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Is the pleasure of driving a constraint for leaving the car?

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Abstract

Society exhibits an increasing dependence on private car use for commuting: city paralysis, pollution and resources waste are main effects of this conduct. Although technological innovations, it is necessary to reduce the volume of individual motorized means in order to improve environmental quality and to decrease congestion. In this study, we examine through a stated preference (SP) experiment to what extent new generations are willing to accept new possibilities for mobility and spatial development. The second important goal is to understand how sociocultural indicators can affect the choices. In fact, several studies showed that in addition to instrumental factors, also symbolic (as status and prestige) and affective (as love driving and freedom) motives influence car use. Through a hybrid discrete choice experiment, we explain how a latent construct, named *pleasure of driving*, can influence the choice. Data are collected by means of a paper and pencil survey among young people that work or study in Lugano.

Keywords

Hybrid discrete choice experiment – latent construct – pleasure of driving

1. Introduction

In the last decades, the use of private car has increased: in Switzerland, approximately 65% of transfers per year (independently from the reason) are done using an individual motorized transport mean (car and motorbike). Commuting is the second reason (24%) for travelling after leisure and the most preferred mean is an individual motorized one, from almost 55% in Zurich to 83% in Ticino (Bundesamt für Statistik, 2010).

This practice entails negative externalities, such as pollution. Transport accounts for approximately 23% of current global energy-related CO_2 emissions and nearly 75% of these are generated by road transport (International Energy Agency, 2009). Furthermore also the quality of urban life, congestion, the accessibility of destinations are negatively influenced by the car use. Considering the limited help that technological innovations can bring, attention to behavioral changes towards more sustainable future must be invested.

Literature underlines that that instrumental factors like cost, travel time and comfort play a determinant role in mode choice. However, in the last 20 years, researchers are focusing on psychological factors to better understand the transport decision-making process (Golob and Hensher, 1998; Steg, 2005; Collins and Chambers, 2005; Nilsson and Küller, 2000). For that purpose, understanding commuters' attitudes and behaviors is a fundamental and necessary condition to attract individuals to the desirable public modes of transport.

A determinant factor, that needs to be explored in depth in order to reduce travel, is the degree to which travel is enjoyed: indeed, the more the travel is enjoyed, the less the desire to reduce it (Ory, Mokhtarian, 2009). According to Mokhtarian and Salomon (2001); Páez and Whalen (2010); Ory, Mokhtarian (2005) travel time is not simply a cost to be minimized as long as one enjoys the travel: activities such as interacting with nature, being with others, relaxing can in fact act as motivations (or in some circumstances as reason) for travelling.

Attention on this topic is mostly relegated to activities that one can do while travelling, like reading, listening to music, enjoying the landscape (Mokhtarian et al., 2001), but very few researchers focused their attention on the act of driving itself (Handy et al., 2005).

What this work pretend to do is to consider the wide construct "*pleasure of driving*" and explore whether (and how) it affects the transport choice through a stated preference experiment. In order to reach our aim, we designed a hybrid discrete choice model in which we inserted an innovative transportation system (i.e. moving walkways) in addition to more classical solutions (public transport, car, carpooling, car sharing).

This paper is organized as follows: Section 2 describes data and methodology; Section 3 reports the results; Section 4 discusses the key findings and the future research plans.

2. Data and methodology

2.1 Data and descriptive statistics

Data used in this research were collected through a paper and pencil questionnaire among young commuters in Lugano, Switzerland. We recruited respondents among professional schools, universities (Università della Svizzera Italiana and Scuola Universitaria Professionale della Svizzera Italiana) and some local firms. Throughout seven months (from February to September 2015) we interviewed 405 people with a slight majority of male respondents (56%). Most respondents were students (74%), the remaining were apprentices (13%), full time (7%) and half time (6%) workers. Mean age was 22 years, almost 90% stated to have a private car available but only about 79% of the sample had a driver's license.

The questionnaire is made up of two sections: an SP experiment with six scenarios (see the section *2.2 Design*), and a battery of attitudinal questions related to driving. In the present work, we focus our attention exclusively on the first section.

