

1 Do Drivers Dream of Walking? An Investigation of  
2 Travel Mode Dissonance from the Perspective of  
3 Subjective Wellbeing

4 Author 1<sup>\*,a</sup>, Author 2<sup>b</sup>

5 <sup>a</sup>*Department, Street, City, State, Zip*

6 <sup>b</sup>*Department, Street, City, State, Zip*

7 **Abstract**

**Introduction**

Subjective wellbeing is a topic that has attracted considerable attention in recent years due to the way it correlates with health. From a transportation perspective, there is a burgeoning literature on the way travel can impact subjective wellbeing, and how this, in turn, can influence behavior.

**Objective**

The objective of this paper is to analyze a number of affective values associated with subjective wellbeing and the modes of transportation that people commonly use. In particular, we are interested in the potential for dissonance with respect to the primary mode of travel.

**Materials and Methods**

The study is based on data collected from a sample of travellers in the city of Santiago, in Chile. Participants in the study were asked about their usual mode of travel, and then were asked to name the mode or modes that they associate with the affective values of freedom, enjoyment, happiness, poverty, luxury and status. Analysis is based on tests of independence and visualization via mosaic plots.

**Results**

The results indicate that users of public transportation experience the most dissonance in terms of affective values, and active travellers the least. For those travellers who experience dissonance, active travel is the mode most commonly associated with freedom, enjoyment, and happiness, public transportation is most commonly associated with poverty, and the automobile is most commonly associated with luxury and status.

8 **1. Introduction**

9 Transportation planning for decades has focused on providing mobility for the  
10 private automobile. This is a model of development that was initially introduced  
11 in North America as a solution to problems created by rapid urbanization, and  
12 that was eventually copied elsewhere (Angotti, 1996; Brown et al., 2009). Despite  
13 the initial promise of automotive technology, it is now evident that mobility

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\*Corresponding Author

Email addresses: a1@university.com (Author 1), a2@school.com (Author 2)  
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14 centred on the private automobile has given rise to a litany of maladies that  
15 are in urgent need of correction. This includes environmental concerns (i.e.,  
16 climate change; Chapman, 2007) as well as numerous other social (Boschmann  
17 and Kwan, 2008; Lucas, 2019, 2012), health (Khreis et al., 2016; Milne, 2012),  
18 and equity issues (Bocarejo and Oviedo, 2012; Martens et al., 2012; Pereira et  
19 al., 2017).

20 As the real impacts of our societal dependence on the private automobile  
21 have become increasingly evident, the transportation agenda has aimed to shift  
22 focus to the reduction of car use and towards the creation of mobility polycultures  
23 that offer a broader menu of transportation alternatives than primarily (or even  
24 just) the private automobile (Miller, 2011). In order to successfully achieve this  
25 goal, it is essential not only to provide the services and facilities that support  
26 public transportation and active travel, but also to attract new users to these  
27 modes of transportation (Ettema et al., 2011). Within this context, it has been  
28 argued that sustainable transportation policies require all participants in the  
29 transportation system to challenge what Gossling and Cohen (2014) termed  
30 *transportation taboos*: deep-seated ideas concerning the contribution to emissions  
31 by individuals, the inequality of market-based approaches, and the social and  
32 psychological functions of transportation. With respect to the latter, it is  
33 important to move beyond a purely utilitarian focus if we are to understand how  
34 the affective value of the transportation experience can be leveraged to improve  
35 alternative transportation - particularly transit and active modes (Anable and  
36 Gatersleben, 2005; Domarchi et al., 2008; Gatersleben and Uzzell, 2007; Steg,  
37 2005).

38 A useful lens to investigate the social and psychological functions of trans-  
39 portation is by means of the concept of subjective wellbeing (SWB; see, inter alia,  
40 De Vos et al., 2013; and Chatterjee et al., 2019). SWB is defined by the OECD  
41 as “[g]ood mental states, including all of the various evaluations, positive and  
42 negative, that people make of their lives, and the affective reactions of people to  
43 their experiences” (OECD, 2013, p. 10). As memorably put by Steg (2005): is  
44 the use of car a must, or is it a lust? A close alignment, or consonance, between  
45 affective values and the mode of transportation used to travel can result in  
46 greater subjective wellbeing and increase the probability of choosing that mode  
47 (i.e., by satisfying the *lust*); on the other hand, dissonance, that is, the lack of  
48 concordance between the mode used and affective values would be detrimental to  
49 subjective wellbeing, especially of those for whom the use of the mode is a *must*  
50 (De Vos, 2019; Mokhtarian and Pendyala, 2018). With these considerations in  
51 mind, one aim of the present research is to investigate *who* experiences dissonance  
52 with respect to their primary mode of travel and affective values, namely freedom,  
53 enjoyment, happiness, feelings of poverty, luxury, and status. Furthermore, it  
54 is possible, even if use of a particular mode is a *must*, that travellers may still  
55 *lust* for something else - in other words, the grass may in fact look greener from  
56 the window of the car. For this reason, we also aim to investigate which mode  
57 or modes are most commonly associated with affective values, with a focus on  
58 those travellers who experience dissonance in their primary mode.

59 Research is based on data collected from a sample of travellers in the city of

60 Santiago in Chile. Survey respondents were asked about their primary mode of  
61 travel, and also about the mode or modes that they associate with the affective  
62 values mentioned above. The paper contributes to the literature in three ways,  
63 as follows:

- 64 1. The research reported here contributes to an emerging literature on the  
65 topic of transportation and affective values in the context of the Global  
66 South (Al-Ayyash and Abou-Zeid, 2019; Bejarano et al., 2017; Shao and  
67 Liang, 2019; Van et al., 2014; Zorrilla et al., 2019); to the best of our  
68 knowledge, the case of Chile has not yet been reported.
- 69 2. Although there is an extensive literature on the enjoyment of commute and  
70 other affective values (see for instance Paez and Whalen, 2010; Redmond  
71 and Mokhtarian, 2001; Whalen et al., 2013; Ye and Titheridge, 2017), from  
72 a hedonic and even eudaimonic perspectives the analysis has yet to be  
73 applied more fully in terms of distributional issues – i.e. which groups more  
74 commonly experience dissonance (see De Vos, 2018).
- 75 3. The analysis shows the attitudes of people towards their primary mode and  
76 their perception towards ‘ideal modes’ – implying their preferences, even  
77 in situations when their ideal mode is not part of their actual choice set.  
78 More concretely, the results indicate that users of public transportation  
79 experience the most dissonance in terms of affective values, and active  
80 travellers the least. For those travellers who experience dissonance, active  
81 travel is the mode most commonly associated with freedom, enjoyment,  
82 and happiness, public transportation is most commonly associated with  
83 poverty, and the automobil is most commonly associated with luxury and  
84 status. We also find that there are some substantial variations in dissonance  
85 by age, education, income, and typical commute time. The attitudes of  
86 travellers towards transport modes are critical factors to be considered by  
87 policy-makers in case they want to promote and increase the use of public  
88 transport or active modes (Bornioli et al., 2019; De Vos et al., 2019; De  
89 Vos and Witlox, 2017; Garling et al., 2019; Redman et al., 2013).

