The influence of evaluation of Instrumental, Symbolic, and Environmental attributes and perceptions regarding gains and losses, on intention to not using a car.

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Abstract

Within the recent years, climate change has become one of the most highly discussed topics; with people trying to find ways to address the matter with policies on products which are some of the main causes of climate change such as greenhouse gas emissions by vehicles. We wanted to investigate how perceived gains or losses in instrumental, symbolic and environmental attributes (due to car restricting policy changes) moderate the likelihood of adopting sustainable modes of transport instead of their cars. Results show that symbolic attributes have a significant effect on not using a car to commute to work, while the other two attributes (instrumental, environmental attributes) were not significant. Furthermore, perceived gains and losses, act as a significant mediator when mediating the effects of instrumental attributes and not using a car to commute to work.

Keywords: Instrumental, symbolic and environmental attributes, adoption of sustainable transportation, prospect theory, gain, loss

The influence of evaluation of Instrumental, Symbolic, and Environmental attributes and

perceptions regarding gains and losses, on intention to not using a car.

In recent years, climate change resulting from global warming has become one of the most pressing issues of our time. The impact of human activities on the environment, particularly the burning of fossil fuels, has led to a significant increase in greenhouse gas emissions, leading to rising temperatures, sea level rise, and extreme weather events (*World Bank Climate Change Knowledge Portal*, 2021). The consequences of these changes have been far-reaching, affecting not only the natural environment but also human societies, economies, and public health.

One of the major contributors to greenhouse gas emissions is transportation. Over 25% of all greenhouse gas emissions are attributable to this sector (*EUR-Lex - Sustainable_Development - EN - EUR-Lex*, 2019). Therefore, it has an essential role to play in the effort to reduce emissions and promote sustainable development. To achieve this goal, it is necessary to implement policies that encourage the adoption of sustainable transportation modes. Sustainable transportation refers to modes of transportation that have a lower environmental impact, reduce carbon emissions and promote sustainable development like walking, cycling, public transport, non-fossil fueled and hybrid vehicles (United Nations Environment Programme, 2022). Encouraging the adoption of these modes of transportation can lead to reduced emissions, improved air quality, and decreased traffic congestion (*What Is Carbon Neutrality and How Can It Be Achieved by 2050? | News | European Parliament*, 2023).

Policies that promote sustainable transportation can take many forms, such as incentives for the use of public transportation or bicycles, the implementation of carpooling programs, or the establishment of low-emission zones. These policies are often aimed at decreasing traffic

congestion, air pollution, and carbon emissions (Broaddus et al., 2009). They can help reduce greenhouse gas emissions and promote sustainable development (Reckien et al., 2017). However, the successful implementation of sustainable transportation policies requires the collaboration of stakeholders, including policymakers, transportation providers, and the public. To be effective, these policies need to be supported by public education and awareness campaigns that promote the benefits of sustainable transportation and encourage the adoption of sustainable transportation modes to promote sustainable development (Ilieva, 2020).

In studying the adoption of sustainable innovations -including sustainable transport modes- Noppers (2019) introduced the so-called ISE model. The ISE-model builds on the adoption of innovations framework developed by Ditmar (1992) and explains how individuals evaluate a sustainable product or a service, based on their functional, symbolic and environmental attributes and how these in turn influence adoption intention (Noppers et al., 2019). The evaluations instrumental attributes refer to the perceived functional outcome of adopting a sustainable transportation mode, such as the positive or negative effects of ownership and use of sustainable innovations Noppers (2019). Examples of instrumental attributes are perceptions regarding the convenience, costs and autonomy associated with the adoption of the product or service. When owning an electric car, for example, there are perceived practical advantages of the product, such as no fuel required so you save money on gas, but also practical disadvantages, such as finding a charging station; that influenced the intention to adopt such a vehicle (Steg, 2005). The general public often assumes that these economical-like decision processes are the main drivers for adoption intention, but Noppers (2014, 2019) showed that symbolic and environmental attributes are just as and, in some cases, even more important predictors of adoption intention Noppers et al., 2014).