In table 1, we report the comparison between the actual (mode that respondents effectively use for commuting) and the stated (choices in the SP experiment) transportation mode for the respondents. The hugest difference is in bike and e-bike shares: this is probably because in the stated experiment we fixed the distance for getting to the workplace/university to 2.6 km, which is the average commuting distance for Lugano (Bundesamt für Statistik, 2010). This distance is greater than the actual, since most respondents (56%) stated to live more than 7 km far from their workplace/university, making impossible to commute effectively by bike. Another notable difference is in public means (train, bus, tram) that account for about 48% in the actual choices but only for 12% in stated choices. Interestingly the share for moving walkway, an innovative transportation system introduced in the experiment, equals 13%: this mode is composed by several walkways, similar to ones located into the airports, set on the main sidewalks of the city center, completely free but uncovered. Its width allows two columns of passengers and its speed reaches 15 km/h (boarding and disembark have a lower speed).

Tab. 1: actual choice vs state choice for commuting

ACTUAL CHOICE				STATED CHOICE			
Public means		Private means		Public means		Private means	
Train	28%	**Bike**	2%	**PT**	12%	**Bike**	18%
Bus	20%	**Walking**	16%	**Moving Walkway**	13%	**E-bike**	15%
Tram	0%	**Private car**	20%	**Car sharing**	0%	**Private car**	25%
Car sharing	1%	**Carpooling**	2%			**Carpooling**	3%
Missing	4%	**Motorbike**	5%	**Missing**	2%	**Motorbike**	12%

2.2 Design

In the SP experiment respondents indicate which transportation mode they would choose given hypothetical situations. In detail, in every scenario, respondents are supposed to live in Lugano and have a job position coherent with their education. The workplace is into the city center and every morning they commute for 2.6 km. What varies across scenarios is the wage they would earn, the travel time for any mode, its monthly cost and the transport system densities.

At the beginning of the questionnaire, respondents face a filter question through which they choose the private means combination that they guess having in this future situation (Tab. 2). The set of alternatives for any choice task is composed by one out of six private means combination and public means (PT, car-sharing, carpooling, moving walkways). Note then, that the set of alternatives varies across respondents according to the private means combination chosen. Carpooling has been inserted in the public means list although it consists in the sharing of a private vehicle as we consider carpooling as a not purchasable alternative.

Tab. 2: Available alternatives according to the filter question

	PRIVATE MEANS	PUBLIC MEANS
1	Private car + conventional bike	All available
2	Motorbike	All available
3	E-bike	All available
4	Private car + motorbike	All available
5	Private car + e-bike	All available
6	Conventional bike	All available

Alternatives are described by three attributes: *monthly cost*, *travel time* (referred to one-way trip) and *move or being moved*. As concerns the monthly cost, in addition to the km costs (TCS, Touring Club Svizzero), we included for Private Car, Motorbike, Conventional bike and E-bike the purchase and maintenance costs and for Private car and Carpooling the parking cost in the city center as well. Recall that the moving walkway alternative is completely free. The attribute move or being moved is a proxy of the system density indicating the walking km needed to cover the commuting distance.

Three levels characterize any attribute:

- Travel time levels are calculated considering the speed and the walking km to cover (according to the move or being moved attribute);
- Central value of Monthly cost has been calculated as: cost per km (including purchase and maintenance)*commuting km*21.75 (working day in a month according to Swiss legislation) + cost for parking. Higher and lower levels are respectively + and – 10% from the central value;
- Move or being moved levels differ among alternatives (for details, see Table 3).

Tab. 3: Move or being moved levels

	Move or being moved		
Public Transport	0,5 km	1 km	1,5 km
Bike		0 km	
Electric bike		0 km	
Moving Walkway	0,5 km	1 km	1,5 km
Private Car	0,2 km	0,4 km	0,6 km
Car-sharing	1 km	1,5 km	2 km
Car-pooling (passenger)	0,3 km	0,5 km	0,7 km
Motorbike		0,2 km	

In the first row of any choice task the monthly wage is specified: according to the Federal Statistical Office (http://www.bfs.admin.ch/), we inserted the median wage (± 25% for the other two levels) for workers five years after obtaining the master degree (in any field).

In Table 4, an example of a choice task for a respondent that guesses having a private car and a conventional bike is shown.

We opted for an efficient design (Rose and Bliemer, 2006; Rose and Bliemer 2007) with blocking (two blocks) through the software Ngene 1.1.2 (Ngene 1.1.2 User Manual & Reference Guide, 2014). In order to avoid very unreal situations, we excluded from the design combinations with the highest value for move or being moved and the lowest for travel time for public transport and moving walkway. For any of the six private + public modes combinations, we built 12 choice tasks (6 for each block). The range of D-errors is 0.09 (conventional bike combination) to 0.39 (motorbike combination).