90 The structure of the paper is as follows. After these introductory remarks,  
91 we follow up with a background section that reviews the literature. Next, we  
92 discuss the case study and data used in the research. Then, the analysis and  
93 results are presented, before concluding with some discussion and directions for  
94 future research.

## 95 2. Background

96 A consensus has emerged in the transportation community regarding the  
97 need to complement the traditional utilitarian perspective of transportation by  
98 looking at mobility and transport issues from the lens of their affective functions.  
99 The affective value of transportation in turn is important due to its potential to  
100 improve or detract from SWB. One of the primary ways to explore this has been  
101 the satisfaction that travelers feel towards their every day mobility experience

(e.g., Cecilia Jakobsson Bergstad et al., 2011). As a consequence, there is a wealth of research on satisfaction with the use of different modes of transportation. For example, numerous studies report that car users often have a higher level of satisfaction compared to other transport modes (C. J. Bergstad et al., 2011; Eriksson et al., 2013; Redmond and Mokhtarian, 2001; Whalen et al., 2013; but see Handy and Thigpen, 2019). In a similar way, there are multiple reports that active travel also tends to yield high levels of satisfaction (Gatersleben and Uzzell, 2007; Handy and Thigpen, 2019; Paez and Whalen, 2010; Smith, 2017; St-Louis et al., 2014; Whalen et al., 2013). In contrast, public transport users tend to assess their experience more negatively (Abenoza et al., 2017; De Vos et al., 2016; Gatersleben and Uzzell, 2007; Handy and Thigpen, 2019; Paez and Whalen, 2010). Multi-modal trips also influence satisfaction levels; for instance, when an individual chooses a particular mode of transportation, she will report a higher level of satisfaction with that chosen mode – perhaps as a form of *post hoc* validation (Susilo and Cats, 2014).

While the use of travel satisfaction has been mainly used in the context of daily trips – typically linked to cost-benefit and utilitarian measurements –, the evaluation of Subjective Wellbeing (SWB) over time has risen as an alternative measure. In the field of travel behaviour, Ettema et al. (2010, p. 725) define SWB as the degree to which an individual positively evaluates the overall quality of their lives, where the general life satisfaction encompasses a more extended temporality – which implies assuming a tendency to be more stable over time. This concept has prompted a growing literature that complements and applies SWB in a broader range of satisfaction scales and situations. The definition of other factors such as travel choice mode, attitudes and external elements of the built environment have been studied for a broader understanding of the changes produced in the SWB (e.g., Handy and Thigpen, 2019). As these factors do not necessarily apply to the general life satisfaction on the long term, the studies have aimed to determine both the direct and indirect effects on the perception of users (see, e.g., Ye and Titheridge, 2017). Other concepts have also emerged as the Satisfaction with Travel Scale (STS), a measurement devised by Ettema et al. (2011), as well as different scales based on people’s travel perceptions. De Vos et al. (2015), for instance, explore in detail the underlying dimensions of the affective domain of STS on which SWB is based (for more on STS see also Friman et al., 2013).

Recent literature on SWB and its link with transport have demonstrated a relationship between people’s perceptions and satisfaction with their daily travel (e.g., Smith, 2017; Mokhtarian and Pendyala, 2018; St-Louis et al., 2014). Scholars have shown that accessibility has been the most developed factor that influences people’s wellbeing (Delbosc, 2012), and activities have a direct impact on travel satisfaction (Cecilia Jakobsson Bergstad et al., 2011). Delbosc (2012, p. 28), for instance, has summarised the most significant influences on psychological wellbeing: poverty and employment, meaningful relationships and health. However, understanding the components affecting people’s perceptions implies the differentiation between affective (also named as symbolic-affective) and instrumental values (C. J. Bergstad et al., 2011). Steg et al. (2011) have

148 compared symbolic-affective opposed to instrumental-reasoned motives based  
 149 on car-use, and other studies have also found associations between affective  
 150 and symbolic aspects of car-use (see, e.g., Gatersleben and Uzzell, 2007; Lois  
 151 and Lopez-Saez, 2009). Previous studies have also demonstrated how socio-  
 152 demographic factors affect the levels of SWB. The effect of income on SWB  
 153 (Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005); education and unemployment  
 154 (Argyle et al., 1999); age (Diener and Eunkook Suh, 1997), and gender (Tesch-  
 155 Römer et al., 2008) have been extensively studied. Recent research also suggests  
 156 the links between commuting, SWB and emotional wellbeing assessment (**Olson**  
 157 **et al. 2013; Kahneman et al. 2004**). However, more research is needed to  
 158 understand how these socio-demographic variables connect as well with the  
 159 affective responses to mode of travel (St-Louis et al., 2014).

160 The research needs already recognized in the developed world are also  
 161 markedly acute in the context of the Global South, where historical inequality  
 162 has tended to create a symbolic attachment to the automobile, in addition to  
 163 negative connotations for public transport and active travel (Zorrilla et al., 2019).  
 164 In this way, there is an emerging literature that investigates affective factors in  
 165 travel behaviour in a number of developing countries. A cross-country study in  
 166 Asia revealed that the affective factors of public transportation and car use are  
 167 important, and in particular the social orderliness of transit was suggested as a  
 168 way to make this mode more attractive to users (Van et al., 2014). In terms of  
 169 active travel, a study in China found that attitudes that embrace new styles and  
 170 technologies despite their cost are associated with the intention to continue using  
 171 shared bicycles (Shao and Liang, 2019). The importance of affective factors for  
 172 policy and planning is further highlighted by research in Colombia that shows  
 173 how users felt proud using a bicycle shared system, in addition to experiencing  
 174 feelings of belonging to a civic culture and the enjoyment and pleasure of travel  
 175 itself (Bejarano et al., 2017). This paper contributes to further our understanding  
 176 of affective values in travel behaviour in a developing country.

### 177 3. Case Study and Data

#### 178 3.1. Context

179 The case study to contextualize the discussion is Santiago de Chile, the  
 180 capital of one of the countries with the highest levels of inequality in terms of  
 181 socio-economic distribution in the world. These inequities have manifested in a  
 182 disproportionate expense in transport by the different socio-economic sectors, a  
 183 disproportion in travel times and distances travelled. On the other hand, car  
 184 ownership and use of public transport in the capital are directly conditioned by  
 185 strong spatial segregation – the higher the income, the higher is the use of the  
 186 automobile; conversely, and the lower the income, the higher is the predisposition  
 187 to use public transport. Although transport is a reflection of deep inequities in  
 188 various dimensions, it has triggered an exceptional discomfort and disagreement  
 189 with the daily travel experience and quality of life.

