Mode Choice and Mode Commitment in Commuters

Rathee D. Sivasubramaniyam[a1], Samuel G. Charlton[a], & Rebecca J. Sargisson[ab]

[a]University of Waikato, New Zealand

[b]University of Groningen, Netherlands

Keywords: Mode choice; mode commitment; motivating factors; intention; travel diary; daily commute.

Acknowledgements

This research was made possible by funding from the School of Psychology at the University of Waikato. We would like to thank our participants for taking part in our study and the organisations that assisted us in recruiting the participants for our study. We would also like to thank Jes Leov for her assistance in developing the questionnaire and travel diary.

Declarations of Interest: None

[1] Corresponding author. Address: Transport Research Group, School of Psychology, University of Waikato, Private Bag 3105, Hamilton, New Zealand. Tel.: +64 7 838 4466 (extn. 8040); fax: +64 7 858 5132. E-mail address: srd12@students.waikato.ac.nz (R. D. Sivasubramaniyam).

Highlights:

- Social norms significantly predicted car users' intentions to commute
- Ease-of-use significantly predicted active commuters' intentions to commute
- All commuters were committed to their mode choice for daily commute
- Drivers and pedestrians commuted using their mode most of the time
- Car passengers, bus users and cyclists commuted using a combination of several modes

Mode Choice and Mode Commitment in Commuters

Abstract

In New Zealand, like many other developed countries, a majority of trips (67%) involve the use of private cars, producing negative effects on the environment and public health. Interventions aimed to reduce car use can be successful if we not only understand the reasons car users drive but also why other commuters use more sustainable alternatives. Although a range of possible motivating factors have been previously identified in the literature, the significance of the present study was to address the question of whether these motivating factors interact with each other to influence commuters' intentions to choose a particular mode for their daily commute. A sample of commuters completed an online survey and a subset completed a 1-week travel diary later. Social norms were a significant predictor of drivers' and car passengers' intentions to use the car, whereas ease-of-use was a significant predictor of drivers' intentions to drive and active commuters' intentions to walk or cycle. All commuters had comparable ecological beliefs and mode-related status which were not related to their intentions to use their travel modes. Although all the commuters were committed to their mode choice for daily commute, drivers and pedestrians were more likely to use only their respective travel modes for daily commute, whereas passengers, bus users, and cyclists were more likely to use a combination of several modes. Future research might productively explore subtypes of car commuters and additional analysis techniques to identify ways of nudging car commuters to reduce their car use in favour of sustainable alternatives.

Keywords*:* Mode choice, mode commitment, motivating factors, intention, travel diary, daily commute

1.0 Introduction

A majority of commuter trips involve privately-owned cars and light vehicles and the number of vehicles and trips has continued to grow over time. The number of passenger cars in use globally has increased from 654 million in 2005 to 947 million in 2015 (OICA, 2015). In New Zealand, the number of passenger cars has increased since 2009 (3.1 million) with an accelerated growth from 2013 onwards (3.2 million) to the highest level ever recorded (3.8 million) in 2017. The amount of travel in passenger cars per capita has also continued to grow from 2012 with 8377 km of annual travel to 9265 km in 2017, also the highest ever recorded (Ministry of Transport, 2018). Unfortunately, the domination of car use over sustainable transport modes has negative consequences on the environment. Transportation is a major contributor of greenhouse gas emissions such as carbon dioxide (CO_2), nitrous oxide (N_20), and methane (CH_4) (Samet, 2007). Passenger cars account for 45% of the total energy use and gas emissions in global transportation (Holmberg, Anderson, & Erdemir, 2012), and 57.7% in New Zealand transportation (Ministry of Transport, 2018). Therefore, there is a widely acknowledged need to encourage commuters to reduce their car use and increase their use of more sustainable modes such as taking the bus, cycling, and walking.

Several researchers have examined how to encourage commuters to use more sustainable modes for their commute. Most of these attempts involved hard measures such as structural improvements by introducing bus-only lanes and cycling paths (e.g., Cervero et al., 2009; Jones and Sloman, 2003; Viegas and Lu, 2001) or service improvements by expanding the bus schedule and subsidising bus fares (e.g., Haque et al., 2013; Jones and Sloman, 2003). However, Garling and Schuitema (2007) suggested that hard measures may be more effective if combined with soft measures, such as providing motivational support to change commuting goals, requesting plans for how to change, and providing customised information. Studies from the US and the Netherlands (e.g., Cairns, Davis, Newson, & Swiderska, 2002; Shoup,

1997; Touwen, 1999) showed a 20- 25% reduction in car use when the researchers combined soft with hard measures, achieving reductions of only 5-15% when only hard measures were used (Cairns et al., 2008). To encourage commuters to change, policy makers and researchers must work together to develop an appropriate suite of measures that address commuters' emotions, attitudes, social norms, personal norms, perceived responsibility, and awareness of the negative impacts of car use (Steg, Geurs, & Ras, 2001).

Researchers have examined a wide range of influences on commuting modes that can broadly describe commuters as: habitual commuters, economic commuters, pleasure-seeking commuters, intentional commuters, and environmentally-conscious commuters. In practice, when commuters are faced with making the same trip every day, repetition in an invariant context may lead to a habitual and largely unconscious choice of travel mode. Repetition of a choice of mode leads to an increased likelihood of the same choice in the future (Bamberg, Ajzen, & Schmidt, 2003; Gardner, 2009; Ouellette & Wood, 1998). As with any habit, repetition may reduce conscious involvement in choosing a commuting mode. For example, involvement in a cognitively demanding task has been shown to make cyclists more likely to choose cycling as a transport mode, even after they had been asked not to choose cycling (as compared to cyclists who had not completed the task)(Aarts & Dijksterhuis, 2000). The demanding task diminished participants' mental resources available to select an alternative mode and they automatically selected their habitual travel mode. With extended repetition, choice of travel mode can become stereotyped and context-bound such that contextual cues in familiar situations can automatically trigger use of the habitual travel mode (Wood, Tam, & Witt, 2005), allowing alternative choices to be considered only in unfamiliar or changed situations such as moving to a new residence (Bamberg, 2006), or a temporary expressway closure (Fujii & Garling, 2003).

Prior to the development of prepotent habits, commuters may choose a travel mode based on economic factors, explicitly considering the costs (time and money) of different modes. The decision-making literature suggests that costs are more salient than gains, and that people tend to be loss averse when making decisions because losses are more salient than gains (Kahneman &Tversky, 1979). In a change from usual car dominance, commuters will choose public transport when traffic is congested because it will take less time than driving (Cervero, 2002; Corpuz, 2007). During off-peak hours, however, commuters were more likely to drive due to less frequent public transport schedules, and less traffic congestion (Corpuz, 2007). Congestion pricing policies have successfully leveraged commuters' loss aversion to reduce car use (Eliasson, Hultkrantz, Nerhagen, & Rosqvist, 2009; Washbrook, Haider, & Jaccard, 2006). Similarly, the costs of car use (maintenance and fuel) are important considerations for some commuters that choose to use the bus (Beirao & Cabral, 2007).

Researchers have also shown that commuters' choice of mode may be based on what makes them feel good or satisfied. Commuters may feel good because a mode fulfils their symbolic motives (e.g., sense of power, prestige, and status) and affective motives (e.g., autonomy, freedom, and control). For example, some commuters may choose to drive because they enjoy being in control of the vehicle and derive a sense of higher status when driving (Steg, Vlek, & Slotegraaf, 2001). Some cyclists find pleasure in improving their traffic skills and their fitness levels (Davies, Halliday, Mayes, & Pocock, 1997). Pedestrians often report a sense of relaxation and an absence of stress while walking during their commute (Anable & Gatersleben, 2005). Bus users report enjoying qualities specific to bus service such as accurate departure time, punctuality, reliability, and the opportunity to talk to other passengers (Ettema, Friman, Garling, Olsson, & Fujii, 2012; Friman, Edvarsson, & Garling, 2001).

For some commuters, the decision to use a particular mode is reasoned and intentional based on three social psychological factors: attitudes, subjective norms, and perceived behavioural control (PBC). Ajzen (1991) explored the relationship between intention and behaviour and proposed in the Theory of Planned Behaviour (TPB) that intentions to perform a behaviour should precede the behaviour itself. Ajzen (1991) suggested that it is possible to influence behaviour and intention through interventions that significantly affect one or more of the three psychological factors. Several researchers have attempted to use TPB to encourage commuters to use the public transport using an intervention aimed at influencing commuters' attitude, social norms, and PBC towards public transport (Bamberg, Ajzen, & Schmidt, 2003; Bamberg, Rolle, & Weber, 2003). After receiving a prepaid bus ticket either alone (Bamberg, Azjen, & Schmidt, 2003) or combined with an information pack (Bamberg, Rolle, & Weber, 2003), students were more likely to use public transport and had more positive attitudes, positive subjective norms, higher PBC, and stronger intentions to use public transport. Therefore, interventions targeted at influencing commuters' attitudes, subjective norms, PBC, and intentions can be successful.