Tab. 4: example of choice task for a respondent that guesses having a private car and a conventional bike as private means.

| *Monthly wage:* 7500 CHF						
	Public Transport	**Conventional bike**	**Moving Walkway**	**Private car**	**Car-sharing**	**Car-pooling**
Travel time	*14 min*	*10 min*	*23 min*	*14 min*	*20 min*	*21 min*
Monthly Cost	*45 CHF/ month*	*4 CHF/ month*	*free*	*260 CHF/ month*	*190 CHF/ month*	*80 CHF/ month*
Move or being moved	*1.0 walking km*	*Whole route by bike*	*1.0 walking km*	*0.2 walking km*	*1.0 walking km*	*0.3 walking km*
Choice	☐	☐	☐	☐	☐	☐

2.3 Methodology

As already stated, the main goal of this work is to investigate whether and to what extent attitudes influence individual choice. Hybrid discrete choice models (Walker, 2001) combine latent variables (LVM) and discrete choice models (DCM) guaranteeing a deeper representation of the decision-making process through a better understanding of attitudes.

Discrete choice techniques model a decision-maker's choice among a set of mutually exclusive and collectively exhaustive alternatives (for a textbook on discrete choice models, see Ben-Akiva and Lerman, 1985). The individual's choice is based on the assumption of rationality: any alternative carries a different amount of utility and the individual chooses the alternative that maximizes his own utility. In Fig. 1 the framework of hybrid discrete choice model is represented: utility functions depend on explanatory variables, both alternative characteristics (i.e. cost, travel time) and personal characteristics (i.e. gender, age); explanatory variables influence also latent variables (attitudes) that in turn affect utility functions.

The estimation of both parameters (discrete choice model and latent variable model) is simultaneous: it represents an improvement over sequential methods, because it produces consistent and efficient estimates of the parameters.

Fig. 1: hybrid discrete choice framework
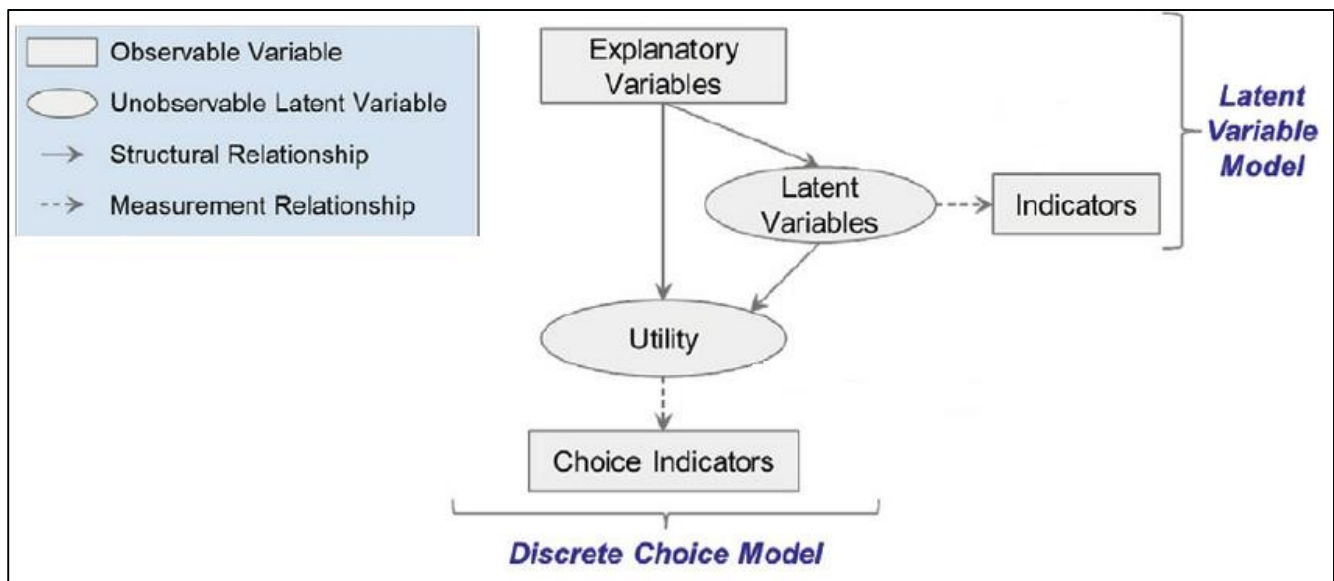
However, the first methodological step is to correctly identify latent constructs from the observed attitudes. Borriello (working paper STRC 2016) carried out this step in a previous work through an explorative factor analysis (EFA, for a textbook on this topic, see Bartholomew et al., 2011; Skrondal and Rabe-Hesketh, 2005) and a structural equation model.