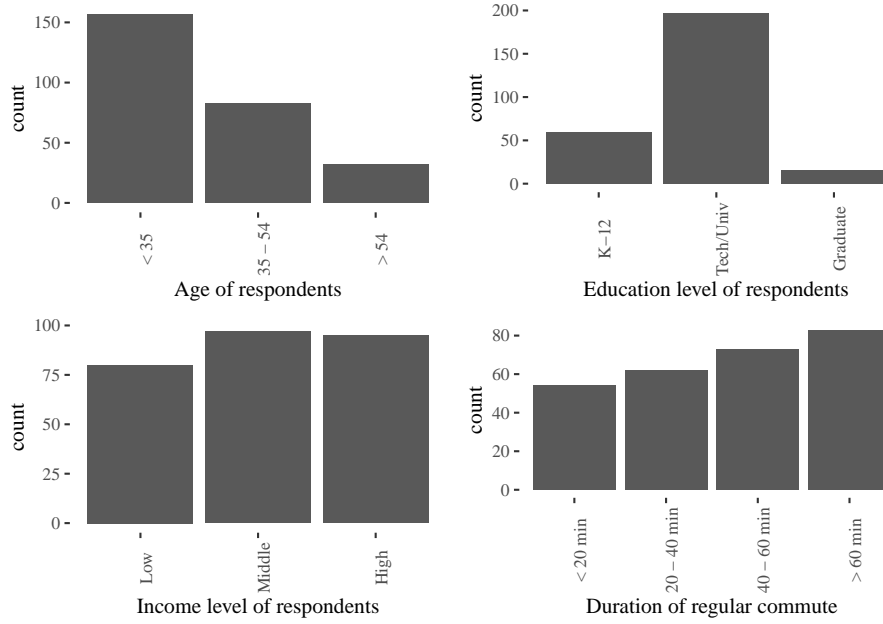


Figure 1: Descriptive statistics of the sample

### 3.2. Sample

The study is based on a survey conducted in the city of Santiago during the months of November and December 2016, that is, the end of the Spring and beginning of Summer. The survey collected information on a wide range of travel and related issues. The data collection considered a quota-sampling method for gathering the information, considering the socio-demographic information from Pre-Census of 2012. An equal representation of both genders and a representation of the proportion of inhabitants per area were chosen as relevant characteristics of the sample. In total, there were  $n = 451$  valid surveys, although not every survey was complete and there were missing responses for some answers.

The survey was structured in eight sections, as follows: 1) Individual characteristics of respondent; 2) Health; 3) Feelings and emotions; 4) Reasons for travel and planning travel; 5) Social interaction; 6) Nature and sustainability; 7) Information and telecommunications; 8) Built environment; and 9) Commuting. For the present study, we draw data from sections 1), 3) and 9). In terms of individual characteristics of the respondents and their commute, participants were asked about basic socio-demographic information, including age, level of education, income, and the typical duration of their regular commute. The descriptive statistics of the sample appear in Figure 1. The sample tends to be younger, and well-educated, with an almost uniform distribution of income levels. The trend in typical commute time is towards longer commutes.

211 In addition, respondents were asked about their primary mode of travel for  
 212 their regular commute. The modes available were Car, Taxi, Colectivo (a form  
 213 of shared ride, intermediate in flexibility and capacity between taxi and bus);  
 214 Motorcycle; Metro; Bus; Bicycle; Walking. As seen in the top panel of Figure  
 215 2, the three most common modes of travel are Metro, Bus, and Car, followed  
 216 by Walking and Bicycle. For the analysis, we aggregate these modes into the  
 217 following categories (bottom panel of Figure 2): Car, Active (Walking + Bicycle),  
 218 Public (Metro + Bus), and Other (Taxi + Colectivo + Motorcycle).

219 Of particular interest for the present study is the following question in Part  
 220 3) of the survey:

221 Q: Please indicate the mode(s) of transport that you relate  
 222 to the following feelings and concepts

223 The question was asked for each of the following affective values: Freedom;  
 224 Enjoyment; Happiness; Poverty; Luxury; and Status. The respondents were  
 225 not constrained to select only one alternative, but could indicate by means of a  
 226 checkbox any and all modes that they felt aligned with each affective value. This  
 227 allows us to do an analysis of modal dissonance, a concept introduced into the  
 228 transportation literature by Schwanen and Mokhtarian (2004) based on earlier  
 229 work by Feldman (1990). Residential neighborhood-type dissonance was defined  
 230 by Schwanen and Mokhtarian (2004) as an incongruence in terms of the the  
 231 land use patterns at the place of residence of an individual, and the individual's  
 232 preferences. The concept of dissonance has since been extended in the travel  
 233 behavior literature to encompass the mismatch between the choices individuals  
 234 make, and the alternatives that would enable users to experience affective or  
 235 instrumental values. This includes, for example, travel mode dissonance (De  
 236 Vos, 2018).

Based on the primary mode of travel and the questions about affective values,  
 we derived a series of travel mode dissonance variables according to the following  
 rule:

$$D_i = \begin{cases} 0 & \text{if primary mode} = \text{mode associated with value } i \\ 1 & \text{otherwise} \end{cases}$$

Therefore, if a respondent's primary mode of travel is Car, but indicated any other  
 mode or modes in relation to Freedom, the respondent experienced dissonance:

$$D_{\text{Freedom}} = 1$$

237 Furthermore, we also expanded the responses to account for all modes  
 238 identified by respondents in relation to the affective values. However, to avoid  
 239 double counting the respondents in our frequency tabulations, we also calculated  
 240 a sample weight that was the inverse of the number of modes selected in response  
 241 to each affective value. For instance, if a respondent selected two modes in  
 242 relation to affective value  $i$ , the two modes receive a weight of  $1/2$ ; if a respondent  
 243 selected three modes, then their weights are  $1/3$ ; and so on. In this way we do  
 244 not treat unfairly those who selected only one mode, and the sum of all weighted  
 245 modes is equal to the sample size.