Finally, some commuters choose travel modes based on their pro-environmental attitudes. Environmentally conscious commuters may also be economic commuters to the extent they are loss averse with regard to the negative impacts that certain travel modes have on the environment (Flamm, 2009; Thogersen & Olander, 2006). Pro-environmental commuters regularly perform pro-environmental behaviours such as recycling and purchasing organic items. These behaviours are consistent with more frequent use of public transport and reducing car use (Atasoy, Glerum, & Bierlaire, 2012; Roberts, Popli, & Harris, 2018; Thogersen & Olander, 2006; Whitmarsh & O'Neill, 2010). To the degree that pro-environmental attitudes are seen as social norms, commuters' transport choices may also be shaped by these social and personal norms (Hunecke, Blobaum, Matthies, & Hoger, 2001).

As can be seen in this brief review, there are a range of different types of considerations that may influence the commuting modes chosen by different types of commuters. Although there are different views on the degree to which these various considerations influence commuters to choose their travel modes, researchers have tended to examine the factors in isolation, such that each researcher focused on the role of just one or a very few factors influencing commuters' mode choices. Conceptually this may be problematic both because different types of commuters may respond to different influences, and also because commuters may be influenced by multiple factors simultaneously. The present study sought to address this issue by comparing the degree to which commuters' intentions to use their typical travel mode is influenced by a wide range of factors.

We wanted to directly compare the full range of factors that have been suggested to have an influence on commuters' mode choices. Specifically, we identified measures to determine the relative influences of habits, economic decision-making, social norms, status, pleasure, ease-of-use, and ecological beliefs. Our motivation for doing this revolved around the conceptual question of whether these seven potential motivating factors interact with each other to influence commuters' intentions to choose a particular mode for their daily commute. As alluded to earlier, the different sorts of findings previously reported in the literature opens the possibility that users of different commuting modes may have different factors motivating their intentions. We also expected that for some commuters, only one factor may be influential whereas for other commuters, several factors may be influential, an aspect that has not previously been explored to any great degree.

In order to explore the relative influence of these different types of motivational factors we recruited a wide range of different types of commuters; those who regularly chose to drive their private car, use the bus, cycle, walk, or commute as a car passenger, across a wide range of demographic characteristics. We asked these commuters to complete an online

survey and then selected a subset of them to complete a 1-week travel diary in which they provided details of their daily commute (e.g., trip duration, trip distance, and mode choice). We hoped to provide a fuller picture of how the range of underlying considerations interact to influence commuters' intentions to choose a particular travel mode for their regular trips to work and school.

2.0 Method

The methodology for the present research involved recruiting a sample of commuters to complete an online survey followed by asking a subset of the respondents to complete a 1-week travel diary in which they provided details of their daily commute. The data collection for both the online survey and travel diary took place in New Zealand between March and May 2018 (Autumn in New Zealand).

2.1 Participants

We recruited respondents 16 years of age and older through notices placed on the intranets of various New Zealand organisations as well as on social media, news media, and through word-of-mouth. Five hundred and eighty-five respondents completed the online survey. The majority of them resided in a single region of New Zealand. We excluded respondents who lived in other regions due to the low number of responses and the availability of idiosyncratic travel modes unique to those areas within New Zealand (e.g., train and Uber). We also excluded respondents who did not use any of the five commuting modes of interest to us. The final regional sample of 313 respondents consisted of 239 women and 74 men, with a wide age range (Table 1). We categorised respondents as drivers, car passengers, bus users, cyclists, or pedestrians based on their responses to one of the questions in the survey. The majority were drivers (n = 191), followed by pedestrians (n = 44), cyclists (n = 32), bus users (n = 24), and car passengers (n = 22; Table 1).

We invited all of the survey respondents to indicate their willingness to take part in completing an online travel diary. Of the 210 respondents who expressed their interest, we accepted the first 10 participants for each commuting mode (i.e., drivers, car passengers, bus users, cyclists, and pedestrians). Three of these participants did not fully complete their travel diary and the final sample consisted of 47 participants (41 female). Specifically, there were 10 drivers, 8 car passengers, 9 bus users, 10 cyclists, and 10 pedestrians in the final sample of commuters completing a travel diary.

Table 1

Demographic Characteristics of Commuters and Modes for Daily Commute (n = 313).

		Percentage of respondents within each commuter group (%)				
	n	**Drivers (n=191)**	**Passengers (n=22)**	**Bus users (n=24)**	**Cyclists (n=32)**	**Pedestrians (n=44)**
Gender						
Male	74	20.94	9.09	20.83	56.28	20.45
Female	239	79.06	90.91	79.17	43.75	79.55
Age						
16-24 years	84	21.47	45.45	29.17	6.25	54.55
25-34 years	63	21.99	22.73	20.83	12.50	15.91
35-44 years	67	21.99	18.18	29.17	21.88	15.91
45-54 years	61	20.42	4.55	12.50	40.63	11.36
55-64 years	34	12.57	9.09	8.33	15.63	2.27
65-74 years	4	1.57	-	-	3.13	-
75 years or over	-	-	-	-	-	-
Level of education						
No secondary school qualification	3	1.05	-	-	-	2.27
High school qualification or equivalent	84	22.51	40.91	33.33	9.38	47.73
Tertiary diplomas or certificate	58	20.42	13.64	29.17	9.38	13.64
Bachelor degree or Bachelor with Honours degree	112	42.41	9.09	20.83	40.63	25.00
Master degree or higher	56	13.61	36.36	16.67	40.63	11.36
Occupation*						
Full time student	97	21.99	54.55	37.50	15.63	65.91
Part time student	27	10.47	4.55	12.50	6.25	2.27
Full time worker	183	65.97	40.91	50.00	68.75	31.82
Part time worker	56	19.37	18.18	12.5	18.75	13.64
Casual worker	16	4.71	13.64	4.17	-	6.82
Unemployed or looking for work	12	2.09	4.55	4.17	-	13.64
Looking after home or family	21	8.90	13.64	-	3.13	-
Retired	2	1.05	-	-	-	-

Note. *Respondents could select any option that applied to them. Blanks indicate no response.

Table 1 (continued).

Household type						
Person living alone	24	7.33	-	4.17	6.25	15.91
Married/de facto couple	68	19.90	31.82	8.33	43.75	15.91
Other adults only (e.g., flatmates)	60	17.28	9.09	8.33	12.50	43.18
Family (including extended) with children	94	31.41	31.82	54.17	25.00	13.64
Family with adults only	49	15.71	27.27	25.00	12.50	6.82
Single adults living children	12	5.76	-	-	-	2.27
Other	6	2.62	-	-	-	2.27
Annual household income						
Less than $50,000	82	18.85	27.27	33.33	9.38	65.91
$50,000 to $99,999	113	39.97	36.36	37.50	43.75	13.64
$100,000 to $149,999	65	23.56	22.73	8.33	21.88	13.64
$150,000 or more	48	16.23	9.09	20.83	25.00	4.55
Average daily travel time						
Less than 10 minutes	24	4.19	18.18	-	12.50	18.18
10-19 minutes	79	27.23	22.73	8.33	25.00	27.27
20-29 minutes	69	20.42	22.73	12.50	28.13	29.55
30-39 minutes	39	13.61	4.55	20.83	12.50	6.82
40-49 minutes	37	13.09	9.09	25.00	6.25	4.55
50-59 minutes	24	6.28	13.64	16.67	6.25	6.82
60 minutes or over	41	15.18	9.09	16.67	9.38	6.82
Average daily travel distance						
Less than 5 kilometres	64	8.90	27.27	8.33	25.00	72.73
5-10 kilometres	78	20.42	31.82	29.17	43.75	25.00
11-15 kilometres	51	18.32	9.09	29.17	18.75	2.27
16-20 kilometres	39	15.71	4.55	20.83	9.38	-
21-25 kilometres	22	10.99	-	-	3.13	-
26-30 kilometres	13	5.76	4.55	4.17	-	-
31-35 kilometres	7	2.62	4.55	4.17	-	-
36-40 kilometres	4	1.05	4.55	4.17	-	-
More than 40 kilometres	34	16.23	13.64	-	-	-

Note. *Respondents could select any option that applied to them. Blanks indicate no response.

2.2 Materials and Procedure

The online survey included questions across 11 topic areas or sections, arranged in a hierarchical structure. Each respondent received a minimum of 10 questions and, depending on their answers, a maximum of 198 questions. The question formats were a mix of check all that apply and forced-choice (see full question set in Appendix A). Of the 198 questions, two were filter questions (commuter mode type) determining the presentation of subsequent questions, ten were questions on demographic characteristics, four were questions on travel characteristics, and 183 were questions corresponding to the various motivating factors (for additional details, see Appendix A).

For the first section, we asked respondents to rate the difficulty of using each of the commuting modes available to them using a 5-point scale (1 = not difficult to 5 = very difficult) (adapted from Berman & Cheng, 2001) Next, we asked respondents two questions on the perceived status associated with the commuting modes on a 7-point scale (1 = *not at all* to 7 = *very much*) (adapted from Nelissen and Meijers, 2011). In the third section, we asked eight items (adapted from Bamberg, Ajzen, and Schmidt, 2003) in which respondents rated their attitudes, subjective norms, PBC, and intentions to use each of the commuting modes available to them. For these items, a 5-point semantic differential response scale was used.