The evaluations of symbolic attributes of the innovation relate to how much the act of adopting is perceived to signal an individual's identity or improve their social status (Noppers et al., 2019). In a study conducted by Griskevicius et al. (2010b), it was discovered that when individuals' social status was activated, they showed a higher preference for environmentally friendly products as compared to extravagant non-green alternatives, even if the green products were priced higher than their conventional counterparts; essentially, opting for pricier green products sends a signal to others that you possess the financial resources to invest in causes that benefit others, thereby enhancing your social standing. For example, when an individual wants to be viewed as a sustainable person a preference for more sustainable transport such as riding a bike to get to work is preferred over the non-sustainable alternative of using a car. This insinuates that the adoption of more sustainable transportation, even if less comfortable, is preferred if then the individual, after using the bike to get to work, for example, is viewed as more sustainable by others and themselves. The ability to express one's identity through the adoption of sustainable transportation can serve as a strong incentive to promote its use especially when an individual strongly identifies with the environment.

The evaluation of environmental attributes of a sustainable innovation represent the perception regarding positive and negative effects that its ownership and/or use can have on the environment (Noppers et al., 2014). Sustainable innovations generally have a lower environmental impact and possess favorable environmental qualities. For example, people who exhibited greater support for environmental principles seemed to demonstrate higher levels of willingness to embrace alternative fuel vehicles and higher chances of utilizing renewable energy sources (De Groot et al., 2012) than a fossil fuel car as well as using public transportation to commute from one location to another.

In the Noppers et al. (2014) and (2019) studies, he works with the ISE attributes model to see the importance of each attribute for the adoption of sustainable innovations. However, could instrumental, symbolic and environmental attributes also promote not doing a certain activity? Additionally, Noppers et al. (2014) study states how consumers would be more likely to choose a car if there are more perceived instrumental advantages than disadvantages, however, they do not clearly explain how these instrumental perceptions arise. This gap could be bridged by implementing prospect theory (Kahneman & Tversky, 1979).

Prospect theory (PT) suggests that an individual's preferences are shaped by their subjective evaluations of potential gains and losses (Kahneman & Tversky, 1979). The subjective evaluations of potential gains and losses, can exhibit bias in their evaluation of the relative value of different outcomes (Saltık et al., 2023). When making a decision, individuals treat gains and losses differently, leading to different subjective probabilities of outcomes (Gonzalez-Ramirez et al., 2018). For example, prospect theory in the transportation sector is seen in the design of loyalty programs for airlines. Passengers are motivated by the perceived gains of accumulating points and unlocking rewards, while also fearing the loss of their hard-earned points or benefits if not used. Airlines effectively leverage prospect theory in the design of their loyalty programs to encourage repeat business and maximize customer engagement. Gain-focused passengers are more likely to be motivated by the perceived gains of accumulating points and unlocking rewards, while loss-averse passengers are more likely to be motivated by the loss of their hard-earned points or benefits.

PT is most commonly recognized for its assertion that individuals tend to give greater importance to losses compared to equivalent gains. This displays a tendency towards risk aversion in the case of gains and risk-taking behavior in the case of losses (Levy, 1996c); this

means that according to prospect theory, decisions are influenced by the comparison of potential gains and losses to a reference point. Recently, prospect theory has also been applied to the adoption of sustainable transportation (Avineri & Chorus, 2010).

Research on prospect theory and car sharing services done by Liu et al. (2014), for example, highlighted how individuals make a choice regarding whether or not to use car sharing services because of what in their personal life feels like a gain or a loss. They showed that individuals who use their car on a regular basis, such as full-time workers, who will commute between home and workplace every day, would more likely chose owning their own car over using a shared car service, even if they were aware that owning their own car would cost a lot more than just using a shared car service. Apparently, the potential loss of being late to work was more influential on this behavior than the gain of saving money. However, there was another group of people in this study who did not need to use the car every day, such as students, who live near campus. They were more likely to use the care sharing services than to buy a private car since for them avoiding the high cost of owning a car was a greater loss than being late to school (Liu et al. 2014).

In the current study we want to use the ISE attributes model (Noppers et al. (2014) to investigate the relationship between evaluations of instrumental, symbolic and environmental attributes and the intention of not using a car for commuting (figure 1). The ISE attributes model provides a useful framework for identifying the key attributes that influence people's transportation choices: instrumental (e.g., convenience, cost), symbolic (e.g., social status, identity), and environmental (e.g., perceived environmental impact) attributes. In this case we wonder if it can also be used to explain not using a certain transport option, in this case not using a car to commute to work. Additionally, we wonder if applying prospect theory to perceptions

regarding instrumental attributes could mediate the relationship between instrumental attributes and giving up car use. By combining the ISE model and prospect theory, we expect to get a more comprehensive understanding of how perceived gains or losses in instrumental attributes influence the relationship between the instrumental attributes and not using a car.

