Exploring the components of the pleasure of driving using a partial least square–path model approach

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Abstract

Instrumental factors, like cost and travel time, play a determinant role in transport mode choice. Irrespective of the purpose of travel, private car use remains the dominate mode of transport in highly developed countries, whilst simultaneously becoming more popular in less developed ones. In order to limit car use, it may be necessary to pay more attention to soft psychological factors, which may help to better understand the transport decision-making process and, as a result, suggest possible corrective actions and policies. There is general agreement that psychological factors, such as environmental awareness, safety, convenience and symbolic aspects of the car, influence the mode choice.

This study seeks to examine the latent construct "*pleasure of driving*", meant as the act of driving itself. This feeling clearly fosters the private car use, clashing with the public interest in reducing it. Using a component based - structural equation model on data collected among young commuters in Lugano (Switzerland), the paper explores the psychological aspects towards driving. Evidence shows that, through a hierarchical model, attitudes related to *car performance* (such as speed, design, brand), *convenience* (such as comfort, practicality) and *emotion* (such as relax, stress, boredom) are strongly connected with the pleasure of driving. A second important latent construct, which influences the private car choice, is related to "green" attitudes, including attitudes towards environmental concerns and sharing vehicles.

Keywords

Driving pleasure; structural equation modeling; attitudes toward driving

1. Introduction

This research is undertaken in the general context of sustainable transport. In the last 30 years, urban transport has experienced a deep transformation worldwide characterized by a spasmodic use of private car in spite of the intensification of public transport system. According to Eurostat, in 2014 in Europe, 83.4 percent of kilometers traveled were on average made using an automobile, ranging from 64.9 percent of kilometers traveled in Turkey to 89.8 percent in Portugal. In Switzerland policies supporting the use of public transport have seen the share of kilometers traveled by car decrease by approximately four percent over the past last twenty-five years, to 77.7 percent of all kilometers travelled. Nevertheless, despite a decrease in the share of kilometers travelled, in Switzerland, the number of cars per capita was observed to increase by 18 percent over the years 1991 to 2014, to 539 cars per 1000 inhabitants.

As early as 1997, Greene and Wegener noted that “there is now broad agreement that the present trends in world transport are not sustainable” (cit. p. 177). Unfortunately, despite widespread support, consensus on how sustainability in transport can be achieved has not been forthcoming. The dominant policy orientation across all contexts (i.e., urban and rural, short and long distance, commuting and leisure trips) consists of various combinations and measures of promoting public transport on the one hand and restricting car traffic on the other.

In order to reduce the negative externalities caused by the excessive car use, such as pollution, congestion and accessibility of destinations, several researchers have suggested numerous “hard” measures, based on the introduction of temporary incentives. Nevertheless, such resolutions may not be effective in achieving car-use reduction by themselves (Stopher, 2004), and moreover in some circumstances, they can be difficult to implement because of public opposition (perceived effectiveness) and political infeasibility (e.g. Gärling and Schuitema, 2007; Jones, 2003).

Due to such difficulties, social scientists and transport psychologists have tended to move their attention towards identifying and measuring psychological factors which influence private car use in order to have a deeper understanding of the decision processes which different individuals employ with respect to transport mode choices, with the aim of developing more appropriate and effective policies. Exploiting the Theory of Planned Behavior (Ajzen, 1985), which suggests that attitudes, social influence and perceived behavioral control affect the intention and consequent behavior, numerous researchers have shown that transport mode choice is influenced by attitudes towards the environment, safety and convenience, as well as by symbolic and affective reasons. Steg *et* al. (2001) showed that symbolic (e.g., car is a means of expressing your social position) and affective (e.g., emotions evoked by driving a car) factors play an important role in choosing to travel by car. Feelings of power, freedom, superiority, prestige and arousal are manifestations of these factors. In the same vein, Steg (2005) found that people are inclined to commute more often by car when they judge its symbolic and affective functions more favorably, and that younger respondents valued such functions more strongly than other age groups. The importance of affective aspects is also highlighted by Anable and Gatersleben (2005) in their work on leisure travels. In their study, instrumental and affective factors were found to have the same influence on the transport mode choice. Golob and Hensher (1998) underline the importance of private car use as a status symbol. They found that women who perceive car use as conveying a higher social status are more inclined to choose solo driving alternatives. Researcher has also found that attitudes towards the environment have a significant influence on car usage. For example, Johansson *et* al. (2006) found that for a sample of Swedish commuters, environmental concerns as well as attitudes towards flexibility and comfort significantly influence the individual's mode choice. Similar evidence was found by Nilsson and Küller (2000), Nordlund and Garvill (2003) and

Collins and Chambers (2005) who found that environmental awareness influences the intention to reduce car use.

Research has further shown that the inclusion of specific psychological predictors can help explain a significant proportion of the variance in people's mode preferences across various situations (Klöckner, 2011). Travel choice policies should therefore include both structural and psychological factors. Indeed, socio-structural contexts and individual's problem awareness, attitudes and norms are important components of travel decisions (Noblet, Thøgersen, Teisl, 2014).

Furthermore, numerous studies examining how psychological aspects influence transport mode choice suggest that so-called "soft" (or "smarter choice" in Cairns *et* al., 2008) measures can be activated to achieve a more sustainable transport system (for an overview see Bamberg *et* al., 2011). Such measures aim to persuade car users to switch to more sustainable modes via information dissemination (Taylor, 2007; Taniguchi *et* al., 2007; Gärling and Fujii, 2009) or by enacting psychological and behavioral strategies (Fujii and Taniguchi, 2006). The efficacy of such strategies has been shown over several studies (e.g., Taylor, 2007; Cairns *et* al., 2008; Richter *et* al., 2010; Brög *et* al., 2009).