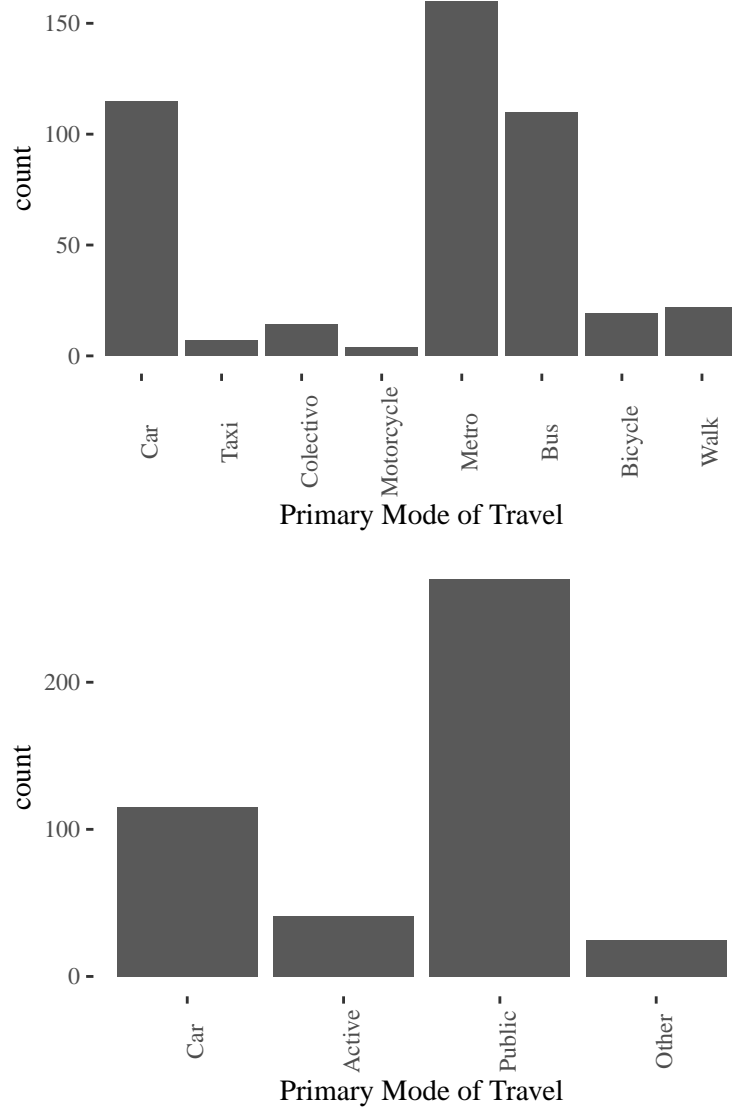


Figure 2: Frequency of primary mode used for regular commute; top panel: all modes, bottom panel: aggregated modes



## 246 4. Analysis and Results

247 In what follows, analysis is done on two related but distinct questions. The  
248 first part of the analysis seeks to understand *who* experiences dissonance, and  
249 the second part, building off that, aims to explore which modes of travel are  
250 more commonly identified as embodying affective values by those travellers who  
251 experience dissonance.

252 Please note that this document was prepared using R Markdown and contains  
253 reproducible analysis. The R markdown file, along with the data file needed to  
254 reproduce the analysis, can be downloaded from the following anonymous Drive  
255 folder:

256 <https://drive.google.com/open?id=189ZvfVvRis5xZA9IlviKCLW2bwbPJAgg>

### 257 4.1. *Who experiences dissonance?*

258 To investigate the first question in our analysis, we create contingency tables  
259 that tabulate the frequency of dissonance with respect to each affective value,  
260 stratified by the attributes of Age, Education, Income, Primary Mode of Travel,  
261 and typical Commute Time. Table 1 presents the frequency (in percentage) of  
262 dissonance, in other words, the percentage of respondents out of the total in  
263 their stratum who indicated mode or mode(s) for the affective value that do not  
264 correspond to their primary mode of travel.

265 As seen in the table, there are five characteristics of the respondents and  
266 their commutes that we use in the analysis. Three of these categories are  
267 socio-economic and demographic, namely age, level of education, and income.  
268 The other two are transportation related, namely primary mode of travel and  
269 commute time. The frequency tables were tested in every case by means of the  
270  $\chi^2$  test of independence ( $p$ -values are reported in the table; lower  $p$ -values mean  
271 that the null hypothesis of independence can be rejected with greater confidence).  
272 It is interesting to note that the only category for which all affective values are  
273 significant at better than 5% level of confidence is mode of travel.

#### 274 4.1.1. *Age*

275 With respect to Age, previous studies have reported that older adults tend  
276 to be more satisfied with their travel experience than younger people (Cao and  
277 Ettema, 2014; De Vos et al., 2016; Ye and Titheridge, 2017). In the case, we find  
278 that five affective values show dissonance that significantly deviates from the null  
279 hypothesis of independence, namely Freedom, Enjoyment, Happiness, Luxury,  
280 and Status. We observe that levels of dissonance tend to be high in general,  
281 and in no case less than 60%. For instance, almost 90% of travellers younger  
282 than 35 experience travel mode dissonance with respect to Freedom, and more  
283 than 94% experience dissonance with respect to enjoyment. In general, younger  
284 travellers tend to experience dissonance more frequently, with dissonance being  
285 less frequent for older travellers. The exception to this trend is Luxury, an  
286 affective value for which older travellers (age >54) experience dissonance more  
287 frequently than mid-aged travellers (ages 35-54).

#### 4.1.2. Education

When seen from the perspective of Education, the results do not support the hypothesis of significant differences in the frequency of dissonance by levels of education for the values of Freedom, Enjoyment, Happiness, and Poverty, and only two affective values show significant differences between education levels: Luxury and Status. In the case of Luxury, dissonance is more frequent among people who have only K-12 education, and less frequently, albeit still high, for people with technical/university level education and post-graduate education. Furthermore, highly educated people (with postgraduate degrees) experience dissonance with respect to Status more frequently than with respect to Luxury.

#### 4.1.3. Income

The next variable we examine is income, and in this case three affective values are significant: Poverty, Luxury, and Status. Since Poverty is a negative affect, we see here that lower income people tend to associate this feeling to their primary mode of commuting more frequently (almost 20% of the time) than other income groups. For example, whereas approximately 16% of mid-income people are dissatisfied with their primary mode of travel in this respect, less than 7% of high income individuals are. Dissonance with respect to Luxury and Status also tends to be more common among lower income people, and declines substantially for mid- and high income respondents. Notice as well that the frequency of dissonance is higher in terms of Luxury than Status for mid- and high income people.

#### 4.1.4. Primary mode of travel

The variable that shows the largest differences in the frequency of dissonance is the primary mode of travel. It can be seen in Table 1 that the differences are significant for all six affective values. Dissonance is particularly acute for users of public transportation when it comes to the values of Freedom, Enjoyment, and Happiness: almost 100% of users of public transportation have identified other mode or modes as better representing those values. Dissonance on these values is the least for active travellers: less than 50% of respondents associate Freedom to a different mode, and only around 60% identified a different mode when responding to the values of Enjoyment and Happiness, compared to approximately 79% and 71% of those who travelled by Car. The picture changes when the values of Poverty, Luxury, and Status are considered. In this case, dissonance is less frequent for people who travel by car: less than 3% of car users associate car with feelings of poverty, 41% associate Luxury with a mode other than car, and only about 31% relate Status to a different mode. Dissonance is more frequent in these values for active travellers, and users of public transportation and other modes, in no case being less than 75%, and being virtually 100% for users of public transportation, who consistently associate Luxury and Status with modes *other* than public transportation.

329 *4.1.5. Typical commute time*

330 Turning now to typical commute time, four affective values show significant  
331 differences at better than 10% confidence: Freedom, Happiness, Luxury, and  
332 Status. Perhaps not surprisingly, dissonance is more frequent among people  
333 whose typical commutes are longer. This is in line with previous findings: both  
334 St-Louis et al. (2014) and Smith (2017) report that commute satisfaction tends  
335 to decline with longer commutes, whereas Handy and Thigpen (2019) found that  
336 commute distance was a negative covariate of commute satisfaction.