This leads us to the following research question:

How does the ISE attributes model, as proposed by Noppers et al. (2014), elucidate the relationship between instrumental, symbolic, and environmental attributes and the intention of individuals to not use a car to go to work?

We hypothesize that:

Hypothesis 1: Positive evaluations regarding instrumental attributes of not using a car such as autonomy, convenience and personal cost will be positively related to the intention not to use a car for commuting to work.

Hypothesis 2: Positive evaluations regarding symbolic attributes of not using a car such as how one wants to be viewed by others or themselves will be positively related to the intention not to use a car for commuting to work.

Hypothesis 3: Positive evaluations regarding environmental attributes of not using a car such as being environmentally friendly and emitting fewer greenhouse gasses will be positively related to the intention not to use a car for commuting to work.
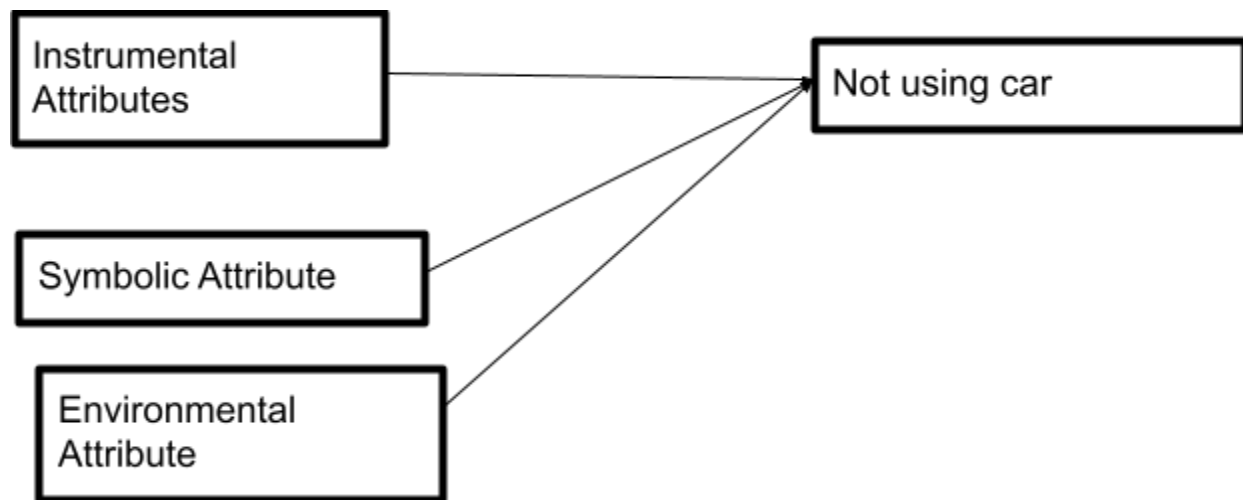
Figure 1

As said, in this study we will extend the ISE model (Noppers et al. (2014) by adding prospect theory (Kahneman & Tversky, 1979) (figure 2) between the relationship of instrumental attributes and not using a car.

This leads us to ask the second research question:

Is the relationship between instrumental attributes regarding car use and intention not to use a car to go to work mediated by a gains and losses perspective?

We hypothesize that:

Hypothesis 1: Evaluations regarding instrumental attributes will be positively related to

perceived gains and loss.

Hypothesis 2: Perceived gains and loss will be positively related to not using a car.