A psychological construct that potentially may be strongly associated with transport mode choice, but which has been largely ignored within the literature, is the pleasure of driving, meant as the enjoyment, excitement and enthusiasm that an individual may derive simply from the act of driving itself. For example, several studies have argued that time spent driving can result in positive utility as opposed to causing disutility. A possible explanation for such an observation might be that emotions and sensations incurred whilst driving may contribute to a desire to drive simply for the sake of driving, and for this reason, policy makers should consider such psychological processes when developing sustainable transport policies. To date however, the literature examining positive utility associated with travel time has mainly focused on motion, control, exposure to scenic beauty, the interaction with nature, travelling with other people, or being able to undertake activities whilst travelling on say public transport, such as reading, listening to music, or relaxing (Mokhtarian and Salomon, 2001; Handy *et* al., 2005).

Pleasure associated with driving has however been discussed within the tourism literature. Here, the pleasure derived from driving has been linked to the importance of, and perception of crowding/congestion, the possibility of seeing scenery, as well as the safety and the flexibility given by visiting the final destination using one's own car (Manning, 1999; Eby and Molnar, 2002; Gartner and Erkkila, 2004; Hallo and Manning, 2009). Outside of tourism, the most relevant contributions to the investigation of the pleasure of driving (PoD) are by Marsh and Collett (1986) and Hagman (2010). Marsh and Collett (1986) identified both affective and symbolic functions as the main factors influencing the passion for driving, regardless of the purpose of the trip. Hagman (2010) similarly identified a twofold classification of the driving pleasure, suggesting that the pleasure of driving is based on the "essence", i.e. engine power, speed and drivability, as expressed through advertisements and motoring related press, and on "context", which is directly experienced by car users, as defined by road quality, weather conditions and purpose of the journey.

The present work contributes by providing a better understanding of the transport mode choice process, and, analyzing data collected among young commuters in Lugano (Switzerland), sheds light on the formation of the wide latent construct of the pleasure of driving. In view of a more sustainable transport reality, attracting young individuals to public modes or reducing private car use becomes an essential and urgent condition. To reach this goal, policies should include both hard and soft measures and therefore a deeper and more extensive knowledge of commuters' attitudes and behavior seems necessary and fundamental.

The remainder of the paper is organized as follows. Sections 2 and 3 contain the methodology and the description of the sample used for this research: data are collected within the project Post-Car World (postcarworld.epfl.ch), funded by Swiss National Science Foundation, and are analyzed using component based - structural equation model techniques (via a partial least square approach). Next, evidence of the study is reported in section 4, after which conclusions are drawn alongside a general discussion of the findings. The paper concludes with a discussion of future research.

2. Methodology

This section describes the structural equation models using a component based approach, which is commonly employed to analyze cause and effect relationships. Component based approaches, such as partial least square (PLS-SEM or PLS-PM), are partial information methods aimed at maximizing the latent variable (LV) representativeness within and between blocks using an iterative process.

The present work represents exploratory research aimed at identifying the structure and key factors composing the construct of *pleasure of driving*. To perform the analysis, a structural equation model based on a component based approach is preferred to a covariance based approach, due to the complex structure (hierarchical model) and the violation of the normality distributional assumption of the data (Doornik-Hansen test for multivariate normality: $\chi^2_{28} = 158.950, p - value < 0.000$).

Structural equation model, component-based approach (PLS-SEM)

Similarly to covariance-based techniques, a SEM based on a component approach consists of two components. The first component, the inner model (or structural model), details the relationships amongst the latent variables, whilst the second component, the outer model (or measurement model), captures the links existing between the latent and observed variables. In the structural model, it is possible to define two different types of latent variables. *Endogenous* latent variables are latent variables that are (partially) explained by other latent variables, whereas *exogenous* latent variables have no association with any other latent variable specified within the model. Similarly, within the measurement model, two further distinctions are possible, according to the type of relationships that exist between the latent constructs and the indicator variables. If the indicators are a function of one or more latent constructs, then the scheme is termed *reflexive* and the associated coefficients for the relationships are named *outer loadings*. If, however, the indicator variables define one or more latent constructs, then the scheme is termed *formative* and the coefficients are named *outer weights*.

Figure 1 reports an example, where the inner model is highlighted in red and the outer model in blue. In this example, the endogenous latent variable LV_4 (or η_4) is explained by exogenous LV_1 – LV_3 (or $\xi_1 - \xi_3$).