For the next two sections (4 and 5), we asked questions pertaining only to respondents' answers to the filter question "Which of these modes have you used for daily commute to and from work or school?" In Section 4 respondents rated their satisfaction with using each commuting mode using the 9-item Satisfaction with Travel Scale (STS; Ettema et al., 2011), on a 9-point semantic differential scale. The Cronbach's alpha reported by Ettema et al. (2011) ranged from .84 to .91 across the three subscales of the STS. In Section 5, respondents rated the perceived autonomy and prestige associated with each mode across five

5-point Likert scale items (1 = *strongly disagree* to 5 = *strongly agree*) (adapted from Ellaway et al., 2003).

As an indication of the role of habit in their choice of commuting mode, Section 6 asked the respondents their frequency of using the travel modes for 10 destinations (e.g., going to the supermarket, visiting a friend in a nearby town) (adapted from Verplanken, et al., 1994) Response-Frequency (RF) measure. Section 7 measured pro-ecological beliefs using the 15 item New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). The NEP scale asks respondents to rate their agreement with a series of statements (on a 5-point Likert scale), seven of which are reverse scored to arrive at an overall score indicative of pro environmental beliefs. The NEP scale has a Cronbach's alpha of .80 (Dunlap et al., 2000). Section 8 contained nine 5-point Likert scale items from the Maximising Tendency Scale (MTS; Diab et al., 2008) to assess the extent to which the respondents try to optimise their decisions, or are willing to satisfice, making decisions that are just good enough. Diab et al. (2008) reported a Cronbach's alpha of .80 for this scale.

Section 9 presented the Risk-Taking Index (RTI; Nicholson et al., 2005), designed to measure respondents' tendencies to engage in or avoid risky behaviour (including driving fast and cycling without a helmet) across 28 items (5-point scale, 1 = *never* to 5 = *very often*). The Cronbach's alpha reported by Nicholson et al. (2005) for all domain subscales ranged from .80 to .88. In Section 10, respondents provided details of their commute such as estimates of commuting time and distance and in Section 11, they provided details of their demographic and socio-economic characteristics (e.g., gender, age, occupation, etc., see Appendix A).

In the travel diary, we asked respondents for details of each leg of all of their trips taken in a week. They completed one diary entry per day for 7 consecutive days (Monday to Sunday). We first asked how many trip legs (i.e., journeys between stops) they made on that

day. The diary format allowed for a possible 15 trip legs each day. If a respondent made more than 15 trip legs, we asked them two more questions on the exact number of trip legs they made in that day and the mode they used most often for those trip legs. For each trip leg, we asked respondents 16 questions on their commute details such as their starting location, destination, estimated distance, estimated time, purpose, and the travel mode used for that trip leg. Out of the 16 questions, three were open-ended and 13 were multiple choice questions.

2.3 Analysis

To assess the role of habit we used the response frequency items and summed the number of times out of 10 that respondents chose their typical commuting mode for the destinations listed in the RF items. The possible range of scores was 0 (*weak*) to 10 (*strong*) habitual use. These scores were normally distributed with majority of the scores lying close to the mean (M=5.45, 95% CI [5.13, 5.76], range=9.00).

As a measure of respondents' economic decision-making tendency, we averaged their scores on the RTI and the MTS. Our preliminary analysis indicated a negative correlation between scores on the RTI and the MTS. Therefore, we reverse-scored the items on the MTS before averaging the scores. The possible range of scores was 1 (*low*) to 5 (*high*) economic decision-making tendency. The scores of economic decision-making tendency were normally distributed (M=1.91, 95% CI [1.88, 1.94], range=3.12).

To measure respondents' social norms towards their travel modes, we averaged their scores on the two social-norm items from Section 3 relevant to their mode choice. The two items were "Most people who are important to me would support the use of [travel mode] for daily commute next time" and "Most people who are important to me think that I should use [travel mode] for daily commute next time". The possible range of scores was from 1 (*weak*) to 5 (*strong*) social norms. The data were negatively skewed, such that most of the commuters had positive social norms associated with their typical mode (M=4.21, 95% CI

[4.10, 4.31], range=4.00). We obtained separate Cronbach's alpha values for each commuter: drivers=.78, car passengers=.84, bus users=.97, cyclists=.87, and pedestrians=.90).

As a measure of respondents' perceived status from using their travel modes, we averaged their scores on the two perceived status (Section 2) and the three perceived prestige (Section 5) items relevant to their mode choice. The possible range of scores was from 1 (*low*) to 5 (*high*) perceived status. Commuters' scores of perceived status were normally distributed (*M*=2.55, 95% CI [2.45, 2.64], range=4.14).

To measure respondents' derived pleasure from using their travel modes, we averaged their scores on the two attitude (Section 3), two perceived autonomy (Section 5), and nine STS (Section 4) items relevant to their mode choice. We converted their average STS scores to a 5-point Likert scale to maintain consistency with the attitude and perceived autonomy scales. Respondents' possible range of scores was from 1 (*not pleasurable*) to 5 (*very pleasurable*). The ratings of pleasure were normally distributed (*M*=3.70, 95% CI [3.63, 3.77], range=3.12). We also obtained separate Cronbach's alpha values for each commuter: drivers=.22, car passengers=.59, bus users=.80, cyclists=.31, and pedestrians=.50.

We averaged respondents' scores on the two items for PBC (Section 3) and the perceived difficulty (Section 1) item relevant to their mode choice to obtain their perceived-ease-of-using their respective travel modes. The two PBC items were "For me to use [travel mode] for daily commute next time would be 1 (*difficult*) or 5 (*easy*)" and "My freedom to use [travel mode] for daily commute next time is 1 (*low*) or 5 (*high*)". We reverse-coded respondents' perceived difficulty scores because the items in the perceived difficulty measure ranged from low perceived difficulty (i.e., easy) to high perceived difficulty (i.e., not easy), whereas the items in the PBC ranged from low PBC (i.e., not easy) to high PBC (i.e., easy). The possible range of scores for the perceived-ease-of-use was from 1 (*not easy to use*) to 5 (*very easy to use*). These scores were negatively skewed, such that most of the commuters

perceived it was easy for them to commute using their usual mode (*M*=4.72, 95% CI [4.66, 4.78], range=2.50). We obtained separate Cronbach's alpha values for each commuter: drivers=.63, car passengers=.76, bus users=.66, cyclists=.53, and pedestrians=.52.

To measure respondents' ecological beliefs, we averaged their scores on the 15 items of the NEP (Section 7) after reverse-scoring the seven even-numbered items so that high scores on these items corresponded to pro-ecological beliefs. The possible range of scores was from 1 (*negative*) to 5 (*positive*) ecological beliefs. The data were normally distributed (*M*=3.77, 95% CI [3.70, 3.83], range=2.73.

We also measured respondents' intentions to use their respective travel modes as an outcome variable in the regression analyses. We measured their intentions by averaging their scores on the two intention items from Section 3: "My intention to use [travel mode] for daily commute next time is 1 (*weak*) or 5 (*strong*)" and "I intend to use [travel mode] for daily commute next time" to which respondents answered 1 (*unlikely*) to 5 (*likely*)". The possible range of scores for intention to use their travel mode was from 1 (*weak*) to 5 (*strong*). The intention scores were negatively skewed, such that most commuters had strong intentions to choose their usual mode for their next commute (*M*=4.69, 95% CI [4.61, 4.77], range=4.00. Where we identified missing values (21 responses) we replaced them with the respective mean scores of each commuter type for that particular measure to maintain the largest possible data set.

To examine respondents' commitment towards their travel mode for their daily commute, we computed their percentages of total number of work or school trip legs and non-work or non-school trip legs involving their choice of travel mode over the week. In each daily entry, when a respondent chose either work or education as the purpose of their trip, we considered their response as a 'work or school trip leg' and considered every other trip purpose as 'non-work or non-school' trip leg. For bus users, we excluded 'change-to-other-

mode' trip legs (i.e., walking to and from bus stops) from their total number of trip legs in a week to avoid a low percentage of work or school trip legs involving bus use. High percentages indicate strong commitment towards their travel mode (i.e., large number of trip legs involving their travel mode), whereas low percentages indicate weak commitment. For work or school trip legs, we found a mean of 78.33 (95%CI [70.60, 86.05], range=100) and for non-work or non-school trip legs, we found a mean of 49.88 (95%CI [42.63, 58.13], range=100). The commitment data for work or school trip legs were negatively skewed (i.e., many commuters were highly committed to their usual mode) but the commitment data for non-work or non-school trip legs were normally distributed.

3.0 Results

3.1 Motivating factors predicting intentions to use travel mode for daily commute

In order to identify the motivating factors predicting intentions to use particular travel modes we carried out a multiple regression analysis for each type of commuter. Our regression analyses showed that the social norms measure was a significant predictor of drivers' and passengers' intentions to use a car for their commute. Perceived ease-of-use was a significant predictor of drivers', cyclists' and pedestrians' intentions (to drive, cycle, and walk, respectively) and pleasure was also a significant predictor of pedestrians' intentions to walk for their daily commute. No other motivating factors significantly predicted the commuters' intentions to use their respective modes and none of motivating factors predicted bus users' intentions to use the bus for their daily commute (Table 2).

