and measurements

The demographic variables used in this study were gender, age, income, and presence of child in the household. Gender was dummy coded, male was coded as 0 and female as 1. Age was categorized in six groups (i.e. 18 – 29, 30 – 39, 40 – 49, 50 – 59, 60 – 69, 70+). Income was coded into three categories; low income < 30 000 SEK; average income 30 – 37 000 SEK; high income > 37 000 SEK. The average monthly income in Sweden is 33 700 SEK (approximately 3 450 USD or 3 050 EUR) (Statistics Sweden, 2017; SEB, 2017). The presence of children in the household was dummy coded, equal to one if there are at least one child in the household. Table 1 present the demography among the participants.

The Big Five personality factors was assessed using the Big Five Inventory, BFI-10 (Rammstedt & John, 2007), which is a 10-item inventory with 2 items measuring each personality factor. The BFI has shown satisfactory levels of convergent and discriminant validity and test-retest reliability (Rammstedt & John, 2007). Personality factor items were measured using a four-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). The Openness index was constructed by averaging the responses to "has few artistic interests" (reversed) and "has an active imagination". The Conscientiousness index was constructed by averaging the responses to "tend to be lazy" (reversed) and "does a thorough job". The Extraversion index was constructed by averaging the responses to "is reserved" (reversed) and "is outgoing, sociable". The Agreeableness index was constructed by averaging the responses to "is considerate and kind to almost everyone" and "is generally trusting". The Neuroticism index was constructed by averaging the responses to "is relaxed, handles stress well" (reversed) and "gets nervous easily". Only respondents who had provided answers on both items to a specific factor were included in the subsequent analyses. Table 1 present the Big Five personality factors among the participants.

Environmental personality was measured through five items; "I carefully recycle my household waste", "In the supermarket, I choose environmentally friendly products", "I would rather buy second hand than new things", "I choose transportation modes that have as little environmental impact as possible", "It is important for me to try to repair things rather than to buy new". Each item was measured using a four-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). When selecting the Environmental personality items, we were influenced by the Students Behavioral Environmental Scale (Markowitz, Goldberg, Ashton & Lee, 2012). The Cronbach alpha coefficient was 0.70 (N=1039) for the Environmental personality index. According to Nunnally (1978), coefficients of 0.70 are acceptable. Only respondents who had provided answers to all five items were included in the analyses. Table 1 present the Environmental personality among the participants.

Table 1. Background characteristics of the study population

	Total (n = 1068)
Demography	
Sex	n = 1063
Men	61.0%
Women	39.0%
Age	n = 1066
18 - 39 years	24.4%
40 - 59 years	44.3%
60 + years	31.3%
Income	n = 1068
Low income	30.1%
Average income	49.3%
High income	20.6%
Children in the household	n = 1046
At least one child at home	28.3%
Personality	
Big Five personality factors	n = 1038 - 1044
Degree of Openness	2.7 (0.7)
Degree of Conscientiousness	3.1 (0.6)
Degree of Extraversion	2.9 (0.7)
Degree of Agreeableness	3.1 (0.5)
Degree of Neuroticism	2.1 (0.7)
Environmental personality	n = 1039
Degree of Environmental personality	2.7 (0.6)
Transporation mode (frequences in usage the last twelve months)	
Car (driving)	n = 1059
Never	13.1%
A few times during the past 12 months	10.2%
A few times every month	7.2%
A few times every week	15.4%
Several times a week	25.9%
Daily	28.1%
Public transportation	n = 1052
Never	6.3%
A few times during the past 12 months	13.3%
A few times every month	20.1%
A few times every week	15.7%
Several times a week	26.4%
Daily	18.3%
Cycle	n = 1046
Never	27.0%
A few times during the past 12 months	20.8%
A few times every month	14.5%
A few times every week	13.4%
Several times a week	15.0%
Daily	9.3%

Note. The personality scales ranges from 1 (lowest degree) to 4 (highest degree).

The question for travel habits was; "Considering your travel habits during the last 12 months, to what extent have you?" – "Driven car", "Used public transportation", "Cycled". The respondents were asked to indicate their level of usage for each one of the three transportation modes on a seven point Likert scale, ranging from 1 ("never) to 7 ("daily"). Table 1 present the frequencies of usage of different modes.