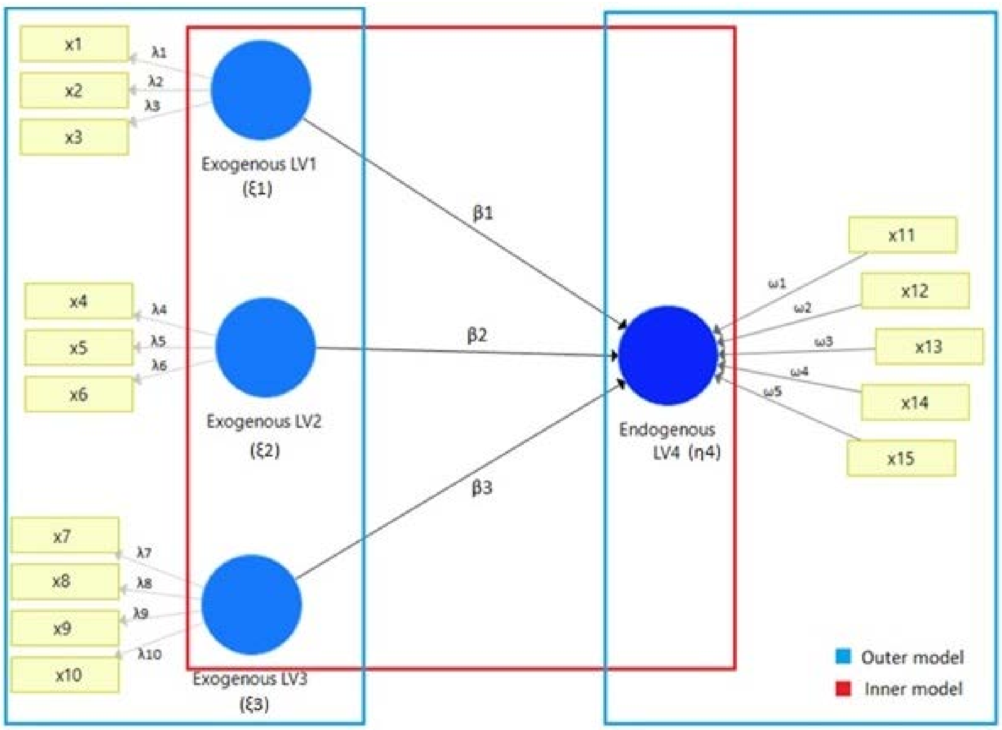

Figure 1: PLS-PM: Example of a path model. In blue, the outer model (or measurement model), in red the inner model (or structural model). Circles represent the latent variables, rectangles represent the indicators.

The basic PLS-PM model consists of a system of interdependent equations based on simple and multiple regressions.

Without loss of generality, it can be assumed that LVs and MVs are scaled to zero mean and unit variance so that the location parameter is not needed. Formally, the structural model can be written as:

$$\eta = \Gamma \eta + \mathrm{B} \xi + \zeta \qquad (1)$$

where η and ξ represent, respectively, the vectors of endogenous and exogenous LVs, B and Γ are the matrices containing the path coefficients and ζ is the vector of residual variables. It is assumed that each latent variable is a linear function of its predictors and that there is no linear relationship between the predictors and the residuals ($E(\varsigma \mid \eta, \xi) = 0$ and $Cov(\varsigma, \eta) = Cov(\varsigma, \xi) = 0$).

The general equations of a reflective measurement model are:

$$\begin{aligned} x &= \Lambda \xi + \varepsilon \\ x &= \Lambda \eta + \varepsilon \end{aligned} \qquad (2)$$

where Λs are the loading matrices representing simple regression coefficients connecting the LVs and the indicators and ε is the vector of errors associated to the measurement process. The two equations in (2) represent respectively the relationships between the MVs and exogenous (ξ) or endogenous (η) latent variables. The model assumes that ε has 0 mean and is uncorrelated with the latent variable of the same block. No assumption on the distribution is made (for a more specific reading on this topic see Chin, 1998).

In a formative measurement model, the latent variable is conceived as a linear combination of the corresponding observed indicators (each manifest variable is therefore exogenous in the measurement model):

$$\begin{aligned} \xi &= \Omega x + \delta \\ \eta &= \Omega x + \delta \end{aligned} \qquad (3)$$

where Ωs are the matrices containing the multiple regression coefficients explaining the relationship between any indicator and the corresponding latent variable and δ is the vector of error associated to the measurement process. The model assumes that δ has 0 mean and is uncorrelated with the indicators within the block.

Following the abovementioned notation, Figure 1 shows the structural as well as both type of measurement of models. In the inner model, an endogenous latent variable is related to three exogenous latent variables and the links are represented by coefficients $\beta_1 - \beta_3$. In the outer model the endogenous latent variable LV_4 (or η_4) has a formative scheme and $\omega_1 - \omega_5$ are the weights explaining the relationships between any indicator X_{11} – X_{15} and the latent variable. Any exogenous latent variable ($\xi_1 - \xi_3$) is represented by a reflexive scheme where $\lambda_1 - \lambda_{10}$ denote the loadings measuring the connection between the latent variable and its indicators.

Regardless of the type of measurement model, once the algorithm convergence is reached, latent variable scores are calculated through the weight relation:

$$\begin{aligned} \hat{\xi} &= \omega x \\ \hat{\eta} &= \omega x \end{aligned} \tag{4}$$

The latent variables estimates are linear aggregates of their observed indicators whose weights are obtained via the PLS estimation procedure as specified by the inner and outer models.

The algorithm used in the PLS-SEM is an iterative process based on two stages (in turn, the first stage is divided into three steps), which alternates inner and outer estimation steps. No formal proof of convergence has been provided so far for more than two blocks, but in practice the convergence is always reached.

1. **Stage one** (repeated until the difference between the sum of the outer weights in two consecutive steps is lower than a threshold (usually set in most software to 10^{-5})):

I. Outside approximation. Computation of latent variable scores using values of manifest variables and arbitrary priors for initial outer weights such that:

$$\nu \propto \pm\Omega x \quad (5)$$

where ν is the vector of the outer estimates of the latent variables, Ω is the matrix containing the outer weights, x is the vector of indicators and the ambiguity of the sign is usually solved by choosing the sign such that the outer estimate is concordant with most of the indicators (n.b., it is possible to reverse the sign in order to be coherent with the theoretical framework and the latent variable meaning). The symbol $\propto$ means that the vector on the left-hand side represents the standardized right-hand side of the equation. This is used as the weights, in each iteration, are scaled to obtain unit variance for the latent variables scores over the observations.

II. Inside approximation. Any latent variable is approximated using its associations with the other latent variables. The component scores obtained at step I are combined using different weighting schemes (path weighting scheme, centroid weighting scheme, factor weighting scheme) to provide a proxy of any specific LV:

$$\vartheta \propto \pm e\nu \quad (6)$$

ϑ denotes the vector of the approximated latent variables, e is the vector containing the inner weights representing the links between LVs and ν is the vector of the outer estimates obtained at step I.