Hypothesis 3: The relationship between perceptions of instrumental attributes of not using a car

and the intention to not use a car to commute to work will be mediated by a positive perceived

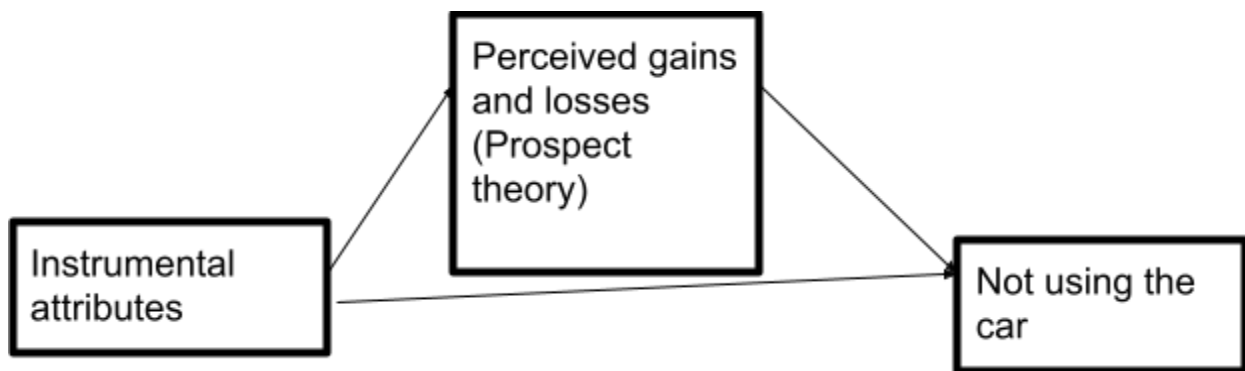gain and loss perception to not using a car.

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Figure 2

   To conduct this study, a quantitative approach was employed. A survey questionnaire was

developed to collect data from a sample of individuals who commute to work using private cars.

The survey included items that assess the participants' evaluations of instrumental attributes (e.g.,

autonomy, convenience, personal cost), symbolic attributes (e.g., self-image, societal

perception), and environmental attributes (e.g., environmental friendliness, greenhouse gas

emissions). Participants will be asked to rate their agreement with these attributes and indicate

their intention not to use a car for commuting to work as well as rating statements up to what

extent they perceive it as a gain or loss.

Methods

Participants

For this study, participants were recruited through convenience sampling by handing out fliers with QR codes in different areas of Groningen leading to our survey, putting fliers in people's mailbox as well as posting it on social media like Facebook, Instagram and group chats in WhatsApp. Participation in this study was voluntary. Participants' responses were collected between May 19 till May 25 of 2023. There was a total of 207 participants who accessed the questionnaire with 15 (7.2%) through the QR code and 192 (92.3%) through the link; 157 (75.8%) completed the questionnaire and 2 (1%) did not, but had enough answered enough to be kept as part of the survey, this gave us a total of 159 participants. From them, a total of 29 (18.2%) were excluded. 6 (3.8%) were excluded because they did not give consent for us to use their results. The last 23 were excluded since they did not meet the criteria of having access to a car or being affected by a policy, 19 (11.9%) did not have access to a car and 4 (2.5%) did not know if they were affected by a commuting policy. The final sample used for this study was of 135 people. In this sample the most prominent age was between 46 and 55 years old. In regard to gender, we had 64.8% identifying as females and 34.4% as males, and 0.8% who identified as other.

Procedure

After receiving the approval from the ethics committee of the university of Groningen, the link to the study was shared to participants in the way mentioned above by the researchers. For participants to be eligible for this study they need to be commuting to work by car or own a car to commute. Furthermore, they needed to be 18 years old or older. The participants in this study needed to be able to understand and speak English or Dutch due to the fact that the

questions in the questionnaire were carried out in those two languages. The questionnaire on average took 10 minutes. The link received by the participants lead them to an online survey via Qualtrics, which contained information about the study, an informed consent, the demographics of the participant and questions regarding instrumental, symbolic and environmental attributes and how if a car policy was implemented how much would they perceive it as a gain or a loss, after that participants were asked how likely they would be to use more sustainable transportation. Furthermore, 1€ to the Voedselbank Groningen for every questionnaire that is filled out, up to 150€ to encourage individuals to participate.

Design

This research is a cross-sectional field study. In testing the ISE-model for not using rather than using a vehicle, we used a regression model to test the predictive power of the independent variables (i.e. evaluations of instrumental, symbolic and environmental attributes), on the dependent variable (i.e intention not using a car to commute to work). Applying the prospect theory to analyze the model, specifically examining the mediation effect of individuals perceived gains and losses between the independent variable of instrumental attributes and the dependent variable not using a car to commute to work.