Table 1: Percentage of respondents who report mode dissonance with respect to various SWB factors

| Variable            | Freedom | $\chi^2$ p-val | Enjoyment | $\chi^2$ p-val | Happiness | $\chi^2$ p-val | Poverty | $\chi^2$ p-val | Luxury | $\chi^2$ p-val | Status | $\chi^2$ p-val |
|---------------------|---------|----------------|-----------|----------------|-----------|----------------|---------|----------------|--------|----------------|--------|----------------|
| <b>Age</b>          |         |                |           |                |           |                |         |                |        |                |        |                |
| < 35                | 89.88   |                | 94.33     |                | 93.52     |                | 87.63   |                | 89.43  |                | 87.17  |                |
| 35 - 54             | 74.22   | < 0.001        | 81.45     | < 0.001        | 82.26     | < 0.001        | 87.38   | 0.4095         | 70.18  | < 0.001        | 68.70  | < 0.001        |
| > 54                | 74.00   |                | 72.92     |                | 68.75     |                | 76.19   |                | 78.57  |                | 66.67  |                |
| <b>Education</b>    |         |                |           |                |           |                |         |                |        |                |        |                |
| K-12                | 85.98   |                | 92.16     |                | 89.22     |                | 79.27   |                | 95.10  |                | 92.39  |                |
| Tech/Univ           | 83.00   | 0.9063         | 86.94     | 0.7005         | 86.94     | 0.9694         | 88.51   | 0.3608         | 78.99  | 0.0058         | 75.00  | 0.013          |
| Graduate            | 78.57   |                | 85.19     |                | 84.62     |                | 86.36   |                | 76.00  |                | 79.17  |                |
| <b>Income</b>       |         |                |           |                |           |                |         |                |        |                |        |                |
| Low                 | 86.51   |                | 82.11     |                | 88.62     |                | 80.19   |                | 88.71  |                | 88.70  |                |
| Middle              | 84.52   | 0.5755         | 89.80     | 0.2264         | 88.00     | 0.9698         | 83.76   | 0.0642         | 85.82  | 0.0204         | 80.00  | 0.0137         |
| High                | 79.19   |                | 90.97     |                | 85.82     |                | 93.69   |                | 73.68  |                | 70.31  |                |
| <b>Mode</b>         |         |                |           |                |           |                |         |                |        |                |        |                |
| Car                 | 58.93   |                | 78.90     |                | 70.91     |                | 97.96   |                | 41.00  |                | 30.69  |                |
| Active              | 46.34   | < 0.001        | 60.98     | < 0.001        | 57.89     | < 0.001        | 75.76   | 0.0045         | 89.47  | < 0.001        | 81.82  | < 0.001        |
| Public              | 99.23   |                | 96.76     |                | 98.80     |                | 81.35   |                | 100.00 |                | 99.57  |                |
| Other               | 91.30   |                | 86.96     |                | 91.30     |                | 93.33   |                | 72.73  |                | 90.00  |                |
| <b>Commute Time</b> |         |                |           |                |           |                |         |                |        |                |        |                |
| < 20 min            | 65.93   |                | 82.95     |                | 77.27     |                | 86.11   |                | 73.49  |                | 67.09  |                |
| 20 - 40 min         | 85.86   | < 0.001        | 87.50     | 0.6115         | 89.58     | 0.0394         | 90.41   | 0.9225         | 83.87  | 0.0925         | 81.18  | 0.0158         |
| 40 - 60 min         | 83.04   |                | 89.91     |                | 89.62     |                | 86.08   |                | 82.35  |                | 77.78  |                |
| > 60 min            | 95.93   |                | 92.17     |                | 93.28     |                | 83.02   |                | 91.15  |                | 90.09  |                |

#### 337 4.2. Which modes do travellers associate with affective values?

338 The preceding analysis suggests that there is significant mode dissonance  
 339 along various dimensions and for various affective values. This is for the most  
 340 part in line with previous research, although by examining different affective  
 341 values individually instead of a summary measure of wellbeing, we are able to  
 342 differentiate better in terms of how travellers respond to different affects. Less is  
 343 known about the values that travellers associate with modes *other* than the one  
 344 they use. For this reason, after developing a profile of the travelers who experience  
 345 mode dissonance in the preceding section, we are now interested in the responses  
 346 of travellers with respect to the modes they tend to associate with various  
 347 affective values. For this analysis we employ a visualization technique known as a  
 348 mosaic plot. Mosaic plots are used in the exploration of multivariate categorical  
 349 data (Friendly, 1994; Hofmann, 2000), and they provide visual representations  
 350 of multi-way contingency tables. The elements of the mosaic plot are called *tiles*,  
 351 and the dimensions of each tile are proportional to values of variables in the  
 352 underlying table.

353 We begin our analysis by plotting primary mode of travel and the modes  
 354 associated with each affective value (see Figure 3). The height of tile  $j$  in these  
 355 mosaics corresponds to the proportion of travellers who primarily travel by mode  
 356  $j$ , hence we can see that the most common primary mode of travel in this sample  
 357 is by public transportation, followed by car, active travel, and other (also see  
 358 Figure 2). Notice that there are some small discrepancies in the heights across  
 359 affective values: these are caused by a small number of non-responses. Next, the  
 360 width of the tile  $k$  in the mosaics is proportional to the frequency with which a  
 361 mode was named in relation to affective value  $i$ . Recall that respondents could  
 362 nominate more than one mode in response to each affective value, and some did.  
 363 For this reason, we used sampling weights, so that the total number of responses  
 364 corresponds to the size of the sample.

365 In terms of Freedom, we see that Car users frequently identify this affect with  
 366 the use of Car; however, those who do not, very often select Active Travel as the  
 367 mode that better represents Freedom. A majority of active travellers, on the  
 368 other hand, identify Active Travel as the mode that evokes feelings of Freedom;  
 369 few of them attach this value to Car, and even fewer to public transportation and  
 370 other modes. Travellers whose primary mode of travel is public transportation  
 371 seldom associate this mode with Freedom, and in fact more frequently relate this  
 372 affective response to Active Travel followed by Car. Users of other modes seem  
 373 to be split almost equally in their attribution of Freedom, between Active Travel,  
 374 Car, and Other. In general, Active Travel is the mode most often identified as  
 375 embodying Freedom, with the exception of Car travellers.