III. Computation of the outer weights based on the adopted scheme. Here, if the indicators are linked to the latent variable through a reflexive scheme, MODE A computation, which calculates the correlation between the latent variable inside approximation and the manifest variable, is the most suitable approach.

Conversely, if the scheme is formative, MODE B, which computes the OLS coefficients from a multiple regression where the latent variable inside approximation is the dependent variable and the block indicators are the regressors is typically chosen.

2. **Stage two**: upon convergence, latent variable scores are computed according to III and finally the matrix of the path coefficients B is estimated using OLS regressions among latent variables.

For further reading on the topic, see Chin (1998), Tenenhaus *et* al. (2004) and Esposito Vinzi *et* al. (2010).

3. Data

Data was collected in Lugano, a city in the Italian speaking canton of Switzerland, from September 2014 to May 2015, in the context of a broader project granted by Swiss National Science Foundation with the goal of exploring the feasibility of a post-car world. Lugano is situated 25 km far from the border of Italy and is the main city of the canton Tessin. It is an important economic center for the south of Switzerland, attracting many foreign workers and students, especially from Italy. Lugano has the highest rate of private car use (75 percent, regardless of the reason) compared to the other Swiss cities, as well as the highest motorization rate (625 out of 1000 inhabitants) in Switzerland (Mikrozensus Mobilität und Verkehr, 2010). Therefore, Lugano makes for a perfect case study to explore the factors composing the pleasure of driving.

Using a paper and pencil questionnaire, a sample of 405 respondents were interviewed about their attitudes towards car use and their preference for commuting. However, for this specific work, which aims at analyzing the components of the pleasure of driving, 90 respondents who didn't have a driver's license were excluded, leaving 315 individuals for the analysis. A screening criteria for the survey was imposed such that sampled respondents had to be below the age of 44 years at the time of completing the survey (mean age was 22.45). In the present work, the focus on younger respondents occurred for three reasons. First, experience suggests that it is easier to collect data from younger generations; second, younger respondents display a higher degree of heterogeneity in terms of travel behavior, and use alternative commuting modes more frequently than older respondents, generating more valuable information (see e.g., Whalen *et* al., 2013; Khattak *et* al., 2011). The final reason can be found in the overall aim of the study. That is, young people tend to value symbolic and affective factors more than any older age groups (Steg, 2005). This finding was supported by a focus group conducted prior to the analysis, which found that these factors can strongly affect the pleasure of driving within this age group. The age constraint can undermine the representativeness of the sample given that about 45 percent of residents in Lugano are over 45 years old. Nevertheless, evidence from this study can provide important and useful insights for policies with the goal of incentivizing a greener behavior of young generations.

The sample consisted of mainly native Italian speakers (90 percent), with either Swiss (53 percent) or Italian citizenship (37 percent), who held a driver's license and worked or studied in Lugano, were 56 percent male, and whose current occupation is student (78 percent), with the remainder being either workers (15 percent), or apprentices (7 percent). The majority of the sample (81 percent) reported earning less than 30,000 CHF/year (the median of the Swiss population is 77,124 CHF). Ninety three percent of the sample reported having at least one car in their household and therefore the opportunity to commute by car, with the average number of days in which the car was in use (with the respondent acting as either the driver or as a passenger) being equal to 3.78 days per week.

The survey contained two sections. The first section consisted of a stated preference experiment exploring transport mode choice. The second section of the survey involved respondents being asked to complete a battery of thirty attitudinal questions related to private car and driving. In the present work, the focus is exclusively on the second section of the survey. Eighteen items are measured using a seven-point Likert scale (Likert, 1932), from *Totally Disagree* to *Totally Agree*, whilst twelve more attitudes were measured through evaluative space grids (Larsen *et* al., 2009), ranging from *Not at all* to *Extremely*. These later questions can be easily translated into an equivalent five-point Likert type scale. In order to correctly identify the unexplored latent construct of the pleasure of driving, focus group with social science and transport experts was conducted. Most of the items used in the questionnaire concerning pro-environmental, symbolic and car performance attitudes were adopted from Mokhtarian *et* al. (2001), Steg (2005), Abrahamse *et* al. (2009), Klöckner and Friedrichsmeiner (2011). In addition to these, the focus group highlighted the necessity to add items concerning car performance and aesthetics, attitudes towards car sharing, and affective and practical motives.

After the qualitative discussion, five different domains are hypothesized to exist, these being related to *environmental concerns*, *car performance and aesthetics*, *sharing vehicle inclination*, *sensations whilst driving* and *convenience*. Given the data, an explorative factor analysis and a structural equation model were undertaken to empirically test whether, and which domains, affect the pleasure of driving.

Table 1 contains the average value for any collected item and the explanation of the variable names. The highest and the lowest values, among the items measured through the seven point scale, are respectively observed in *ecodist* ("It's urgent to do something against the ecological destruction caused by using the car", 5.43) and *cpstrang* ("I like to share a ride with unknown people (carpooling) because I can meet someone interesting", 2.43). More generally, attitudes related to environmental awareness (*airq1*, *airq2*, *dist*, *futgen*, *ecodist*, *morept*) commonly display large values indicating a strong interest in environmental issues by the respondents. Among attitudes measured through the five point scale (from *relax* to *chall*), the highest value is recorded by *fun* ("In my experience, I think that driving is fun", 3.82) and lowest by *boring* ("In my experience, I think that driving is boring", 2.16).

Table 1: average values of items measured with a seven points scale (top of the table) and with a five points scale (bottom of the table).