Measures

The study was conducted through Qualtrics XM, where participants were first asked to provide consent to being part of the research. In this study, the participants had to answer various inquiries concerning their commuting patterns, driving habits, perspectives on transportation methods and commuting policies, perceived control over not utilizing a car, environmental

self-awareness, and political ideologies. However, most of these aspects will not be elaborated on within this paper since they are relevant to other researchers' study. The same sample was used to answer five different research questions.

Specifically related to this study, participant responses regarding evaluations of instrumental, symbolic, and environmental attributes of not driving a car to work were analyzed. The questionnaire used for this purpose can be found in Appendix A. Participants rated the importance of these attributes on a five-point Likert scale, ranging from "strongly agree" to "strongly disagree," with an option for "I do not have an opinion." This scale was adapted from Noppers et al. (2014). Additionally, participants assessed the perceived gains or losses associated with instrumental attributes and not using a car to commute to work using a scale ranging from -3 to 3. Scores from -3 to -1 indicated a perception of loss, while scores from 1 to 3 indicated a perception of gain (also found in Appendix A).

Analysis

For the first research question, a Multiple linear regression for the three hypotheses was done to see if there is a positive relationship between the evaluations of the three ISE attributes and intention not using a car to commute to work. For the second research question, a simple linear regression was used to investigate the first two hypothesis relationships between instrumental attributes and perceived gains and losses as well the relationship between perceived gains and losses and not using a car to commute to work. Also a mediation analysis was carried out between the instrumental attributes (independent variable), not using a car to commute to work (dependent variable), and perceived gains and losses (mediator variable) .

Results

Descriptive

Before running the main analysis for the study, descriptive statistics was run. In the descriptive analysis we measure the means, standard deviations and correlations between the core study variables: instrumental, environmental, symbolic attributes (see table 1). Second, we analyzed the mean, standard deviation and correlation between instrumental attributes and gain/loss in instrumental attributes (see table 2). In these tables we look at the variables mean, standard deviation and correlation values.

Table 1

Means, Standard Deviations, and Correlations Between Core Study Variables and P-values

Variable	Mean	SD	1.	2.	3.
1. Instrumental attributes	3,02	0,99	-		
2. Symbolic attributes	3,19	1,02	0,690**	-	
3. Environmental attributes	4,17	0,82	0,419**	0,622**	-

**Correlation is significant at the 0.01 level (2-tailed)

Table 2

Means, Standard Deviations, Correlations Between Core Study Variables and P-values

Variable	Mean	SD	1.	2.
1.Instrumental attributes	3,02	0,99	-	0,459**
2. Perceived gain and loss	-0,22	1,46	0,459**	-

**Correlation is significant at the 0.01 level (2-tailed)

After running the descriptive statistics, it leads us to hypothesis testing.

Results of Multiple linear regression analysis not using a car for instrumental, symbolic, environmental attributes

Table 3

Coefficients of a multiple linear model for instrumental, symbolic and environmental attributes on the intention to not use a car to commute to work

Model		Unstandardized coefficients		Standardized coefficient	t	Sig
		B	Std. Error	Beta		
1	Instrumental attributes	0,240	0,160	0,156	1,495	0,138

Symbolic attributes	0,706	0,184	0,462	3,831	<0,001
Environmental attributes	0,059	0,180	0,031	0,327	0,745

a. *Dependent variable: intention to not use the car to commute to work*

A multiple linear regression was used to assess the predictive power of the ISE attributes on the intention of not using a car to commute to work. A significant regression equation was found ($F_{(3,115)}$= 21,784, $p<,001$), with an R^2 of 0,362. The multiple linear regression table above shows that all three attribute variables had a positive relationship with not using a car to go to work, but only symbolic attributes had a significant relationship with not using a car to get to work.

Extending from the ISE attributes model by Noppers (2014), two simple linear regression analyses were done to see the effect of instrumental attributes on perceived gains and losses as well as the effect of perceived gains and losses on not using a car to commute to work. A mediation effect analysis with instrumental attributes as the independent variable, not using a car to commute to work as the dependent variable and perceived gains and losses as the mediation variable.