Table 2

Parameter Values and Coefficients of Predictors from Multiple Linear Regression of Commuters' Intentions to Use Their Travel Modes

	Coefficients					Analysis of Variance				
Predictor variables	*b*	*SE*	95% CI for *b*	*β*	*p*[b]	*F*-value	*df*	*p*	R^2	adj. R^2
Drivers (n = 191)						5.87	7, 183	.000	.18	.15
Constant (Intercept)	2.67	.64	1.40, 3.93	-	.000					
Social norms	.21	.04	.13, .30	.36	.000					
Ease of use	.19	.09	.01, .37	.15	.04					
Habit	.02	.02	-.01, .05	.08	.23					
Ecological beliefs	.08	.07	-.06, .22	.08	.26					
Pleasure	.01	.07	-.12, .15	.01	.85					
Economic decision-making	-.07	.14	-.35, .20	-.04	.61					
Perceived Status	-.02	.05	-.12, .08	-.04	.64					
Passengers (n = 22)						4.12	7, 14	.01	.67	.51
Constant (Intercept)	-.66	2.32	-5.63, 4.32	-	.78					
Social norms	.67	.29	.04, 1.31	.63	.04					
Pleasure	.35	.40	-.50, 1.20	.17	.39					
Ease of use	.19	.32	-.49, .88	.13	.56					
Ecological beliefs	.60	.46	-.84, 1.15	.10	.74					
Economic decision-making	.11	.59	-1.16, 1.39	.04	.85					
Perceived Status	-.13	.29	.04, 1.31	-.09	.67					
Habit	-.09	.11	-.32, .15	-.21	.43					
Bus users (n = 24)						1.84	7, 16	.15	.45	.20
Constant (Intercept)	1.53	2.41	-3.58, 6.63	-	.54					
Social norms	.26	.19	-.13, .66	.37	.18					
Pleasure	.46	.42	-.43, 1.35	.33	.29					
Economic decision-making	.84	.85	-.96, 2.64	.23	.34					
Habit	.01	.10	-.21, 22	.01	.95					
Ease of use	-.03	.30	-.65, .60	-.02	.93					
Perceived Status	-.10	.27	-.68, .47	-.08	.71					
Ecological beliefs	-.22	.34	-.93, .49	-.14	.52					

Table 2 (continued).

	Coefficients					Analysis of Variance				
Predictor variables	*b*	*SE*	*95% CI for b*	*β*	*p*[b]	*F-value*	*df*	*p*	R^2	*adj.* R^2
Cyclists (n = 32)						3.27	7, 24	.01	.49	.34
Constant (Intercept)	2.07	1.78	-1.61, 5.74	-	.26					
Ease of use	.86	.25	.35, 1.37	.64	.002					
Ecological beliefs	.10	.19	-.28, .49	.09	.60					
Habit	.02	.05	-.08, .12	.07	.68					
Social norms	-.03	.14	-.31, .26	-.03	.86					
Perceived Status	-.05	.13	-.32, .22	-.06	.72					
Pleasure	-.18	.28	-.75, .40	-.10	.53					
Economic decision-making	-.36	.34	-1.07, .35	-.16	.30					
Pedestrians (n = 44)						11.33	7, 36	.000	.69	.63
Constant (Intercept)	-1.57	1.10	-3.79, .66	-	.16					
Ease of use	.78	.25	.28, 1.29	.46	.004					
Pleasure	.61	.19	.21, 1.00	.40	.004					
Habit	.08	.06	-.04, .21	.13	.19					
Perceived Status	.07	.11	-.15, .30	.07	.50					
Economic decision-making	.02	.31	-.61, .66	.01	.94					
Social norms	.01	.15	-.30, .31	.01	.96					
Ecological beliefs	-.10	.14	-.40, .19	-.07	.47					

3.2 Differences in motivating factors between commuters

Another way of looking at the relative influence of the seven motivating factors is to compare them across the different commuter types. To do this, we conducted a one-way, between-subject, ANOVA for each factor, where the independent variable was commuter group with five levels (drivers, passengers, bus users, cyclists, and pedestrians). From Table 3, we see that commuters were significantly different from each other in terms of the ease-of-use, pleasure, economic decision-making, and habit factors. They were not significantly different from each other in terms of the social norms, perceived status, and ecological beliefs factors.

All the commuters had medium to high scores for the social norms measure. For the ease-of-use factor, post-hoc pairwise comparisons (Games-Howell) showed that drivers perceived using their travel mode to be easier than car passengers perceived theirs. Post-hoc pairwise comparisons (Bonferroni-adjusted) for the ANOVA on derived pleasure from using travel modes showed that cyclists' found using their travel mode (i.e., cycling) more pleasurable than all the other commuters did. Passengers found using their travel mode (i.e., car as passenger) more pleasurable than drivers did, whereas pedestrians found using their travel mode (i.e., walking) more pleasurable than bus users did.

As for habit, post-hoc pairwise comparisons (Games-Howell) demonstrated that drivers have a stronger habit of using their travel mode than bus users, cyclists, and pedestrians do. Passengers have a stronger habit of using their travel mode than bus users and pedestrians do, whereas cyclists have stronger habit of cycling than pedestrians do towards walking. Although the ANOVA for economic decision-making indicated an overall significant difference, there were no pairwise differences. All commuters had low scores for the perceived status factor and high scores on the ecological beliefs factor.

Table 3

Parameter Values and Coefficients of Each Factor from the one-way ANOVA

		Coefficients			Analysis of Variance		
Motivating Factors	*N*	*Mean*	*SE*	95% CI	*F*-value	*p*	η^2
Social Norms					2.24*	.07	.03
Pedestrians	44	4.49	0.12	4.25, 4.73			
Drivers	191	4.24	0.07	4.11, 4.37			
Cyclists	32	4.09	0.17	3.76, 4.42			
Passengers	22	3.94	0.20	3.54, 4.34			
Bus users	24	3.85	0.27	3.33, 4.37			
Ease of Use					4.55*	.003	.10
Drivers	191	4.82	0.03	4.76, 4.88			
Pedestrians	44	4.69	0.07	4.55, 4.83			
Cyclists	32	4.68	0.10	4.49, 4.87			
Bus users	24	4.39	0.16	4.08, 4.70			
Passengers	22	4.36	0.14	4.08, 4.64			
Pleasure					27.10	.000	.35
Cyclists	32	4.49	0.07	4.35, 4.63			
Pedestrians	44	4.00	0.08	3.83, 4.17			
Passengers	22	3.92	0.10	3.72, 4.12			
Bus users	24	3.51	0.13	3.25, 3.77			
Drivers	191	3.49	0.04	3.41, 3.57			
Habit					72.02*	.000	.62
Drivers	191	6.74	0.17	6.40, 7.08			
Passengers	22	5.27	0.51	4.28, 6.26			
Cyclists	32	4.03	0.42	3.20, 4.86			
Bus users	24	2.83	0.39	2.07, 3.59			
Pedestrians	44	2.40	0.20	2.01, 2.79			
Economic decision-making					2.55	.04	.03
Drivers	191	1.95	0.02	1.91, 1.99			
Cyclists	32	1.91	0.17	1.58, 2.24			
Pedestrians	44	1.86	0.12	1.62, 2.10			
Passengers	22	1.84	0.07	1.71, 1.97			
Bus users	24	1.79	0.27	1.27, 2.31			
Status					2.17	.07	.03
Pedestrians	44	2.85	.13	2.59, 3.10			
Cyclists	32	2.68	.16	2.36, 3.00			
Drivers	191	2.48	.06	2.36, 2.60			
Passengers	22	2.44	.15	2.12, 2.75			
Bus users	24	2.41	.15	2.09, 2.73			
Ecological Beliefs					1.36	.25	.02
Drivers	191	4.82	0.03	4.76, 4.88			
Pedestrians	44	4.69	0.07	4.55, 4.83			
Cyclists	32	4.68	0.10	4.49, 4.87			
Passengers	22	4.36	0.14	4.08, 4.64			
Bus users	24	4.39	0.16	4.08, 4.70			

Note: *We used Welch's F as the ANOVA statistic because the assumption of homogeneity of variance was violated. Where we used Welch's F, we used the Games-Howell post-hoc analysis for pairwise comparisons.

3.3 Mode commitment

Another interesting perspective on commuters' use of a particular mode was revealed by examining the degree to which they used one mode, and only that mode for their travel; in other words their commitment to a particular travel mode. So, using the 1-week travel diary data, we identified the commuters' percentage of trip legs involving their travel mode and alternative modes. We considered commuters who used their travel mode most frequently in a week to have higher commitment towards their travel mode. Interestingly, we found that all commuters were committed to their travel modes because they used their respective modes most frequently compared to alternative modes for daily commute.