ITEM	AVERAGE
I limit my auto travel to help improve congestion and air quality (**airq1**)	3.94
To improve air quality, I am willing to pay a little more to use an electric or other clean-fuel (**airq2**)	4.43
Having shops and services within walking distance of my home is important to me (**dist**)	4.81
My personal car use is affecting the quality of life for future generations (**futgen**)	4.33
It's urgent to do something against the ecological destruction caused by using the car (**ecodist**)	4.83
It would be useful if I used PT instead of my car in order to reduce congestion and pollution (**morept**)	4.38
I would like people to look at me and envy me while I am driving my dream car (**envy**)	3.24
I like speedy cars (**fast**)	4.45
When I hear a strong car rumble, I am interested in which car it is (**rumble**)	4.22
Car design is essential for me (**design**)	4.47
Powerful cars make me feel strong (**power**)	3.38
I identify myself with my car or my dream car brand (**brand**)	3.4
I am incline to pool a ride (carpooling), since it is economically convenient, environmentally friendly and less boring (**cpconv**)	3.84
I like to share a ride with unknown people (carpooling) because I can meet someone interesting (**cpstrang**)	3.06
In pooling a ride, my schedule becomes less flexible (**cpflex**)	4.71
If there were more pick-up points for car-sharing in my city, I would not need a private car (**csstat**)	3.36
I like car-sharing since I can drive with no worries about parking (**cspark**)	3.92
*When I rent a car, I carefully choose the type according to its peculiarities (**csmodel**)*	*4.21*
In my experience, I think that driving is relaxing (**relax**)	3.27
In my experience, I think that driving is stressful (**stress**)	2.82
In my experience, I think that driving is fun (**fun**)	3.77
In my experience, I think that driving is boring (**boring**)	2.19
In my experience, I think that driving is safe (**safe**)	3.03
In my experience, I think that driving is risky (**risk**)	3.2
I think that driving a car for commuting is a flexible solution (**flex**)	3.71
I think that driving a car for commuting is a binding solution (**bind**)	2.75
In my experience, I think that driving a car for commuting is a comfortable solution (**comf**)	3.68
In my experience, I think that driving a car for commuting is an uncomfortable solution (**discomf**)	2.57
In my experience, I think that driving a car for commuting is handy (**handy**)	3.5
In my experience, I think that driving a car for commuting is challenging (**chall**)	2.69

4. Results

4.1 Explorative Factor Analysis (EFA)

The structural equation model is preceded by an explorative factor analysis in order to establish the number of latent constructs and the links with the thirty indicators collected in the survey. This analysis suggested that only twenty-three items contribute to explaining the variance within the data (according to the rule of thumb by Hair *et* al. (1998), for a sample size of 250-350 observation only items with loadings greater than 0.35 should be retained) and the best representation occurs with five factors (results of the orthogonal rotation are shown in Table 2).

The first factor summarizes attitudes related to car performance (hereafter termed *Performance*), the second factor includes environmental concerns (*Environment*), and the third relates to practicality and convenience whilst commuting by car as well as comfort (*Convenience*). The fourth factor from the *explorative factor analysis* represents attitudes related to car-sharing and carpooling (*Sharing attitudes*), whilst the fifth and last factor includes emotions whilst driving (*Emotion*).

In order to validate the constructs' internal consistency, Cronbach's alpha was computed. The Emotion factor was observed to have the lowest Cronbach's alpha value (0.7082), which nonetheless is higher than the acceptance limit of 0.7 given by Nunnally (1978). Items for the remaining constructs show an even higher consistency (Cronbach's alpha values range from 0.7521 to 0.8766).

Note that the relationships between *discomf* and *Convenience*, *challeng* and *Convenience*, *stress* and *Emotion*, *boring* and *Emotion* were found to be negative, meaning that an increase in the factor score of one reflects a decrease in the factor score of other related attitudes. The remaining relationships were all found to be positive.

Table 2: EFA results with 5 latent variables. Last column represents the complement to 1 of the communality: higher is the value, less variance is explained by the factors retained by the analysis. Blank cells represent abs(loading) < 0.35.

Variable	Performance	Environment	Convenience	Sharing attitudes	Emotion	Uniqueness
Airq1		0.6232				0.4987
Airq2		0.6516				0.5900
Futgen		0.6613				0.6207
Ecodist		0.6301				0.5358
Morept		0.4361				0.6054
Envy	0.7508					0.4732
Fast	0.7112					0.4162
Rumble	0.7104					0.3885
Design	0.7283					0.4141
Power	0.8158					0.3968
Brand	0.7037					0.4989

Cpconv				0.7466		0.4669
Cpstrang				0.7117		0.4875
Csstat				0.5663		0.5631
Cspark				0.5821		0.5596
Relax					0.7066	0.5448
Stress					-0.5727	0.6550
Fun					0.5639	0.5782
Boring					-0.5921	0.6119
Comfort			0.7677			0.4138
Discomf			-0.7766			0.4204
Handy			0.8359			0.2988
Challeng			-0.7744			0.3633
Cronbach's alpha	0.8766	0.7521	0.8665	0.7634	0.7082	

In order to explore the dimensionality and the consistency underlying these constructs, a further factor analysis using the factor scores obtained from the explorative factor analysis was undertaken (Figure 2). This second factor analysis suggests that two factors can be used to explain the majority of the variance existent within the factor scores derived from the previous analysis. The environment and sharing attitudes were found to be positively related to the first factor suggesting that a high value of the first latent construct is associated with a high score for the *Environment* and *Sharing attitudes*, or in other words, a respondent who cares about the environment and agrees with car-sharing and carpooling principles will show a higher score on the first latent factor. *Performance, Convenience* and *Emotion* are positively related to the second underlying construct such that the more a person likes fast and powerful cars or thinks that driving a car is comfortable, handy or relaxing and fun, the higher their score will be on this factor. Considering the whole set of items included in the analysis and the directions of the links among latent constructs, the first latent construct represents the *Green attitudes* whilst the second latent construct the *Pleasure of driving.*

It is worth noting that Convenience shows a uniqueness value of 0.7911 (in red) which is greater than the cutoff suggested by Nunnally. A possible explanation is that this latent construct reflects items like "In my experience, I think that driving a car for commuting is handy (*handy*) /

challenging (*chall*)", and therefore is not totally coherent with the rest of the items which tend to refer to generic aspects of trips undertaken by car. An additional reason to keep this construct in the analysis is that *Convenience* is not observed to be related with Green attitudes, but provides a good statistical link with the Pleasure of driving (0.4411), above the threshold suggested by Hair *et* al. (0.35) given the sample size.