3. Results

The model presented here includes eight alternatives, both public and private, for a commuting trip in Lugano. In the utility functions we inserted three attributes (i.e. travel time, monthly cost and move or being moved), socioeconomic variables, two error components for private and motorized means and five latent constructs obtained from the structural equation model. Specifically, the first latent variable summarizes attitudes related to car performance (hereafter, *Performance*), the second one includes environmental concerns (*Environment*), the third regards practicality and convenience (*Convenience*), the fourth represents attitudes related to car-sharing and carpooling (*CsCp*) and the last factor describes emotions (*Emotion*).

Commenting results of the HDCM, travel time, monthly cost and move or being moved have the expected negative coefficient meaning that an increase in these attributes leads to a decrease in the utility functions of all alternatives. It is possible to calculate to what extent people are inclined to pay in order to decrease the travel time: for saving one minute in a commuting trip, the willingness to pay (WTP) is 0.25 CHF, which amounts to pay 53 CHF more per month for saving 5 minutes every day per route. In a study on Swiss commuters, Axhausen et al. (2004) found a value of 0.46 CHF for saving one commuting minute using public transport and 0.51 CHF using private means; few years later Axhausen et al. (2008) reviewed estimations respectively to 0.31 CHF/min for public transport and 0.32 CHF/min for private means. The WTP is smaller in the present study maybe due to the sample composition differences: we interviewed mostly students or young workers (22 years old is the average) that stated to earn less than 30,000 CHF per year, while in their studies Axhausen et al. had an average income for commuters of 84,656 CHF. On this topic, Hess et al. (2008) calculated the WTP for Swiss commuters according to distance and income: who works 5 km from home and has a gross income household lower than 12,000 CHF/year and commutes by private means is willing to pay 0.33 CHF/min, twice commuting by public means (0.16 CHF/min).

Monthly wage has a positive effect (three different levels for wage) on the most expensive alternatives: higher wage increases the utility of private car, car-sharing and carpooling with respect to the other alternatives.

Both error components are significant meaning that there is inter-alternative correlation among motorized alternatives (public transport, private car, car-sharing, carpooling, motorbike) and private means groups, as well as heteroscedasticity.

The significance of all socio-economic variables included in the HDCM model facilitates the understanding of the transport mode choice process. Working rather than studying increases the utility of choosing car and motorbike: workers might face higher time constraints than students, and they might need more flexibility on the job. Those who used to commute by private means have a higher probability to prefer private means for commuting and those who use the car at least three days per week (as driver or as passenger) have a higher utility from private car use than occasional drivers or passengers. Interestingly young people (from 18 to 25) have a higher utility from private car use than older people (> 26 years old). This could be an "early years" effect having waited so long for the driving

license as well as an innovation effect due to the opportunity to commute by a new mean that makes them feel adult and independent. The negative sign of the coefficient for *sportsman* (p-value 0.06) related to the light transport mode is intriguing: people who do sport frequently (two or more times per week) have a lower utility from choosing bike and moving walkway than people that rarely do sport. An explanation could be that sporty people do not perceive walking or cycling to reach the workplace or the university as an exercise that can improve their performances, while persons rarely practicing sports consider walking or cycling essential for a healthier life.

As concerns the latent variables, all coefficients are significant in the measurement equations (Table 5).