Table 4

Coefficients of a simple linear model for instrumental attributes on perceived gain and losses

	Unstandardized	Standardized		

Model	Coefficients		coefficient		
	B	Std. Error	Beta	t	sig
1 Instrumental attributes	0,694	0,124	0,459	5,589	<0,001

a.   Dependent Variable: perceived gain and losses

A simple linear regression was used to assess the predictive power of instrumental attributes on perceived gains and losses; when looking at the relationship between instrumental attributes and perceived gains and losses the relationship is positive and significant (Table 4). A significant regression equation was found ($F(1,117)= 31,234$, $p< ,001$), with an R^2 of 0,211.

Table 5

Coefficients of a simple linear model for perceived gain and losses on not using a car to commute to work.

Model	Unstandardized Coefficients		Standardized coefficient		
	B	Std. Error	Beta	t	sig

1	Perceived gain and losses	0,52	0,078	0,514	6,62	<0,001

    a.   Dependent Variable: Not using a car to commute to work

The simple linear regression done on perceived gain and losses on not using a car to commute to work shows a positive and strong correlation as can be seen in the table above (Table 5). A significant regression equation was found ($F_{(1,122)}= 43,82$, $p< ,001$), with an R^2 of 0,264.

R²= 0.315 **

Instrumental Attributes — $R^2= 0.21$** — Perceived Gains and Losses — $R^2= 0.399$** — Not using a car to commute to work
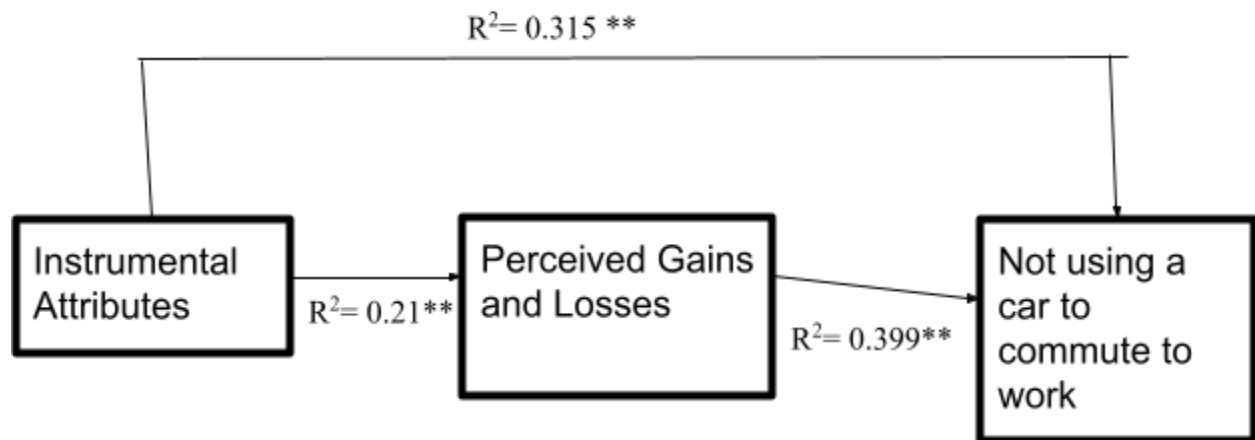
Figure 3

As expected, instrumental attributes were a significant predictor of perceived gains and losses ($F_{(1,109)} = 27,69$, $p < 0,000$,beta= 0,46. The relationship between perceived gains and losses and not using a car to commute to work, also is significant $F_{(1,110)} = 36,93$, $p < 0,0001$,beta= 0,34. The direct relationship between instrumental attributes and not using a car to commute to work has a positive significant relationship with $F_{(1,109)} = 45,78$, $p < 0,0000$,beta= 0,631.The indirect effect is also positive. This means that instrumental attributes were

positively related to not using a car (see figure3) through its effect on perceived gain and loss

(see figure 3).

Discussion

In this study we wanted to investigate how the ISE attributes model by Noppers et al.

(2014) could be used to understand the relationship between instrumental, symbolic and

environmental attributes with the intention of not using a car to commute to work. We extended

the model by studying the relationship between evaluations of instrumental attributes of not

using a car to commute to work and the intention not to use a car mediated by perceived gains

and losses perspective.