Figure 1 shows the five commuter groups' mean percentages of work or school trip legs involving their respective mode choice. Drivers drove most of the time in the week (92.47%) and walked for the remaining trip legs (7.53%). Passengers used the car as a passenger most of the time (60.94%), followed by walking (29.21%) and taking the bus (4.29%). Most of pedestrians' trip legs involved walking (88.00%) and the rest involved driving (8.67%) and using the car as passenger (3.33%). Bus users used the bus frequently (68.89%) and cyclists cycled for most of their trip legs (69.08%). Car passengers, bus users, and cyclists used all other modes occasionally, whereas drivers and pedestrians used their travel modes for their most of their daily commute trips.

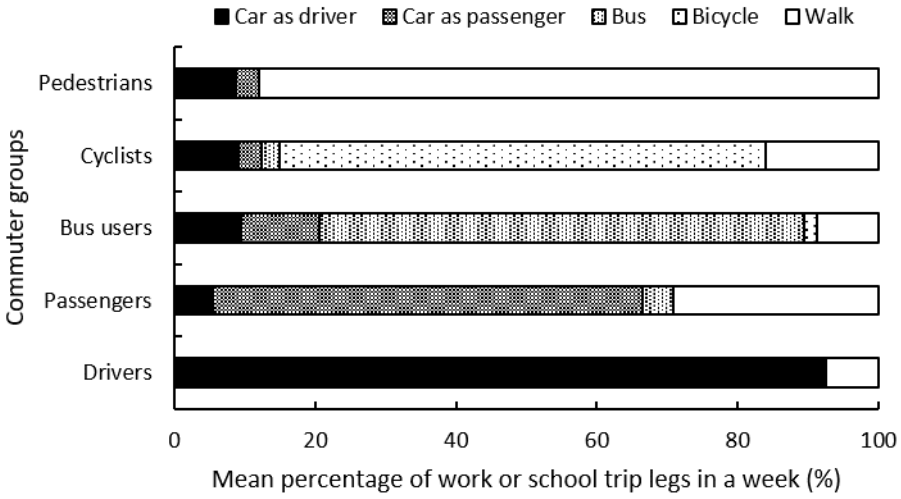

Figure 1. Mean percentages of each commuter groups' work or school trip legs using various modes over a week.

We then wondered whether commuters' commitment levels to their mode choice would be different for non-daily commute trips (i.e., non-work or non-school trips). Therefore, we computed each commuter groups' mean percentages of non-work or school trip legs involving their travel mode in a week. Figure 2 shows that all commuters, except car passengers, used their travel mode more often for work or school trip legs compared to non-work or non-school trip legs. However, the repeated measures *t*-tests (Table 4) found that the differences were only significant (Bonferroni-adjusted) for bus users, cyclists, and pedestrians, such that these commuters were more likely to use their travel modes for daily commute trips rather than non-daily commute trips. Drivers and car passengers were equally likely to use the car for both types of trips.

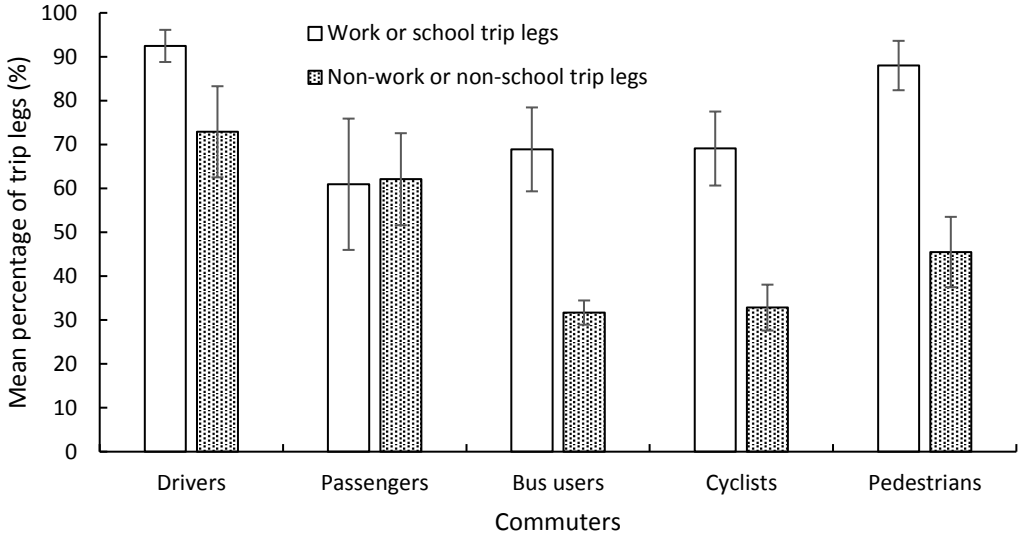

Figure 2. Mean percentages of respondents' work or school trip legs and non-work or non-school trip legs using their choice of travel mode over a week for five commuter groups. The error bars represent the standard error of the mean.

Table 4

Parameter Values and Coefficients for Repeated Measures t tests Comparing Percent of Trip Legs for Daily vs. Non-daily Commute

	Percent of work or school trip legs		**Percent of non-work or school trip legs**				
	M	95% CI	*M*	95% CI	*t*	*p*	*d*
Drivers	92.47	85.30, 99.64	72.90	52.86, 92.92	1.58	.149	.79
Car passengers	60.94	31.63, 90.25	62.10	23.19, 64.27	-.12	.905	.04
Bus users	68.89	50.17, 87.61	34.15	26.29, 37.11	3.78	.005*	1.76
Cyclists	69.08	52.56, 85.60	32.83	22.58, 43.08	5.75	.000*	1.63
Pedestrians	88.00	76.98, 99.02	45.50	29.8, 61.20	5.24	.001*	1.94

*Significant based on Bonferroni-adjusted (.01) *p*-value.

4.0 Discussion

Strongly committed commuters are less likely to use other travel modes for any of their trips (Simma & Axhausen, 2001). In our study, drivers were the most committed

towards their travel mode, such that they drove their car for the greatest proportion of their daily trips. Few drivers in our study used other modes, with the exception of a small percentage of trip legs that involved walking. Buehler and Hamre (2016) also reported that walking was the only non-car mode used by the majority of car users. Other researchers have described commitment as either mono-modal when only one travel mode is used for most trips or multi-modal when multiple travel modes are used (Heinen & Chaterjee, 2015; Kuhnimhof, Chlond, & Von der Ruhren, 2006; Nobis, 2007). In these terms, Kuhnimhof et al. (2006) reported that car drivers can usually be characterised as mono-modal.

Like drivers, the pedestrians in our study also showed high commitment and used fewer travel modes compared to car passengers, bus users, and cyclists who used a variety of modes for their trips. Certainly part of this pattern may be due to situational constraints, such as when bad weather causes cyclists to use weather-sheltered modes (i.e., car or bus), or very short trip distances that occasion walking. Similarly, non-routine trips often involve a range of destinations (e.g., church, supermarket, gym) encouraging the use of a variety of travel modes. In other words, non-routine or unfamiliar trips may occasion alternative mode choices to be considered (Carrel, Vij, & Walker, 2011; Wood et al., 2005).

Looking beyond mode commitment, our results indicated that there are different motivating factors underlying different types of commuters' mode choices. Social norms was the best predictor of drivers' and passengers' intentions. It is also noteworthy that there were no significant differences in the social norm scores of any of the commuter types, reporting relatively neutral to positive social norms for their respective travel modes. Previous studies have found that family members and friends can be a source of inspiration to drivers through observations of car use (Jopson, 2004; Noblet, Thogersen, & Teisl, 2014) or conversations around car use (Haustein, Klockner, & Blobaum, 2009). This was also the case for car passengers (Teal, 1987) and pedestrians (Schneider, 2011). Therefore, interventions aimed to

influence the attitudes of commuters towards sustainable travel modes, could also influence the attitudes of the people in commuters' social networks (e.g., family members, friends, co-workers, and neighbours).

Ease-of-use was a significant predictor of drivers', cyclists', and pedestrians' intentions to use their travel modes. In contrast to social norms, there were significant differences between the commuter groups in terms of their perceptions of ease of using their modes, with drivers reporting the highest score for this factor. Drivers may find it convenient to use the car because they can carry out their daily responsibilities (e.g., transport children from day care, and shopping) (Maxwell, 2001), and park their cars easily at places that offer convenient parking such as workplaces, universities, and shopping malls (Mackett, 2003). The cyclists in our study also had high scores for this factor. Cyclists in previous studies have demonstrated positive self-efficacy towards cycling (De Gues, De Bourdeaudhuij, Jannes, & Meeusen, 2008; Venkatesh & Davis, 1996) and some claimed that having the necessary facilities that complemented their cycling behaviour, such as bicycle lockers and shower rooms made it easier for them to cycle to work or school (Dickinson, Kingham, Copey, & Houghie, 2003; Hunt & Abraham, 2007). The pedestrians in our study also reported high perceived ease-of-use, possibly a consequence of the shorter distances of their commutes, an average of less than 5 km a day (Table 1).