Table 5: measurement model coefficients

LATENT VARIABLE	NAME	VALUE	T-TEST	P-VALUE
Performance	*brand*	-1.30	-11.18	0.00
Performance	*design*	-1.37	-14.58	0.00
Performance	*envy*	-1.36	-11.93	0.00
Performance	*fast*	-1.58	-14.48	0.00
Performance	*power*	-1.42	-13.35	0.00
Performance	*rumble*	-1.77	-14.68	0.00
Environment	**airq1**	1.19	11.59	0.00
Environment	*airq2*	0.952	8.75	0.00
Environment	*ecodist*	0.942	10.21	0.00
Environment	*futgen*	0.905	7.91	0.00
Environment	*morept*	1.11	10.61	0.00
CsCp	*cpconv*	1.25	10.45	0.00
CsCp	*cpstrang*	1.06	11.01	0.00
CsCp	*cspark*	1.15	10.08	0.00
CsCp	*csstat*	1.14	10.23	0.00
Convenience	*challeng*	-1.01	-17.90	0.00
Convenience	*comfort*	0.974	14.92	0.00
Convenience	*discomf*	-0.988	-14.71	0.00
Convenience	*handy*	1.06	17.90	0.00
Sensation	*boring*	-0.401	-5.98	0.00
Sensation	*funny*	0.268	3.83	0.00
Sensation	*stress*	-0.392	-4.96	0.00
Sensation	*relax*	0.337	4.55	0.00

Performance is positively reflected in its six items: higher is the latent variable score, higher will be any measured attitude (*brand, design, envy, fast, power, and rumble*). In other words, those who are deeply interested in car performances show higher scores on attitudes like "Powerful cars make me feel strong" or "Car design is essential for me". The same result appears with Environment (*airq1, airq2, ecodist, futgen and morept) and CsCp (cpconv, cpstrang, cspark and csstat*): people who care more about environment, ecology and sharing trips confer higher scores on attitudes like "I limit my auto travel to help improve congestion and air quality" and "I am incline to pool a ride, since it is economically convenient, environmentally friendly and less boring" more likely. Latent construct Convenience is

positively linked to *comfort* and *handy* and negatively to *discomfort* and *challenging*: people who feel that commuting by car is a convenient solution, tend to give high values to comfort and practicality and low values to discomfort and unpracticality. Finally, Sensation has similar results, being positively related to *relax* and *funny* and negatively to *stress* and *boring:* those who feel good commuting by car, score higher on relax and fun items and lower on stress and boredom.

In the DC model, latent variables inclusion helps to better understand the decision-making process, pointing out how attitudes can affect the choice (Table 6).

Table 6: latent variables estimates in DC

LATENT VARIABLE	VALUE	T-TEST	P-VALUE
Convenience	0.875	4.90	0.00
CsCp	1.67	7.83	0.00
Environment	2.05	8.85	0.00
Performance	-2.18	-2.65	0.01
Sensation	3.36	5.69	0.00
Envi*Gend	-0.259	-0.79	0.43
Perf*Gend	0.018	0.06	0.96
Perf*Ita	2.81	3.50	0.00
Sens*Ita	-6.07	-9.11	0.00
Monthly cost	-0.011	-6.27	0.00
Travel time	-0.118	-8.97	0.00
M.o.b.m.	-1.33	-8.58	0.00
EC motorized	3.13	13.69	0.00
EC private	-2.40	-14.03	0.00

In the specification presented in this work, we inserted the main effect of the latent variable Performance in private car and car-sharing utility functions (remember that in carpooling we only consider the possibility to be a passenger) and two interactions between the latent variable and, respectively, gender and Italian speaking dummy variable (Italian citizens and Swiss citizens living in Ticino). Results surprisingly suggest that, everything else being equal, there is a difference between those who speak Italian and those who do not, while the gender difference is not significant: in detail, commuters who speak Italian increase their utility for private car and car-sharing while the main effect of Performance increases, and conversely, commuters who do not speak Italian increase their utility for such modes while Performance decreases. That is, if Italian speaking people are car fanatic, showing interest in fast and powerful cars, liking to be envied while they are driving their dream car and identifying themselves with the brand of the car, they evaluate private car and car-sharing utilities

higher than not Italian speaking people. It is an expression of how much car matters in Italian culture, of its importance and its meaning as status symbol, more important than elsewhere.

The latent variable Environment, inserted in public transport, bike, moving walkway and e-bike utility functions, has a significant and positive estimated coefficient. Commuters who have high score on this latent construct, that is those who feel guilty for the quality of life of future generations, who are willing to pay more to use an electric or other clean fuel vehicle, or those who think that it is urgent to do something to limit ecological problems, are more inclined to choose ecological and not motorized solutions or public transport (all else being equal). Also in this case, the interaction with the gender is not significant, suggesting that young commuters in Lugano, males and females, equally care about the environment.