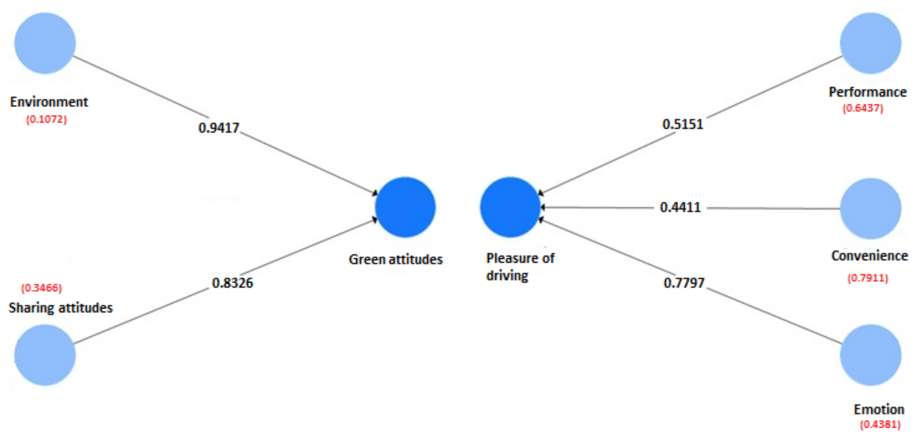

Figure 2: second stage EFA results. Sharing attitudes and Environment are positively linked to Green Attitudes, whilst Performance, Convenience and Emotions are positively related to Pleasure of Driving (PoD). The values on the arrows represent the loadings, whilst the red values in brackets identify the uniqueness values.

4.2 PLS-SEM

This section reports the composition of the latent construct *pleasure of driving*. Following the structure given by the explorative factor analysis, it was hypothesized that:

1. *Performance, convenience* and *emotion* have a positive and significant impact on the *PoD*;
2. *Emotion* has the highest influence on the *PoD*, followed by *performance* and *convenience.*

In this analysis, the results of the latent construct *green attitudes* is not presented given that this construct is not related to the aim of the paper, which is specifically to look at attitudes related to the pleasure of driving. It is worth noting, however, that the structure suggested by the EFA was confirmed through the PLS-SEM. The results of this model can be obtained upon request.

The structural equation model was estimated using the SmartPLS 3 software (Ringle *et* al., 2015). Fourteen items, those found to be significant in the explorative factor analysis, related to *performance* (six items), *convenience* (four items) and *emotion* (four items) were used to design the *pleasure of driving* construct via a hierarchical reflective-formative structure. In the first (or lower) level (hereafter referred to as the first stage latent variable, indicated by FLV), observed items were linked to three latent variables which, in turn, are connected to one further latent variable at a second (higher) level (SLV). Note that to build a hierarchical PLS-PM model, three different techniques can be used: (1) a repeated indicator approach, (2) a two-stage approach, or (3) a hybrid approach. In this work, the first approach is used. Fourteen indicators were linked to their respective FLVs and at the second stage, all indicators were connected to the SLV. For an in-depth analysis on this topic see Becker *et* al. (2012).

With reference to the approach used in the hierarchical model, FLVs use a reflective scheme and MODE A for the measurement mode, whilst the SLVs use a formative scheme and MODE B. Finally, following Becker' *et* al.'s (2012) guidelines, a path weighting scheme for the PLS-SEM algorithm was adopted.

The specification of the model is reported in Figure 3. It is hypothesized that FLVs are reflected in the items and therefore the attitude towards car performance and aesthetics is manifested in items like "I would like people to look at me and envy me while I am driving my dream car (*envy*)", "When I hear a strong car rumble, I am interested in which car it is (*rumble*)" or "I identify myself with my car or my dream car brand (*brand*)"; emotions while driving are measured through items like "In my experience, I think that driving is fun (*fun*) / relaxing (*relax*)"; attitude towards convenience of driving is reflected in statements such as "In my experience, I think that driving a car for commuting is handy (*handy*)" or "In my experience, I think that driving a car for commuting is a comfortable solution (*comfort*)". Finally, these three latent constructs compose the *pleasure of driving*.

In the measurement model, all indicators were found to be statistically significant. Note however that as PLS-SEM is a non-parametric method, it relies on a nonparametric bootstrap procedure to test the statistical significance of the results (Davison and Hinkley, 1997, Hair *et* al., 2017). In the current analysis, five thousand random subsamples where used to generate *t*-values which for the measurement model resulted in values ranging from 10.129 to 43.768, whilst for the structural model values ranging from 7.647 to 14.804 were obtained. Figure 3 synthetizes the path model. Contrary to the latent construct *performance*, which is positively related to all six indicators (from *rumble* and *power*, 0.807 to *brand*, 0.741), *emotion* and *convenience* alternate between positive and negative (shown respectively in black and in red in Figure 3) links with their respective indicators. Specifically, *emotion* is positively related to *fun* (0.791) and *relax* (0.725) and shows a negative relationship with *boring* (-0.759) and *stress* (-0.633), whilst *convenience* presents a positive link with *handy* (0.867) and *comfort* (0.835) and a negative connection with *chall* (-0.853) and *discomf* (-0. 825).