376 The pattern with respect to Enjoyment is similar to that for Freedom, but  
 377 with an even more decisive tilt towards Active Travel, with even more respondents  
 378 whose primary mode of travel is Car choosing Active Travel as the mode that  
 379 better represents Enjoyment. Notice that very few of Active Travelers selected  
 380 Car as an enjoyable mode. Likewise, compared to Freedom, Active Travel is  
 381 perceived as being more enjoyable by users of Public Transportatoin and Other

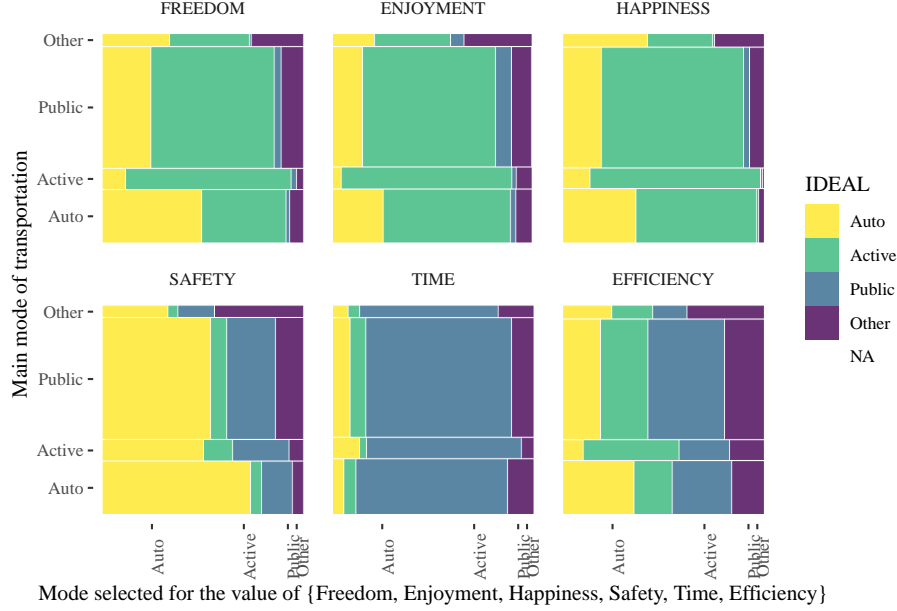


Figure 3: Mosaic plots for affective values; the y-axis is the proportion of respondents by main mode of transportation, and the x-axis is the proportion of modes selected for each value

382 modes. Responses with respect to Happiness are somewhere in between Freedom  
383 and Enjoyment, but Happiness is, if anything, even less frequently identified  
384 with Public Transportation.

385 Three other affective responses show a marked difference. Public Transportation  
386 was seldom associated by respondents to feelings of Freedom, Enjoyment,  
387 and Happiness; on the other hand, it is the mode that is most commonly se-  
388 lected by respondents for evoking feelings of Poverty - even by users of Public  
389 Transportation. Active Travel was the second most common response for its  
390 association with Poverty. Likewise, Whereas Active Travel was often associated  
391 to feelings of Freedom, Enjoyment, and Happiness, the mode most frequently  
392 associated with Luxury and Status is the Car, although active travellers seem  
393 to be somewhat more resistant to this association compared to respondents who  
394 travel by Car, Public Transportation, and Other modes.

395 Next, we further explore these responses after stratifying by Age, Education,  
396 Income, and Commute Time. We test the underlying 3-way tables by means of  
397 the Cochran-Mantel-Haenszel  $\chi^2$  test of independence.

#### 398 4.2.1. Age

399 There are some interesting differences when viewed from the perspective of  
400 travellers of different ages (see Figure 4). For example, as seen above, active  
401 travel is commonly associated with freedom, happiness, and enjoyment, even

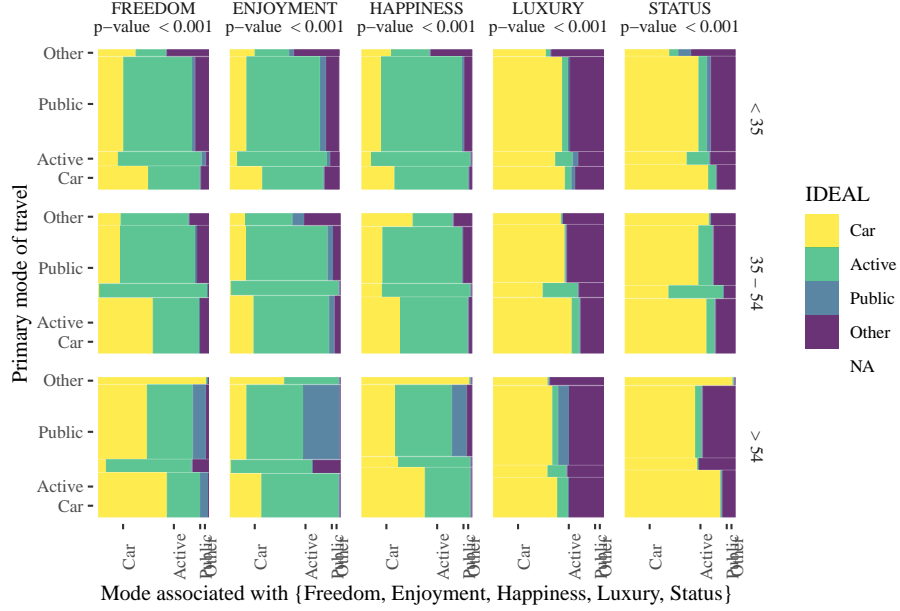


Figure 4: Mosaic plots for affective values by age; the y-axis is the proportion of respondents by main mode of transportation, and the x-axis is the proportion of modes selected for each value (p-values are for Cochran-Mantel-Haenszel Chi-Squared Test)

by car users, but especially by users of public transportation and other modes. However, when we break this down by age, we notice that this tendency weakens as people age, and older travellers increasingly associate these affective values to the car. Furthermore, the tendency to associate status with the car tends to increase with age, with the possible exception of public transport users, for whom other options (possibly taxi), gain status for older travellers (> 54) at the expense of other modes, including the car. In contrast, the car loses in the value of luxury with age, while other options become more commonly associated with feelings of luxury for older respondents, even for car users (Figure 2). Older car users (> 54) show less dissonance in status than in luxury, while active travellers present more dissonance in status than in luxury - and in fact, they more commonly project status in the car.

#### 4.2.2. Education

Only two affective values were significant in the preceding analysis when seen from the perspective of education, namely luxury and status. As seen in Figure 5, the perceptions of luxury and status are fairly consistent when differentiated by education. Most respondents tend to associate luxury and status to the use of car, albeit this association is stronger for status than for luxury. The second mode most often mentioned in relation to luxury is “other” likely due to the