CsCp latent construct has been inserted into both car-sharing and carpooling utility functions. Everything else being equal, higher score in this latent variable translates into higher probability of choosing sharing vehicles. In particular, persons who pool a ride for its convenience, for environmental awareness and persons who do not worry about parking in doing car-sharing, confer higher utility to car-sharing and carpooling.

As concerns Convenience, ceteris partibus, the more respondents care about practicality and comfort the higher is the utility associated to private car.

Also the results concerning the latent construct Sensation differ according to the Italian speaking dummy: specifically, those who do not speak Italian who stated that commuting by car is a relaxing and funny solution, tend to confer higher utility to private car. Italian speaking people, quite opposite, tend to choose private car also when stress and boredom in commuting increase (see the coefficients magnitude in Table 6). It is still a signal that cultural and social background has a strong influence on the transportation mode choice: Italian speaking people are deeply attached to the car and have a higher probability to choose this mode, even if they judge commuting by car stressing and boring.

4. Discussion

This work, by means of a SP experiment, aimed at providing a deeper knowledge of the decision-making process for commuting mode choice through a hybrid discrete choice model.

In the last two decades, researchers moved their attention from instrumental factors to psychological attitudes to better explain choices in transport, mainly considering environmental awareness (Nilsson and Küller, 2000), symbolic and affective factors (Steg, 2005), pleasure of travelling (Ory and Mokhtarian, 2005). However, in the current state-of-practice very few researchers focused strictly on the wide construct of pleasure of driving (Hagman, 2010; Marsch and Collett, 1986). Borriello (STRC 2016) identified this global attitude in three latent constructs that are *Performance*, *Convenience* and *Sensation*. Performance includes attitudes related to car aesthetics and characteristics (i.e. design, brand, speed, power), Convenience incorporates comfort and practicality and Sensation reflects fun

and relax in commuting by car. Moreover, from his analysis emerges another wide construct, *Green Attitude*, made up of two latent constructs, *Environment awareness* and *CsCp* (attitudes pro car-sharing and carpooling).

The sample is composed by young students and workers in Lugano. Main result of our analysis suggests that commuters who have higher scores in Convenience, Performance and Sensation (these last two interacted with a dummy for Italian speaking people) choose private car more likely than commuters who have not. Conversely, people who scored higher values in Environmental and CsCp tend to confer higher utility at public transport, bike and e-bike and moving walkway than people who scored lower values.

From the analysis also emerges that cultural background matters in choosing transportation mode: there is a difference between Italian speaking people and others regarding latent variables Performance and Sensation. People who speak Italian tend to choose more likely private car than people who do not, when Performance increases and even when Sensation decreases. This is a clear expression of the attachment to the car of Italian (by culture, not citizenship) people, of its importance and its manifestation as status symbol. Note that due to the proximity of Lugano to the Italian boarder, the sample just contains 10% of not Italian speaking people.

Differently from Lois and López-Sáez (2009) findings, interactions between gender and the abovementioned latent constructs are not significant.

Another important finding is the willingness to pay for reducing commuting time: 0.25 CHF for saving one minute, which amounts to pay 53 CHF more per month for saving 5 minutes every day per route. This result is slightly lower than Axahusen et al. (2008) found on Swiss commuters, but their sample included people with higher incomes.

The pleasure of driving is an important factor affecting the transportation mode choice: higher is the pleasure, higher is the utility from private car use. This empirical finding suggests to consider also sensations that people feel when they drive in establishing policies aimed at reducing externalities like congestion and pollution. Follow that it is hard to convince commuters who feel deep pleasure when driving to leave their private car: policy makers could intervene reinforcing and subsidizing car-sharing and making more attractive electric vehicles. Certainly, it would be profitable to identify commuters who do not feel pleasure when driving and concentrate policies efforts on this cluster. This research identifies significant differences in social and cultural background and suggests to focus on not Italian speaking people.

The presented work will be improved including in the sample young people studying or working in Zurich, Luzern, Lausanne and Neuchatel in order to explore whether and how the social and cultural context can affect the pleasure of driving, and in turn the mode choice.

In closing, it should be reminded that the specification presented in this work is one among several tested and more work remains to be done in performing different specifications.

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