The particular interest is the analysis of the inner model, where the relationships between latent variables can be explored. The regression coefficients, reported on the arrows of the structural model, confirm the first hypothesis, which assumes that *emotion, performance* and *convenience* have a positive influence on the *pleasure of driving*. Everything else being equal, an additional unit in the *performance*, *emotion* and *convenience* scores results in an increase of the *pleasure of driving* score of 0.721, 0.275 and 0.363 respectively. In other words, an individual who have presents a high score for the attitudes towards *performance, emotion* and *convenience*, will more likely experience a higher degree of pleasure and enjoyment from driving a car. However, even if sensations experienced whilst driving (relax, stress, enjoyment, boredom) play a significant and important role in affecting the SLV, the second hypothesis seems not to be confirmed, as the highest impact on the pleasure of driving is generated by interest in car performance and aesthetics.

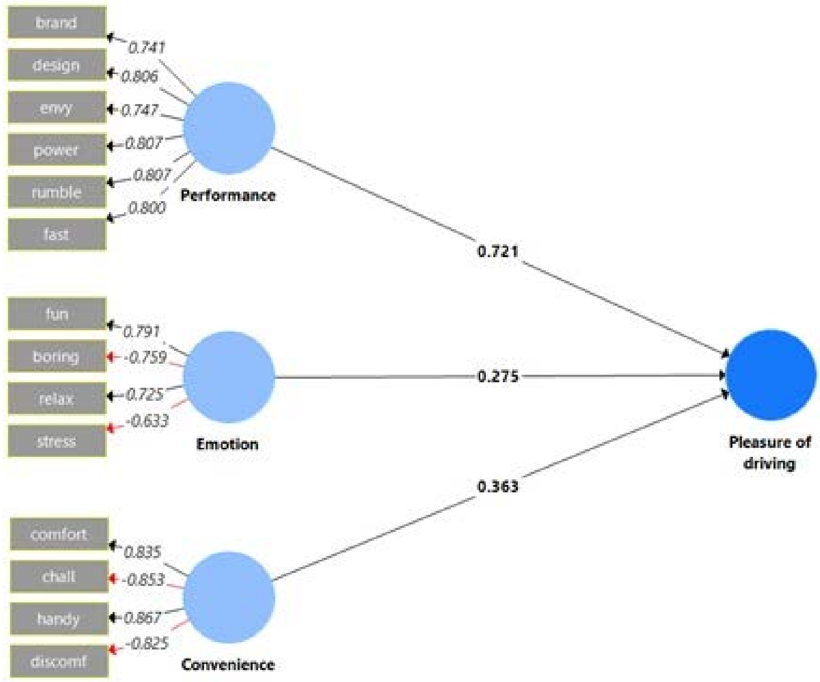

Figure 3: PLS-PM, Pleasure of driving. Variables in grey rectangles represent the observed indicators, those in light blue circles represent the first level latent variables, whilst that in the blue circle denotes the second level latent variable. Black and red arrows symbolize respectively a positive and a negative link.

Performance of the reflective measurement model should be evaluated by examining the construct reliability and validity of the model (shown in Table 3) as well as by exploring discriminant validity. Checks on Cronbach's alpha, Dijkstra-Henseler ρA, the composite reliability measure and average variance extracted confirm that each latent construct is manifested in the observable items thought to measure the same concept. Discriminant validity evaluates whether unrelated constructs are in fact unrelated. Henseler *et* al. (2015) proposes using the Heterotrait – Monotrait ratio (HTMT), which outperforms the Fornell – Larker criterion as well as the cross-loading and partial cross-loading checks. Table 4 contains the HTMTs between any pair of latent constructs within the reflective scheme: a value lower than 0.85 (or 0.90) indicates that the two constructs are not related.

Table 3: Acceptable values for the Cronbach's alpha, ρ_A and composite reliability are greater than 0.7; AVE should be greater than 0.5. In brackets the p-values obtained using a bootstrap procedure with 5000 subsamples

	Cronbach's Alpha	**ρ_A**	**Composite Reliability**	**Average Variance Extracted**
Convenience	0.867 (57.36)	0.869 (58.34)	0.909 (96.68)	0.714 (31.05)
Emotion	0.711 (20.04)	0.733 (19.53)	0.819 (41.14)	0.532 (16.86)
Performance	0.876 (79.91)	0.879 (88.19)	0.906 (120.08)	0.617 (29.74)

Table 4: Discriminant validity, Heterotrait – Monotrait ratio. In brackets the p-values obtained using a bootstrap procedure with 5000 subsamples (H_0: HTMT ≥ 1)

	Convenience	*Emotion*	*Performance*
Convenience			
Emotion	0.321 (5.432)		
Performance	0.212 (4.054)	0.354 (6.25)	

A check for the multicollinearity of the variables is opportune in a formative construct. The most common index is the Variance Inflation Factor (Table 5), which expresses to what extent the variance of an estimated regression coefficient is inflated by the collinearity of the regressors.

Table 5: Variance Inflation Factor computed for the formative construct *pleasure of driving*. Hair *et* al. (1995) indicate a value lower than 10 to avoid multicollinearity.

	Pleasure of driving
Convenience	1.085
Emotion	1.155
Performance	1.121

With regards to goodness of fit, it is important to reiterate that PLS-SEM does not rely on a well identified global optimization criterion and therefore does not have a fitting function to assess the goodness of fit of the model. Nevertheless, several researchers have proposed a number of different methods to evaluate a structural equation model estimated using a component based approach. Tenenhaus *et* al. (2004) propose the Global of Fit index (GoF), which takes into account the model's predictive ability in both the measurement and the structural model. Hair *et* al. (2017) propose to use the standardized root mean square residuals (SRMR) which computes the average magnitude of the discrepancies between observed and expected correlations. Dijkstra and Henseler (2015) suggest d_LS (i.e., the squared Euclidean distance) and d_G (i.e., the geodesic distance) indices, which test the statistical (bootstrap-based) inference of the discrepancy between the empirical covariance matrix and the covariance matrix implied by the composite factor model. However, these latter indices are not properly defined in the case of a hierarchical model with repeated indicators.