Pedestrians' pleasure from walking was also a significant predictor of their intentions to walk for their daily commute. Indeed this intrinsic pleasure in the activity has been previously shown to be important to many pedestrians (Gatersleben & Uzzell, 2007). As with the ease-of-use ratings, we found significantly different pleasurability ratings for the different commuter groups. Cyclists were more likely to find using their travel mode pleasurable than all other commuters. Cycling not only provides physical and mental health benefits, but it also provides fun, such that cyclists can enjoy the view, breathe fresh air, and feel

accomplished when they have gone on a long ride (Schneider, 2011). Drivers had the lowest score on this measure, albeit their mean score indicated neutral feelings from driving. One option for encouraging drivers to consider other mode choices may thus be to emphasise the less pleasurable aspects of car use (e.g., traffic congestion and stress) and make the pleasurable aspects of active commuting more apparent (Hennessy & Wiesenthal, 1999; Koslowsky, Kluger, & Reich, 1995).

Although previous researchers have observed economic influences on mode choice decisions (Beirao & Carbral, 2007; Cervero, 2002; Corpuz, 2007) we were unable to detect any significant influences in our study and there were no appreciable differences between commuter types on these measures. We also examined status as a predictor of commuters' intentions to use their travel modes. Based on previous research that identified status as an important aspect in car use (e.g., Steg et al, 2001; Steg, 2005), we expected to see an influence of perceived status on commuters' intentions to use their travel modes, particularly in drivers and car passengers. All the commuters in our study had comparably low scores on the perceived-status measure, and this factor did not predict any of their intentions to use their respective travel modes.

Although there is a general consensus that pro-environmental attitudes or beliefs are associated with sustainable travel behaviour (Atasoy et al., 2012; Kahn & Morris, 2009), our measure of ecological beliefs was not a significant predictor of any of the five types of commuters' intentions to use their respective travel modes and there were no significant ecological belief differences between the commuters. Similarly, other researchers found that different types of commuters had similar environmental attitudes (Thomas & Walker, 2015) and their pro-environmental beliefs neither increased their bus use (Heath & Gifford, 2002) nor reduced their car use (Fujii, 2006). We believe that social desirability bias may have influenced our findings, such that respondents answered the ecological belief-related

questions so as to appear to have pro-ecological beliefs. Some individuals may overstate their frequency of performing pro-environmental behaviour (e.g., using green travel modes and recycling) to appear pro-environmental (Thogersen & Olander, 2006) or report that they are pro-environmental but actually do nothing to reflect their attitude (Sargisson & McLean, 2015). Therefore, interventions aimed at enhancing commuters' ecological beliefs around active commuting may not be very effective, particularly in our group of commuters because they already have positive ecological beliefs. Further research could potentially look into how to manifest commuters' ecological beliefs into actions that actually support their beliefs and include a social desirability scale to test for this bias explicitly.

The final factor we examined was the amount of previous experience commuters had using their preferred mode (habit strength or response frequency). Although there were significant differences between the commuter groups, the response frequency measure was not a significant predictor of any of the commuters' intentions to use their respective travel modes. Although it may seem counterintuitive to use a response frequency measure of what is often an automatic behaviour (i.e., habit) to predict a controlled, conscious measure of choice (i.e., intention), consistent with previous research drivers had the highest prior experience of using their travel mode and pedestrians the lowest (Bamberg, Ajzen, & Schmidt, 2003; Bamberg, Rolle, & Weber, 2003; Ouellette & Wood, 1998).

Despite our interesting findings, our study had several limitations. We used commuters' *intentions* to use their respective travel modes as the proxy outcome variable in the regression analyses of the seven motivating factors, instead of their *actual* behaviour. Commuters' intentions to use their travel mode may not truly reflect the extent to which they actually use the travel modes, as there is evidence of the intention-behaviour gap, such that medium-to-large-sized change in intentions lead to only small-to-medium-sized changes in actual behaviour (Sheeran, 2002; Webb & Sheeran, 2006). So, we asked the respondents to

complete a self-report travel diary under the assumption that their travel diary responses would more closely resemble their actual commuting behaviour. Many travel behaviour researchers have used intentions as an outcome measure (e.g., Bamberg, 2000; Bamberg, Ajzen, & Schmidt, 2003; Matthies, Kuhn, & Klockner, 2002) and have used travel diaries to examine commuters' actual behaviour (e.g., Bamberg, Rolle, & Weber, 2006; Garvill, Marell, & Nordlund, 2003; Schlich & Axhausen, 2003).

A second sort of issue arose in the context of our mode commitment results. Specifically, the travel diary participants were comprised of the first ten volunteers from each commuter group, a self-selected sample that may have had high levels of commitment to their commuting practices with some influence on their willingness to complete the travel diary, thus resulting in high commitment levels. This also meant that some of the travel diary participants were from outside the regional sample (11 out of the 47). The potential for self-selection bias, as well as the gender imbalance in our sample (approximately 75% female) was present to some degree in both the online survey and the travel diary portions of the study and represents an ongoing methodological challenge for this research going forward.

Another issue to be addressed going forward would be to use techniques such as structural equation modelling to contrast the competing influences for observed mode choice decisions, instead of stated intentions to choose a particular commuting mode. This analysis approach was not possible in the present study due to the wording of our mode choice questions and the limited number of respondents in some of our commuter groups (Kline, 2011, suggested a sample size of 100 or more for each observation category). In this context, some additional differentiation of types of drivers could also be useful for analysis. In the present study, the sample of drivers was very heterogeneous as reflected in both the demographic variables and in the low predictive values observed in the regression analyses of their mode choice intentions (relative to some of the other commuter groups). This

differentiation could lead to a better understanding of drivers' commuting choices and identification of the best ways to nudge them to make more sustainable choices.

Finally, our habit strength measure may not adequately reflect commuters' habit strength of using their respective travel modes because we did not impose a time pressure on our respondents for the RF measure which, according to Verplanken et al. (1994), was essential to capture the element of automaticity of commuters' habitual use of their travel mode.

Overall, our study has created the potential for further studies to understand the influence of the motivating factors on commuters' mode choice in depth and to incorporate them in interventions aimed at reducing the use of cars and increasing the use of sustainable travel modes. The commuters in our study reported conflicting motivating factors related to their intentions to use their respective travel modes, which provides the opportunity to 'nudge' them in different ways to use more sustainable travel modes without forbidding any choice or significantly altering the economic rewards of any choice (see Nudge Theory; Thaler & Sunstein, 2008). We are optimistic that these tailored and well-tested nudge techniques can reduce car use and eventually reduce the emission of poisonous gases that pose a threat to the environment and its inhabitants.

Acknowledgements

Blinded information. See attached acknowledgements page.

References

Aarts, H., & Dijksterhuis, A. (2000). The automatic activation of goal-directed behaviour: The case of travel habit. Journal of Environmental Psychology, 20, 75-82.

Ajzen, I. (1991). The theory of planned behaviour. Organisational behaviour and human decision processes, 20, 179-211.

Anable, J., & Gatersleben, B. (2005). All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. TRA: Policy and Practice, 39(2-3), 163-181.

Atasoy, B., Glerum, A., & Bierlaire, M. (2012). Attitudes towards mode choice in Switzerland. Lausanne, Switzerland: Transport and Mobility Laboratory (TRANSP-OR). Retrieved from https://transp-or.epfl.ch

Bamberg, S. (2000). The promotion of new behaviour by forming an implementation intention: Results of a field experiment in the domain of travel mode choice. Journal of Applied Social Psychology, 30(9), 1903-1922.

Bamberg, S., (2006). Is residential relocation a good opportunity to change people's travel behaviour? Results from a theory-driven intervention study. Environment and Behaviour, 38(6), 820–840.

Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behaviour: The roles of past behaviour, habit and reasoned action. Basic and Applied Social Psychology, 25(3), 175-187.

Bamberg, S., Rolle, D., & Weber, C. (2003). Does habitual car use not lead to more resistance to change of travel mode? Transportation Planning and Technology, 30(1), 97-108.

Beirao, G., & Cabral, J. A. S. (2007). Understanding attitudes towards public transport and private car: A qualitative study. Transport Policy, 14, 478-489.

Beirao, G., & Carbral, J. A. S. (2007). Understanding attitudes towards public transport and private car: A qualitative study. Transport Policy, 14, 478-489.

Berman, R., & Cheng, L. (2001). English academic language skills: Perceived difficulties by undergraduate and graduate students, and their academic achievement. Canadian Journal of Applied Linguistics, 4(1), 25-40.

Buehler, R., & Hamre, A. (2016). An examination of recent trends in multimodal travel behavior among American motorists. International Journal of Sustainable Transportation, 10(4), 354-364.

Cairns, S., Davies, A., Newson, C., Swiderska, C., 2002. In: Making travel plans work: Research report. Department of Transport, London, UK.

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., & Goodwin, P. (2008). Smarter choices: Assessing the potential to achieve traffic reduction using 'soft measures'. Transport Reviews, 28(5), 593-618.

Carrel, A., Vij, A., & Walker, J. L. (2011, January). Understanding multimodal behavior: individual modality styles and their influence on travel behavior. Paper presented at the Transportation research Board 90th annual Meeting, Washington, WA.