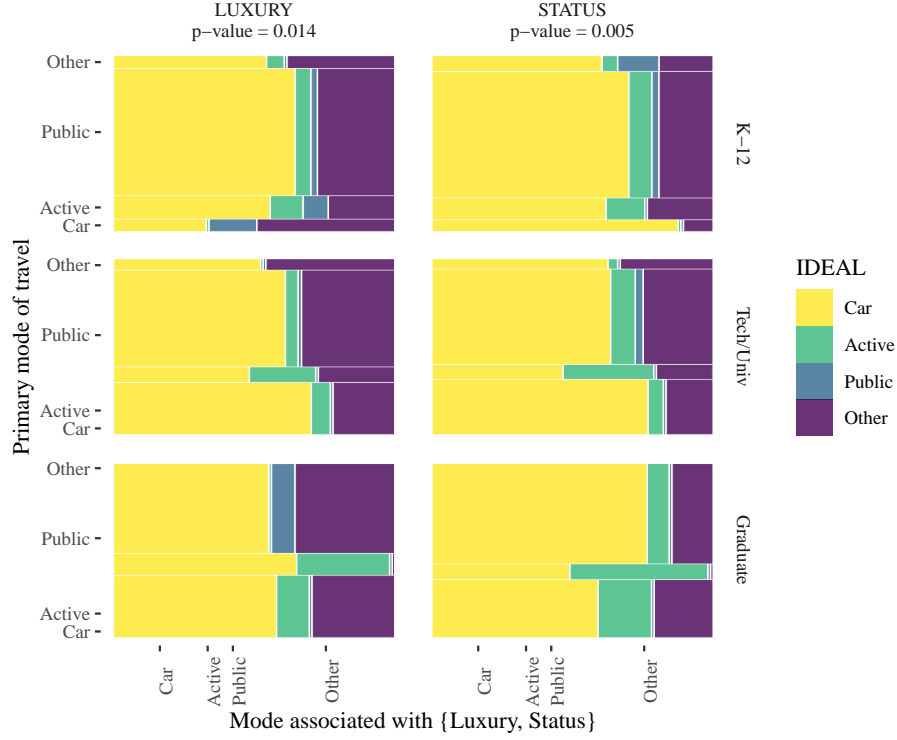


Figure 5: Mosaic plots for affective values by education; the y-axis is the proportion of respondents by main mode of transportation, and the x-axis is the proportion of modes selected for each value (p-values are for Cochran-Mantel-Haenszel Chi-Squared Test)

flexibility and convenience (but cost) of using taxis. The exception in this case is the traveller with graduate education who uses active modes. This type of respondent, while still more likely to associate luxury and status with the car, more commonly links active travel to these affects than travellers with lower levels of education. Most public transport users tend to associate luxury and status to the car, however, they associate active modes with status more than the same group with respect to luxury.

#### 4.2.3. Income

Three affective values were significant in the analysis by income; perhaps not surprisingly, all three have an economic dimension. Figure 6 reflects some important social inequalities associated with the way users feel about transportation in Santiago. When the affective perception of poverty is analyzed, the image shows that generally public transport is the mode most commonly associated with poverty. There are some interesting differences, however, to be observed by income level. Whereas middle income users of public transportation associate



436 this mode to poverty most frequently, this is not the case of high income users  
 437 of public transportation, who tend to link active travel to poverty with greater  
 438 frequency. Similarly, active travel is more often associated with poverty by low  
 439 income travellers than middle or high income travellers. A possible explanation  
 440 for this is that walking or cycling are related to the idea of a lack of financial  
 441 means to access other modes of transport. For high income car users, on the  
 442 other hand, public transportation may have connotations of poverty due to its  
 443 massive use, whereas active travel may be seen more as a lifestyle alternative.

444 With respect to luxury and status, we see again that these two values  
 445 coincide more strongly in their association with the car. Moreover, we also notice  
 446 that these perceptions become increasingly frequent at higher levels of income.  
 447 Unlike users of other modes, the high-income public transport user group tends  
 448 to concentrate a broader association of luxury and status factors with active  
 449 transport, reinforcing the notion that at higher levels of income, people may see  
 450 active modes as a lifestyle alternative. High income active travellers, although  
 451 still more likely to associate luxury and status to the car, are more likely than  
 452 users of other modes to associate these affects to active travel, perhaps due to  
 453 an awareness of the benefits of walking and using the bicycle. Furthermore,  
 454 high-income users of cars are more likely to experience consonance with respect  
 455 to status and luxury, in what might be a form of self-congratulatory confirmation  
 456 of success.

#### 457 4.2.4. *Typical commute time*

458 The last dimension that we examine is typical commute time. Four affective  
 459 values were significant along this dimension in Table 1. Figure 7 shows the way  
 460 travellers associate different affective values to modes of transportation by length  
 461 of typical commute. The first couple of factors, freedom and enjoyment, are  
 462 associated with eudaimonic and hedonic factors of wellbeing, as discussed earlier  
 463 in the paper. On the other hand, the luxury and status are defined mainly by a  
 464 socio-economic component. As seen in the figure, freedom and enjoyment are  
 465 most frequently mentioned in relation to active travel, followed by car. However,  
 466 active travel is more frequently associated with freedom and enjoyment by people  
 467 who typically undertake relatively short trips (<20 min) or travellers whose  
 468 typical trips are longer (>60 min). In this respect, active travel may be seen  
 469 as an ideal mode for trips, and as an enviable mode by people whose trips are  
 470 longer.

471 In the case of luxury and status factors, both follow a similar pattern, despite  
 472 variations in travel times. Despite the travel time exceeding 60 minutes, car  
 473 users consider that their transport mode is mostly associated with luxury and  
 474 status. The users of active transport in the sample tend to travel less than 20  
 475 minutes, and this is the same segment that considers that the status and luxury  
 476 factors correspond mainly to the car and then to active transport. Looking at  
 477 the four factors set out in Figure 7, it could be understood that the modes that  
 478 are associated with intrinsically positive characteristics such as freedom and  
 479 enjoyment tend to use public transport. On the contrary, factors such as luxury  
 480 and status tend to have a negative connotation, where the association with the

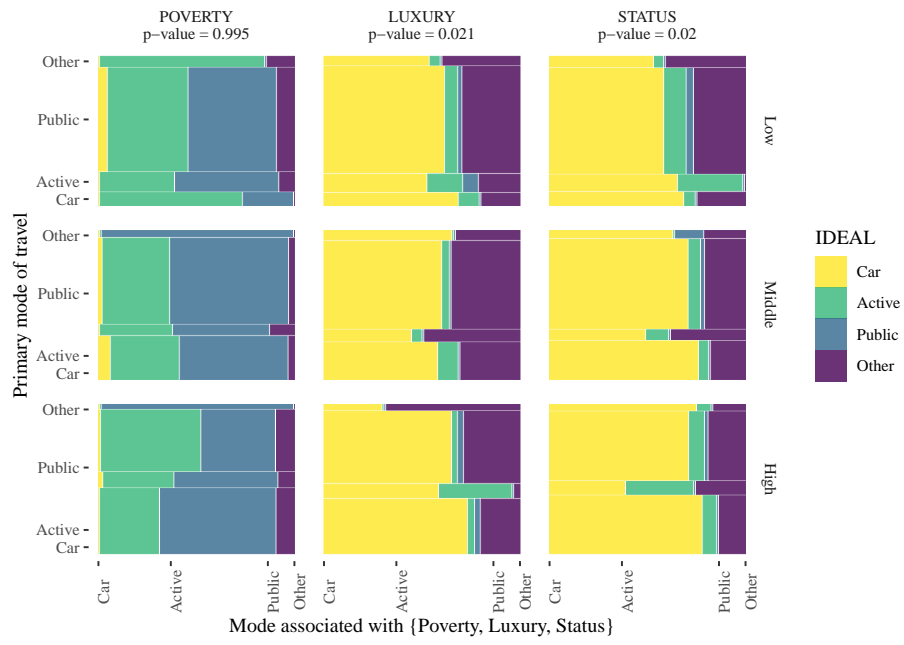


Figure 6: Mosaic plots for affective values by income; the y-axis is the proportion of respondents by main mode of transportation, and the x-axis is the proportion of modes selected for each value (p-values are for Cochran-Mantel-Haenszel Chi-Squared Test)