4.3. Ethics

All procedures were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all individual participants included in the study.

5. Results

5.1. Relations between travel habits, demography and personality

Table 2 contains the bivariate correlations between study variables. Car driving is negatively correlated with usage of public transportation, while cycling is unrelated to both car driving and usage of public transportation (Table 2).

Car driving is negatively correlated with Openness, Agreeableness, Neuroticism, and Environmental personality, while positively correlated with Conscientiousness, Extraversion, and age.

Usage of public transportation is negatively correlated with Conscientiousness, and age, while positively correlated with Openness, Agreeableness, Neuroticism and Environmental personality.

Cycling is negatively correlated with age, while positively correlated with Conscientiousness, Agreeableness and Environmental personality.

Table 2. Correlation matrix for transportation modes, personality factors and age

	2	3	4	5	6	7	8	9	10
1. Car driving	-0.51**	-0.02	-0.16**	0.11**	0.09**	-0.02	-0.17**	-0.19**	0.22**
2. Public transportation		-0.03	0.11**	-0.08*	0.00	0.12**	0.10**	0.17**	-0.19**
3. Cycling			0.03	0.10**	0.03	0.11**	0.01	0.27**	-0.16**
4. Openness				0.02	0.11**	0.11**	0.02	0.22**	-0.03
5. Conscientiousness					0.21**	0.09**	-0.18**	0.13**	0.03
6. Extraversion						0.18**	-0.28**	0.01	0.15**
7. Agreableness							-0.14**	0.17**	-0.06
8. Neuroticim								0.13**	-0.24**
9. Environ. personality									-0.15**
10. Age									

Note. * $p < .05$; ** $p < .01$. Age is measured on a six point scale (e.g. $18 – 29$: $30 – 39$: $40 – 49$: $50 – 59$: $60 – 69$; $70 +$). Environ. personality = Environmental personality.

5.2. The effects of demography and personality on car driving

To examine the influence of demography and personality on car driving we conducted a hierarchical multiple regression analysis. Step 1 shows that frequencies of car driving increase if the respondent is male, older, has an average income and has presence of children at home. After controlling for demography, the Big Five personality factors explained a significant amount of unique variance in car driving frequencies. Low degree of Openness and

Conscientiousness were positively related to car driving. In step 3, we entered Environmental personality. People who drive cars often have a lower degree of Environmental personality compared to people who drive car less often (Table 3).

Table 3. Hierarchical regression models exploring how demography and personality predict car driving ($N = 1009$)

Independent variables	Step 1: Demography	Step 2: Demography, Big Five	Step 3: Demography, Big Five, EP
Demography			
Gender	-0.19***	-0.18***	-0.16***
Age	0.26***	0.24***	0.24***
Income (Low)	-0.25***	-0.23***	-0.23***
Income (High)	-0.07*	-0.05	-0.05
Child in household	0.18***	0.18***	0.19***
Personality			
Openness		-0.11***	-0.09**
Conscientiousness		0.07*	0.08**
Extraversion		0.06	0.05
Agreeableness		-0.02	-0.01
Neuroticism		-0.01	0.00
Environmental			-0.11***
R^2_{Adj}	0.19***	0.21***	0.22***

Note. Entries for predictors are beta weights (i.e., standard regression coefficients). Abbreviations: *Big 5* Big Five personality factors; *EP* Environmental personality, *p<.05; ** p <.01; *** p <.001.

5.3. The effects of demography and personality on usage of public transportation

To examine the influence of demography and personality on using public transportation we conducted a hierarchical multiple regression analysis. Step 1 shows that frequencies of usage of public transportation increase if the respondent is female, young, and do not have children at home. After controlling for demography, the Big Five personality factors explained a significant amount of unique variance in usage of public transportation. High degree of Agreeableness and Openness and low degree of Conscientiousness were related to usage of public transportation. In step 3, we entered Environmental personality. People who use public transportation often have a higher degree of Environmental personality compared to people who use public transportation less often (Table 4).

5.4. The effect of demography and personality on cycling

To examine the influence of demography and personality on cycling we conducted a hierarchical multiple regression analysis. Step 1 shows that high frequent cycling is related to being young, not having low income and presence of children at home. After controlling for demography, the Big Five personality factors explained a significant amount of unique variance in cycling. Conscientiousness and Agreeableness are positively related to cycling. The effect from the Big Five personality factors disappear when Environmental personality is entered in step 3. The Environmental personality is explaining a significant amount of unique variance (Adj. $R^2 = 7\%$, $p < .001$). Worth noticing, Environmental personality explain more on cycling than the demography and Big Five personality factors together (Table 5).