For the sake of completeness, the value of the GoF is 0.788, indicating a very good fit, whilst the SMRS is 0.201, suggesting that the model is not appropriately specified. However, as already pointed out, the model evaluation based on such indices is an ongoing debate in the current literature.

5. Conclusion

There is general consensus that modern society should aim for more sustainable life styles to be adopted. Particular efforts should be made in the area of transportation, where more trips are being undertaken using private vehicles than at any other time in history, with a resulting increase in negative externalities such as pollution and congestion being experienced. In order to suggest appropriate policies to assist in promoting more sustainable transport usage, the last two decades have seen attention being drawn away from examining how instrumental factors such as cost and travel time can be manipulated in order to promote sustainable transport usage, towards how more psychological attitudes can play a role. Evidence has shown that, amongst other factors, environmental awareness (Nilsson and Küller, 2000), symbolic and affective factors (Steg, 2005) and pleasure of travelling (Ory and Mokhtarian, 2005) strongly influence transportation mode choice. Added to this, this paper argues that emotions and sensations experienced whilst driving, as well as symbolic and more practical factors, can contribute to an increased desire for travel itself and, for this reason, policy makers should also consider these aspects when developing sustainable transport policies.

The present work endeavors to shed light on the composition of the latent construct '*pleasure of driving'* which has been interpreted as relating to the enjoyment, excitement and enthusiasm of the act of driving itself, which potentially can significantly affect the mode choice. Little research, mostly conducted by sociologists and psychologists (Hagman, 2010; Marsch and Collett, 1986) has explored this topic, with most research occurring within the tourism literature, which even then has tended to focus on the role affective and symbolic functions play. Conversely, this research has sought to provide an in-depth analysis of the role various attitudes towards driving can have on '*pleasure of driving'*, including symbolic and affective factors, as well as emotions and sensations, attitudes towards practicality, environmental concerns and the inclination to share vehicles.

The analysis reported here used explorative techniques such as factor analysis and structural equation modelling (component based) on a sample of young drivers, who are expected to reveal higher excitement and enthusiasm for driving, working or studying in Lugano, a city in the Italian speaking canton of Switzerland. Evidence from the hierarchical structural equation model shows that fourteen observed items are related to car performance and aesthetics, such as speed, brand, design, engine power, to emotions experienced whilst driving, such as excitement and relaxation, and finally to more practical sensations, such as comfort and ease. The resulting latent constructs have respectively been named *performance, emotion* and *convenience.* The pleasure of driving is composed of these three above-mentioned constructs, which are identified as having a significant positive impact upon it. Thus, an individual with a high score for the attitudes towards *performance, emotion* and *convenience* is more likely to experience a high degree of pleasure and enjoyment when driving a car. However, even if *emotion* plays a significant and important role in affecting driving pleasure, the highest impact was found to be generated by having an interest in car performance and aesthetics.

Using all the attitudinal indicators collected during the questionnaire, a result that we foresee analyzing more in depth is the composition of an additional latent construct at the second level, namely *green attitudes*, which includes attitudes related to the environment (*environment*) as well as attitudes towards sharing vehicles (*sharing attitudes*). This construct could potentially act as a counterpart in the mode choice decision process. That is, whilst the pleasure of driving is hypothesized to have a positive effect on the choice of individual motorized transport means, enhancing for instance the probability of choosing the private car, a greener attitude is likely to have the opposite effect.

Given the evidence provided in the present work, it is possible that current attempts at promoting more sustainable transport usage may be somewhat misplaced, especially for young people in car based societies. This is because the majority of such studies seek to influence car users to use non-car-based alternatives such as public transport. If the pleasure of driving a car strongly influences the individual's mode choice, it would be easier to persuade car users to switch to other car-based alternatives rather than to public transport options such as buses or trains. People who experience a high degree of pleasure whilst driving are far more likely to choose the car regardless of the incentives offered for switching to public transport. Policy makers therefore should consider incentivizing the purchase of electric vehicles in order to reduce the pollution, or promote car sharing alternatives by implementing policies such as restricting access to specific areas of the city to these high occupancy vehicles. Moreover, the finding that having an interest in car performance and vehicle aesthetics as being the most influential factors, suggests that vehicle design should be carefully considered when designing and building greener vehicles, and policy makers might consider promoting public car-sharing after investing in "high performance" electric vehicles for their fleet (fast, powerful, with a captivating design, different brands and models).

This study exhibits some limitations such as the generalizability due to the sample composition. Indeed, the sample includes only people under 45 years of age, excluding the perception of the act of driving itself of very experienced drivers, which can be different to the one explained in this paper.

A specificity of this paper is that the survey is implemented in the geographical area where the pleasure of driving is strongly present. Lugano is a city heavily influenced by the Italian culture, which is deeply rooted in the passion for cars (Ferrari, Lamborghini, Maserati, Pagani, Fiat, Alfa Romeo are only some examples of Italian car manufacturers). This point may explain why the latent construct *performance* shows the highest impact on the pleasure of driving.

Following the evidence provided by the present work, the next step is to effectively evaluate whether and to what extent the pleasure of driving affects the decision-making process in a mode choice setting. A mode choice experiment foreseen as a next step in our research including non-privately owned car-based alternatives, such car-sharing and carpooling as well as public means, might suggest the most appropriate direction in which the policies should push in order to reduce the individual private car use.

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