Cervero, R. (2002). Built environments and mode choice: Toward a normative framework. TRD: Transport and Environment, 7(4), 265-284.

Cervero, R., Sarmiento, O. L., Jacoby, E., Gomez, L. F., & Neiman, A. (2009). Influences of built environments on walking and cycling: Lessons from Bogotá. International Journal of Sustainable Transportation, 3(4), 203-226.

Corpuz, G. (2007, September). Public transport or private vehicles: Factors that impact on mode choice. Paper presented at the Australasian Transport Research Forum (ATRF), Melbourne, Australia.

Davies, D. G., Halliday, M. E., Mayes, M., & Pocock, R. L. (1997). Attitudes to cycling: A qualitative study and conceptual framework. Crowthorne: Transport Research Laboratory.

De Gues, B., De Bourdeaudhuij, I., Jannes, C., & Meeusen, R. (2008). Psychosocial and environmental factors associated with cycling for transport among a working population. Health Education Research, 23(4), 697-708.

Diab, D. L., Gillespie, M. A., & Highhouse, S. (2008). Are maximisers really unhappy? The measurement of maximising tendency. Judgement and Decision Making, 3(5), 364-370.

Dickinson, J. E., Kingham, S., Copey, S., & Houghie, D. J. P. (2003). Employer travel plans, cycling and gender: Will travel plan measures improve the outlook for cycling to work in the UK? TRD: Transport and Environment, 8(1), 53-67.

Dunlap, R. E., Liere, K. D. V., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. Journal of Social Issues, 56(3), 425-442.

Eliasson, J., Hultkrantz, L., Nerhagen, L., & Rosqvist, L. S. (2009). The Stockholm congestion - charging trial 2006: Overview of effects. TRA: Policy and Practice, 43, 240-250.

Ellaway, A., Macintyre, S., Hiscock, R., & Kearns, A. (2003). In the driving seat: Psychosocial benefits from private motor vehicle transport compared to public transport. TRF: Traffic Psychology and Behaviour, 6, 217-231.

Ettema, D., Friman, M., Garling, T., Olsson, L. E., & Fujii, S. (2012). How in-vehicle activities affect work commuters' satisfaction with public transport. Journal of Transport Geography, 24, 215-222.

Ettema, D., Garling, T., Eriksson, L., Friman, M., Olsson, L. E., & Fujii, S. (2011). Satisfaction with travel and subjective well-being: Development and test of a measurement tool. TRF: Traffic Psychology & Behaviour, 14, 167-175.

Flamm, B. (2009). The impacts of environmental knowledge and attitudes on vehicle ownership and use. TRD: Transport and Environment, 14(4), 272-279.

Friman, M., Edvarsson, B., & Garling, T. (2001). Frequency of negative critical incidents and satisfaction with public transport services (I). Journal of Retailing and Consumer Services, 8, 95-104.

Fujii, S. (2006). Environmental concern, attitude toward frugality, and ease of behavior as determinants of pro-environmental behavior intentions. Journal of Environmental Psychology, 26(4), 262-268.

Fujii, S., & Garling, T. (2003). Development of script-based travel mode choice after forced change. TRF: Traffic Psychology & Behaviour, 6, 117-124.

Gardner, B. (2009). Modelling motivation and habit in stable travel mode contexts. TRF: Traffic Psychology & Behaviour, 12, 68-76.

Garling, T., & Schuitema, G. (2007). Travel demand management targeting reduced private car use: Effectiveness, public acceptability and political feasibility. Journal of Social Issues, 63(1), 139-153.

Garvill, J., Marell, A., & Nordlund, A. (2003). Effects of increased awareness on choice of travel mode. Transportation, 30, 63-79.

Gatersleben, B., & Uzzell, D. (2007). Affective appraisals of the daily commute: Comparing perceptions of drivers, cyclists, walkers, and users of public transport. Environment and Behaviour, 39(3), 416-431.

Haque, M. M., Chin, H. C., & Debnath, A. K. (2013). Sustainable, safe, smart—three key elements of Singapore's evolving transport policies. Transport Policy, 27, 20-31.

Haustein, S., Klockner, C. A., & Blobaum, A. (2009). Car use of young adults: The role of travel socialization. TRF: Traffic Psychology & Behaviour, 12, 168-178.

Heath, Y., & Gifford, R. (2002). Extending the theory of planned behavior: Predicting the use of public transport. Journal of Applied Social Psychology & Marketing, 32(10), 2154-2189.

Heinen, E., & Chaterjee, K. (2015). The same mode again? An exploration of mode choice variability in Great Britain using the National Travel Survey. TRA: Policy and Practice, 78, 266-282.

Hennessy, D., & Wiesenthal, D. (1999). Traffic congestion, driver stress, and driver aggression. Aggressive Behaviour, 25(6), 409-423.

Holmberg, K., Anderson, P., & Erdemir, A. (2012). Global energy consumption due to friction in passenger cars. Tribology International, 47, 221-234.

Hunecke, M., Blobaum, A., Matthies, E., & Hoger, R. (2001). Responsibility and environment: Ecological norm orientation and external factors in the domain of travel mode choice behavior. Environment and Behavior, 33(6), 830-852.

Hunt, J. D., & Abraham, J. E. (2007). Influences on bicycle use. Transportation, 34(4), 453-470.

International Organization of Motor Vehicle Manufacturers (OICA). (2015). Vehicles In Use. Retrieved from http://www.oica.net/category/vehicles-in-use/

Jones, P. M., & Sloman, L. (2003, August). Encouraging behavioural change through marketing and management: What can be achieved? Paper presented at the 10th International Conference on Travel Behaviour Research, Lucerne, Switzerland. Retrieved from http://citeseerx.ist.psu.edu/

Jopson, A. (2004, September). The role of norms in mode choice. Paper presented at the 3rd International Conference on Traffic and Transportation Psychology, Nottingham, United Kingdom. Retrieved from http://eprints.whiterose.ac.uk/2501

Kahn, M. E., & Morris, E. A. (2009). Walking the walk: The association between community environmentalism and green travel behaviour. Journal of the American Planning Association, 75(4), 389-405.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), 263-291.

Kline, R. B. (2011). Principles and practice of structural equation modeling. New York, NY: The Guilford Press.

Koslowsky, M., Kluger, A., & Reich, M. (1995). Commuting stress: Causes, effects and methods of coping. New York, NY: Plenum.

Kuhnimhof, T., Chlond, B., & Von der Ruhren, S. (2006). Users of modes and multimodal travel behaviour: Steps toward understanding travellers' options and choices. Transportation Research Record: Journal of the Transportation Research Board, 1985(1), 40-48.

Mackett, R. L. (2003). Why do people use their cars for short trips? Transportation, 30, 329-349.

Matthies, E., Kuhn, S., Klockner, C., 2002. Travel mode choice of women: The result of limitation, ecological norm, or weak habit? Environment and Behaviour, 34(2), 163–177.

Maxwell, S. (2001). Negotiations of car use in everyday life. In D. Miller (Ed.), Car Cultures. Oxford, United Kingdom: Berg Publishers.

Ministry of Transport. (2018). Annual fleet statistics 2017. Wellington, New Zealand: Ministry of Transport.

Nelissen, R. M. A., & Meijers, M. H. C. (2011). Social benefits of luxury brands as costly signals of wealth and status. Journal of Evolution and Human Behaviour, 32, 343-355.

Nicholson, N., Soane, E., Fenton-O'Creevy, M., & Willman, P. (2005). Personality and domain-specific risk taking. Journal of Risk Research, 8(2), 157-176.

Nobis, C. (2007). Multimodality: Facets and causes of sustainable mobility behaviour. Transportation Research Record: Journal of the Transportation Research Board, 2010(1), 35-44.

Noblet, C. L., Thogersen, J., & Teisl, M. F. (2014). Who attempts to drive less in New England? TRF: Traffic Psychology & Behaviour, 23, 69-80.

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behaviour predicts future behaviour. Psychological Bulletin, 124(1), 54-74.

Roberts, J., Popli, G., & Harris, R. J. (2018). Do environmental concerns affect commuting choices: Hybrid choice modelling with household survey data. Journal of the Royal Statistical Society, 181(1), 299-320.

Samet, J. M. (2007). Traffic, air pollution, and health. Inhalation Toxicology, 19(12), 1021-1027.

Sargisson, R. J., & McLean, I. G. (2015). Linking knowledge and action on sustainable living. Sustainability, 8(3), 127-135.

Schlich, R., & Axhausen, K. W. (2003). Habitual travel behaviour: Evidence from a six-week travel diary. Transportation, 30, 13-36.

Schneider, R. J. (2011). Understanding sustainable transportation choices: Shifting routine automobile travel to walking and bicycling (Doctoral dissertation). University of California, Berkeley, CA. Retrieved from https://escholarship.org/uc/item/06v2g6dh

Sheeran, P. (2002). Intention-behaviour relations: A conceptual and empirical review. European review of social psychology, 12(1), 1-36.

Shoup, D. (1997). Evaluating the effects of cashing out employer-paid parking: Eight case studies. Transport Policy, 4(4), 201-216.