Table 4. Hierarchical regression models exploring how demography and personality predict use of public transportation ($N = 1005$)

Independent variables	Step 1: Demography	Step 2: Demography, Big Five	Step 3: Demography, Big Five, EP
Demography			
Gender	0.17***	0.16***	0.14***
Age	-0.18***	-0.17***	-0.16***
Income (Low)	0.06	0.05	0.05
Income (High)	0.05	0.05	0.05
Child in household	-0.08*	-0.07*	-0.08*
Personality			
Openness		0.06*	0.05
Conscientiousness		-0.07*	-0.08*
Extraversion		0.00	0.01
Agreeableness		0.12***	0.11***
Neuroticism		0.03	0.02
Environmental			0.09**
R^2_{Adj}	0.07***	0.09***	0.10***

Note. Entries for predictors are beta weights (i.e., standard regression coefficients). Abbreviations: *Big 5* Big Five personality factors; *EP* Environmental personality, *p<.05; ** p <.01; *** p <.001.

Table 5. Hierarchical regression models exploring how demography and personality predict cycling ($N = 997$)

Independent variables	Step 1: Demography	Step 2: Demography, Big Five	Step 3: Demography, Big Five, EP
Demography			
Gender	-0.06	-0.08*	-0.13***
Age	-0.13***	-0.11***	-0.10**
Income (Low)	-0.13***	-0.13***	-0.14***
Income (High)	-0.03	-0.02	-0.02
Child in household	0.08*	0.08*	0.05
Personality			
Openness		0.02	-0.02
Conscientiousness		0.10**	0.06
Extraversion		0.01	0.02
Agreeableness		0.09**	0.05
Neuroticism		0.05	0.02
Environmental			0.27***
R^2_{Adj}	0.05***	0.06***	0.13***

Note. Entries for predictors are beta weights (i.e., standard regression coefficients). Abbreviations: *Big Five* Big Five personality factors; *EP* Environmental personality; *EP* Environmental personality, *p<.05; ** p <.01; *** p <.001.

6. Discussion

6.1. General discussion of the findings

The present study examined the effects of demography and personality on travel habits (i.e. driving car, using public transportation and cycling). It is interesting that the individual characteristics in terms of demography and personality are almost the opposite between car drivers and people who use public transportations. Frequencies in car driving is positively related to male, age, presence of child in the household, while frequencies in usage of public transportation is negatively related to male, age and presence of child in the household. These findings are consistent with previous research (Johansson, Heldt & Johansson, 2006; Noble, 2005; Ruud & Nordbakke, 2005; Transportation analysis, 2017). Frequencies in car driving is negatively related to Openness and positively related to Conscientiousness, while usage of public transportation is positively related to Openness and negatively related to Conscientiousness. Conservatism is foremost related to a low degree of Openness, but also somewhat to a high degree of Conscientiousness (Chamorro-Premuzic, 2011; Larsen & Buss, 2005; Markowitz, Goldberg, Ashton & Lee, 2012). Therefore, it seems as people who drive car frequently are more conservative than people who use public transportation frequently. Perhaps, people need to be more creative and innovative to find a proper travel by public transportation, which fit the characters of people high on Openness? Perhaps, car is a more time efficient transportation mode compared to public transportations, and therefore motivated by people high on Conscientiousness? What we know is that Swedish car drivers view the car as an efficient mode in order to carry out everyday activities (Forward, 2014). Future research need to explore to what extent car usage might be motivated from the lifestyle of the drivers (e.g. tight time schedule) and to what extent it can be motivated from the personality of the drivers (e.g. conservative). Such information is important for psychologists, designers, transportation planners and policy makers in understanding different behaviors, especially if they want to change travel habits toward more sustainable options.

Not surprisingly, usage of public transportation is positively related to an Environmental personality, while car driving is negatively related to an Environmental personality. This finding is consistent with previous research that have found that a high degree of Environmental personality increases the likelihood of choosing an environmentally friendly mode (Johansson, Heldt & Johansson, 2006).