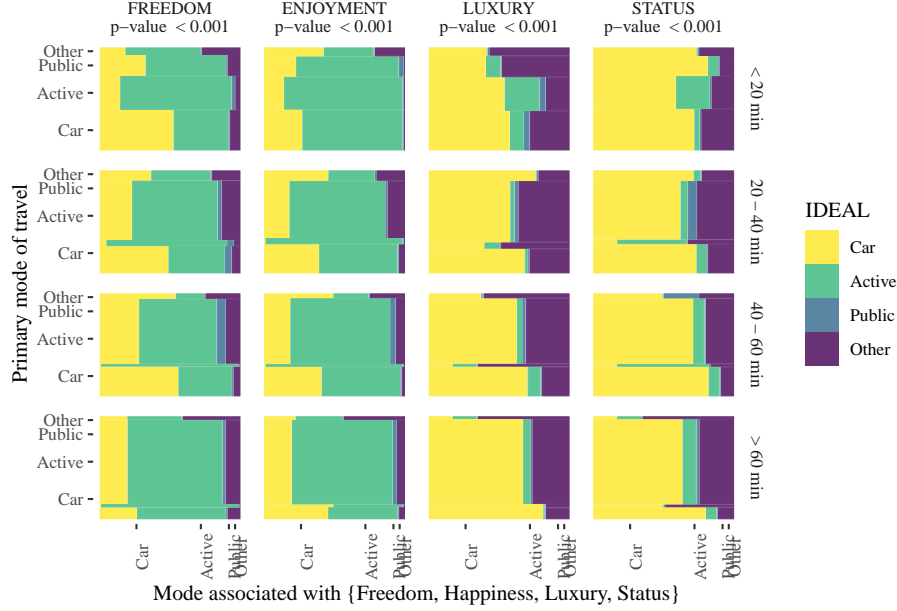


Figure 7: Mosaic plots for affective values by commute time; the y-axis is the proportion of respondents by main mode of transportation, and the x-axis is the proportion of modes selected for each value (p-values are for Cochran-Mantel-Haenszel Chi-Squared Test)

car and other modes of transport (such as the individual taxi and the collective taxi) tends to dominate.

## 5. Conclusions

Subjective wellbeing is a topic that has attracted considerable attention in recent years due to its relationship with health. In the field of transportation, there is a large and growing body of literature that documents the way transportation can impact subjective wellbeing. Likewise, there is strong evidence that subjective wellbeing can influence travel behavior. As the world tries to move from a culture dominated by a century-long love affair with the automobile, there is a pressing need to understand how travellers perceive different modes of transportation from the lens of subjective wellbeing. Insights in this regard could prove valuable to develop and implement plans and policies to attract and retain users to healthier, more environmentally friendly transportation options, in particular active travel and public transportation. For this reason, understanding mode dissonance, the extent to which the context of travellers differs from their aspirations, is a worthwhile topic for research.

The premise of the research presented in this paper is that subjective wellbeing is a composite construct of various affective values. In this paper we investigated

mode dissonance from the perspective of six affective values associated with subjective wellbeing, namely freedom, enjoyment, happiness, poverty, luxury, and status. The research presented here was based on a sample of travellers in Santiago, the capital of Chile. Participants in this research were asked about their typical mode of travel, and then about the mode or modes that they associate with each of the six affective values. Analysis using hypothesis testing (tests of independence) and visualization techniques (mosaic plots) uncovered interesting patterns. Some of our findings are well aligned with previous research; for example, active travellers experience less dissonance than car users, and users of public transportation experience the most dissonance of all. However, by considering affective values separately instead of aggregating them into a single indicator of subjective wellbeing, we manage to preserve some granularity with respect to various responses. This turns out to be important, because hedonic/eudaimonic values are more frequently related to active travel (freedom, enjoyment, happiness), whereas poverty is more frequently related to public transportation and active travel. Luxury and status, on the other hand, are more frequently associated to luxury and status.

Further delving into the question of which modes are associated with these affective values, we find that there are important differences in terms of the typical mode of travel. Active travellers experience dissonance with relatively little frequently with respect to freedom, enjoyment, and happiness, but when they do, they tend to attach positive values to the car. Car users experience dissonance with respect to these affects more frequently than active travellers, and when they do, they strongly relate positive hedonic/eudaimonic values to active travel. In other words, it is possible that drivers dream of walking when it comes to feelings especially of enjoyment and happiness. The other side of the coin is also interesting. When it comes to affective values with a stronger socio-economic flavor, such as poverty, luxury, and status, car users tend to experience dissonance less frequently than users of other modes. Active travellers, although more resistant to the lure of the car compared to users of public transportation, also tend to attach values of luxury and status to the car when they experience dissonance.

An examination of these effects by age, level of education, level of income, and typical trip duration reveals that some of the responses become more pronounced. For instance, older people are less likely than younger people to associate active travel with positive hedonic/eudaimonic affects, and are more likely to attach these values to the car. People with higher incomes are more attuned to the luxury and status values of cars, whereas lower income people are more likely to relate active travel to luxury and status.

Our results not only help to flesh out some ways in which mode dissonance could play out from the perspective of different affects, but also does so in the context of a Latin American country, a region where historically there are deep-seated taboos with respect to different modes of transportation: the poor travel by public transportation and/or are forced active travellers; where the rich enjoy the luxury of private vehicles and/or are active travellers by choice. In this way, the paper helps us to reflect on the ways the public experiences transportation-

545 related subjective wellbeing, and how this in turn could be used to increase the  
546 attractiveness of public transport and active travel in the socio-demographic  
547 groups studied.

548 With respect to opportunities for future research, a possible avenue for  
549 extending the findings reported in this paper relates to the use of the modes  
550 other than the typical mode of transportation. In a recent paper that investigated  
551 commute satisfaction for car users, Al-Ayyash and Abou-Zeid (2019) considered  
552 three models: for current trip satisfaction, remembered satisfaction while using  
553 public transport, and current satisfaction using public transport. The findings  
554 suggest that low service quality in public transportation can result in a generalised  
555 negative perception, and that this perception is more difficult to smooth if  
556 commuters do not regularly use public transport. Another avenue for future  
557 research could be to consider the mix of modes typically used. While in this paper  
558 the analysis focused on the primary mode of transportation, many travellers  
559 experience more than one mode of transportation in their daily activities. For this  
560 reason, considering the multimodal component of travel would be interesting; for  
561 example, future research could consider people who eventually arrive by bicycle  
562 to the metro station or people that, after using a colectivo for part of a trip, end  
563 their journey by bus.

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568 2015), `rticles` (Allaire et al., 2018), and `tidyverse` (Wickham, 2017).

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