Simma, A., & Axhausen, K. W. (2001). Structures of commitment in mode use: A comparison of Switzerland, Germany and Great Britain. Transport Policy, 8(4), 279-288.

Steg, L. (2005). Car use: Lust and must. Instrumental, symbolic and affective motives for car use. TRA: Policy and Practice, 39(2), 147-162.

Steg, L., Geurs, K., & Ras, M. (2001). Motives in transport models: Can they be ignored? In D. Hensher (Ed.), Travel Behaviour Research - The Leading Edge. Oxford, United Kingdom: Pergamon.

Steg, L., Vlek, C., & Slotegraaf, G. (2001). Instrumental-reasoned and symbolic-affective motives for using a motor car. TRF: Traffic Psychology & Behaviour, 4(3), 151-169.

Teal, R. F. (1987). Carpooling: Who, how and why. TRA: Policy and Practice, 21A(3), 203-214.

Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. New York, NY: Penguin Books.

Thogersen, J., & Olander, F. (2006). To what degree are environmentally beneficial choices reflective of a general conservation stance? Environment and Behaviour, 38(4), 550-569.

Thomas, G. O., & Walker, I. (2015). Users of different travel modes differ in journey satisfaction and habit strength but not environmental worldviews: A large-scale survey of drivers, walkers, bicyclists and bus users commuting to a UK university. TRF: Traffic Psychology & Behaviour, 34, 86-93.

Touwen, M. (1999). Travel Planning in the Randstad: An Evaluation Based on ReMOVE. Hague, Netherlands: Netherlands Ministry of Transport.

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. Decision Sciences, 27(3), 451-481.

Verplanken, B., Aarts, H., Van Knippenberg, A., & Van Knippenberg, C. (1994). Attitude versus general habit: Antecedents of travel mode choice. Journal of Applied Social Psychology, 24(4), 285-300.

Viegas, J., & Lu, B. (2001). Widening the scope for bus priority with intermittent bus lanes. Transportation Planning and Technology, 24(2), 87-110.

Washbrook, K., Haider, W., & Jaccard, M. (2006). Estimating commuter mode choice: A discrete choice analysis of the impact of road pricing and parking charges. Transportation, 33, 621-639.

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. Psychological Bulletin, 132, 249-268.

Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. Journal of Environmental Psychology, 30, 305-314.

Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. Journal of Personality and Social Psychology, 88(6), 918-933.

Appendix A

Questions Used in the Online Survey

Survey Questions		Response scale	Note
Filter question #1: During your daily commute to work or school, which of the following modes are available to you? (For your understanding, a mode is available to you when you have unrestricted access to it regardless whether you use the mode or not. 1. Private car as driver 2. Private car as passenger 3. Public transport: Bus 4. Bicycle 5. Walking 6. I do not commute		n/a	Respondents who selected 'I do not commute' advanced to the demographic questions (Section 10)
Section 1	**Measures of perceived difficulty** 1. Please rate how difficult would it be for you to use [travel mode] for daily commute to and from work or school.	5-point scale 1=*not difficult* to 5=*very difficult*	All commuters respond to one item for each mode that they selected in Filter question #1

Section 2	**Measures of perceived status** 1. If I used [travel mode] for daily commute to and from work or school I will have high status 2. If I used [travel mode] for daily commute to and from work or school I will be respected	7-point scale 1 = *not at all* to 7 = *very much*	All commuters respond to two items for each mode that they selected in Filter question #1
Section 3	**Measures of attitude** For me, to use of [travel mode] for daily commute next time would overall be: 1. Bad or good 2. Unpleasant or pleasant	5-point semantic differential scale	All commuters respond to eight items for each mode that they selected in Filter question #1
	Measures of social norms 1. Most people who are important to me would support the use of [travel mode] for daily commute next time. 2. Most people who are important to me think that I should use [travel mode] for daily commute next time.	5-point scale 1=*disagree* to 5=*agree*	
	Measures of perceived behavioural control 1. For me to use [travel mode] for daily commute next time would be: difficult or easy 2. My freedom to use [travel mode] for daily commute next time is: low or high	5-point semantic differential scale	
	Measures of intentions 1. My intention to use [travel mode] for daily commute next time is: weak or strong 2. I intend to use [travel mode] for daily commute next time: unlikely or likely	5-point semantic differential scale	
Filter question #2 Which of these modes have you used for daily commute to and from work or school? 1. Private car as driver 2. Private car as passenger 3. Public transport: Bus 4. Bicycle 5. Walking 6. None of the above		n/a	Respondents who selected 'None of the above' advanced to the demographic questions (Section 10)
Section 4	**Measures of satisfaction with travel** 1. Travelling on [travel mode] is: very hurried or very relaxed 2. When I travel in [travel mode], I'm: very worried I would not be in time or very confident I would be in time 3. When I travel in [travel mode], I'm: very stressed or very calm 4. When I travel in [travel mode], I'm: very tired or very alert	9-point semantic differential scale	All commuters respond to nine items for each mode that they selected in Filter question #2

	5. When I travel in [travel mode], I'm: very bored or very enthusiastic 6. When I travel in [travel mode], I'm: very fed-up or very engaged 7. Travelling on [travel mode] was the: worst or best I can think of 8. Travelling on [travel mode] had: very low standard or very high standard 9. Travelling on [travel mode] worked: very poorly or very well		
Section 5	**Measures of perceived autonomy** 1. I can travel where I want, when I want by [travel mode] 2. I feel in control when I travel by [travel mode] 3. Travelling in [travel mode] fits in well with the routine of my daily life	5-point scale 1=*strongly disagree* to 5=*strongly agree*	All commuters respond to three items for each mode that they selected in Filter question #2
	Measures of perceived prestige 1. Most people would like to travel by [travel mode] like the way I do 2. When I travel by [travel mode] it makes me feel I'm doing well in life	5-point scale 1=*strongly disagree* to 5=*strongly agree*	All commuters respond to two items for each mode that they selected in Filter question #2
Section 6	**Measures of habit** Please indicate which travel mode you would choose for the following 10 destinations or trip purposes: 1. Summer excursion with friends to a lake 2. Visit a friend 3. Visit your parents who live 3 km away 4. Engage in sports 5. Stroll through the city 6. Evening visit to a bar 7. A trip on a nice day 8. Routine grocery shopping 9. Eat in a restaurant 10. Go to the movies		Respondents select one of the five modes (i.e., car as driver, car as passenger, bus, bicycle, or walk) All commuters respond to all ten items
Section 7	**Measures of ecological beliefs** 1. We are approaching the limit of the number of people the earth can support 2. Humans have the right to modify the natural environment to suit their needs (R) 3. When humans interfere with nature it often produces disastrous consequences 4. Human ingenuity will ensure that we do NOT make the earth unliveable (R) 5. Humans are severely abusing the environment	5-point scale 1=*strongly disagree* to 5=*strongly agree*	All commuters respond to all 15 items

	6. The earth has plenty of natural resources if we just learn how to develop them (R) 7. Plants and animals have as much right as humans to exist 8. The balance of nature is strong enough to cope with the impacts of modern industrial nations (R) 9. Despite our special abilities humans are still subject to the laws of nature 10. The so-called "ecological crisis" facing humankind has been greatly exaggerated (R) 11. The earth is like a spaceship with very limited room and resources 12. Humans were meant to rule over the rest of nature (R) 13. The balance of nature is very delicate and easily upset 14. Humans will eventually learn enough about how nature works to be able to control it (R) 15. If things continue on their present course, we will soon experience a major ecological catastrophe		
Section 8	**Measures of maximising tendency** 1. No matter what it takes, I always try to choose the best thing 2. I don't like having to settle for "good enough" 3. I am a maximiser 4. No matter what I do, I have the highest standards for myself 5. I will wait for the best option, no matter how long it takes 6. I never settle for second best 7. I am uncomfortable making decisions before I know all of my options 8. Whenever I'm faced with a choice, I try to imagine what all the other possibilities are, even ones that aren't present at the moment 9. I never settle	5-point scale 1=*strongly disagree* to 5=*strongly agree*	All commuters respond to all nine items
Section 9	**Measures of risk-taking tendency** We are interested in everyday risk-taking. Please could you tell us if any of the following have ever applied to you, <u>now</u> and in your adult <u>past</u>? 1. Rock Climbing 2. Scuba Diving 3. Smoking	Now: 5-point scale 1=*strongly disagree* to 5=*strongly agree*	All commuters respond to all 12 items twice (for present and past)

	4. Poor diet 5. High alcohol consumption 6. Quitting a job without another to go to 7. Gambling 8. Risky investments 9. Fast driving 10. City cycling without a helmet 11. Standing for election 12. Publicly challenging a rule or a decision	Past: 5-point scale 1=*strongly disagree* to 5=*strongly agree*
Section 10	**Travel characteristics** 1. Most frequently used mode 2. Mode use period 3. Estimated commuting time in a day 4. Estimated commuting distance in a day	Four questions
Section 11	**Demographic characteristics** 1. Gender 2. Age 3. Occupation 4. Education level 5. Household type 6. Annual household income 7. Place of residence 8. Moving status 9. Period since last move	Nine questions