The effect of the Openness factor on public transportation seems to be explained by pro-environmental values (Table 4). People that use public transportation often also score especially high on Agreeableness (Table 4), which might be explained by a friendly attitude toward other travelers and that public transportation, compared to car, is more representative for an agreement in which all get along (compare section 2). Altruism relates to both high degree of Agreeableness and pro-environmental values. Perhaps, public transportation is a more altruistic transportation mode compared to car? We suggest that future research investigate the relation between degree of altruism and choice of transportation modes.

Our findings on the Big Five personality factors and usage of public transportation is not consistent with a previous research by Yazdanpanah and Hosseinlou (2017). They found that usage of public transportation is positively related to high degree of Extraversion and Neuroticism. The inconsistency might be explained by cultural differences between Sweden and Iran, and/or methodological differences in terms of scales and statistical analyses.

Bicycling is less explained by demography and the Big Five personality factors, compared to car driving and usage of public transportations. However, cycling is better explained by the Environmental personality than the other two. The Environmental personality is a better predictor of frequencies in cycling than any other predictors used in the present study. In contrast to previous research, we found that females cycle as much as male do. First in step two and three of our hierarchal regression analysis, when personality was entered, we found a gender effect, consistent with previous study – male cycle more than female (Statistic New Zealand, 2007). It is worth noticing that cycling is related to a high degree of Conscientiousness and a high degree of Agreeableness. Further, it is interesting that both of these personality factors are explained by the Environmental personality (Table 5). Our interpretation of these analysis is that females in Sweden (i.e. urban areas of Gothenburg) are cycling for environmental reasons more than males. We suggest more research on motives for males and females on cycling in order to understand what drives their behaviors.

6.2. Methodological considerations

The results of this study must be viewed in light of its limitations. The cross-sectional design in the present study only permits us to explore relationships and not causal effects. However, from a theoretical point of view it might be argued that personality factors cause the behavior and not the other way around (Chamorro- Premuzic, 2011; Larsen & Buss, 2005).

Web-based surveys allow the involvement of a large number of participants, and may easily be used in Sweden where almost everyone has access to the Internet in their home (The Internet Foundation in Sweden, 2017). However, one potential problem with our setting is that the sample is neither representative for Sweden nor the nine urban municipalities in the area of Gothenburg. Among our respondents, there was a higher proportion of males, older people and well-educated people (Martinsson et al., 2018).

Another limitation was the self-reporting of travel habits rather than measuring the actual behavior. To estimate actual behavior from introspective self-reports and questionnaire ratings cause familiar problems in the field of social and personality psychology (Baumeister, Vohs and Funder, 2007). We recommend future research to pay more attention to measures of actual travel habits, for instance through direct observations, automatic behavioral registrations, smart phones.

The Big Five personality factors were measured by a short scale, with substantial losses and clear psychometric disadvantages in comparison to a full-length scale (Ramstedt & John, 2007). Further, the Environmental personality scale can be questioned in terms of construct validity. However, the internal consistencies for the five items of the Environmental personality is acceptable (Cronbach alpha = 0.7). It is also worth noticing that the relations between the Big Five personality factors and the Environmental personality are consistent with previous research (Table 2; Hirsh, 2010; Hirsh & Dolderman, 2007; Swami et al., 2010).

Caution should be taken in generalizing the present results to other regions. Although the Big Five personality factors show universal characteristics, traveling habits, and the relationship between personality factors and travel habits, might differ across regions (Limanond, Niemeier, & Mokhtarian; 2005; Yazdanpanah & Hosseinlou, 2017). Therefore, we cannot comment on the extent to which present and previous results might have been influenced by regional culture characteristics, related to Sweden in general and the urban area of Gothenburg in particular. In the light of our findings, future studies can replicate the study in different regions and cultures that may behave differently.

Finally, the magnitudes of the relationship between the Big Five personality factors and travel habits reported in this study were quite modest.

We suggest that future research add a mixed-modes approach. In addition to cars, public transportation and bicycles as single modes of travel, it would be interesting to explore how demography and personality effects how these modes are combined. Although such combinations are well-studied in the logistic literature (see for instance SteadieSeifi et al., 2014), they have not garnered as much focus in relation to everyday travel habits among consumers (Hagberg & Holmberg, 2017).

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