The results from our investigation on how the ISE attributes model could be used to

understand the relationship between instrumental, symbolic and environmental attributes with

the intention of not using a car to commute to work show a relationship between all the attributes

and dependent variable in our correlation matrix. However, when they were regressed in a

multiple regression, only evaluations on symbolic attributes turned out to be a significant

predictor of the intention to not use a car to commute to work, supporting Hypothesis 2. This

suggests that the symbolic meaning attached to not using a car carries more weight in influencing

the intention of not using a car for commuting than practical or environmental factors. These

results were similar to Noppers et al. (2014) study. He too found that evaluations of symbolic

attributes was the most significant predictor on adopting sustainable innovations compared to

instrumental and environmental attributes. The only difference between this current study and

Noppers et al. (2014) study is that he found a significant relationship between all the attributes

and dependent variable in the regression model while this current study only found a significant relationship between symbolic attributes and not using a car to commute to work.

Once we extended the ISE attributes model with perceived gains and losses acting as a mediator, instrumental attributes, such as autonomy, convenience, and personal cost, were found to have a positive and significant relationship with the perceived gains and losses associated with not using a car. Moreover, positive evaluations of these instrumental attributes were positively related to the intention of not using a car for commuting to work. Overall, The results revealed a strong indirect effect of perceived gains and losses on the relationship between evaluations of instrumental attributes and not using a car to commute to work. This result was interesting since when the multiple linear regression was done the correlation matrix presented a relationship between instrumental attributes and not using a car (when controlling for other attributes) was not significant. However, when entered in another model with another variable (perceived gains and losses), the relationship is significant. This might have happened because perceived gains and losses, is a more significant regressor than symbolic and environmental attributes. The results support all three of the hypotheses mentioned in regards to extending the ISE attributes model with perceived gains and losses acting as a mediator. This implies that the evaluations of instrumental attributes (referring to practical or functional qualities) of not using a car to commute to work were found to have a positive and significant relationship with perceptions of gains and losses regarding. This suggests that when individuals assessed the instrumental attributes of something (i.e. autonomy and cost), their judgments were associated with the perceived benefits and drawbacks they expected to experience. The significant relationship between instrumental attributes and not using a car for commuting implies that positive perceptions of autonomy, convenience, and cost savings influence people's decision to choose

alternative transportation options.Furthermore, individuals' perception of the advantages and

disadvantages of perceived gain and losses of not using a car to commute to work played a

meaningful role in their intention of not using a car to commute to work. Individuals' perceptions

of the advantages and disadvantages associated with not using a car were influential factors in

their decision to opt for alternative transportation options for their commute to work. When

looking at similar studies such as Liu et al. (2014) on prospect theory and car sharing services,

similar results are found. In Liu et al. (2014) it was highlighted that individuals make a choice

regarding whether or not to use car sharing services because of what in their personal life feels

like a gain or a loss, and in this study it was found that perceived gains and losses in instrumental

attributes affect the intention to not use a car to commute to work.

Practical implications

      Our research provides practical implications; specifically to policy makers as well as

advertisement. This study brought forth that how individuals perceive certain instrumental

attributes (i.e. autonomy, cost) as a gain or a loss can influence intention to use a car to commute

to work or not. As policy makers it is useful to understand what features of an attribute would

cause the least anger within a community so that when a policy is imposed less people would

feel negatively about the regulation or policy imposed, leading to more individuals being willing

to confirm with it. Knowing what people perceive as a gain or as a loss, can help advertisements

promote a certain image of what for example not using a car will lead them to gain and what they

will not lose.

Limitations and Strengths

In this study to avoid steering our participants our questionnaire was randomized. This ensured the reliability and credibility because the responses participants gave were less biased and more valid since they were not influenced by the order of the questions to respond in a certain direction which kept the integrity of the research. Due to the context of the study, we used a very targeted group of individuals for this study since individuals living in the Netherlands were asked to answer the survey making it not a generalizable sample. Also when looking at the demographics of the participants we noticed that the majority of the participants were in the higher end of economic status compared to the average Dutch person. Due to the lack of generalizability, it limits external validity. The findings may not accurately represent behaviors of the broader population, limiting the ability to apply the results to a wider context. Continuing on the topic of participants, we noticed that three of our participants sent us messages about what they currently do for the environment and how they have electric cars etc. even though that is not what the study was investigating, this shows participant engagement and involvement beyond the requirements. Such feedback can provide valuable insights but it does raise some red flags in the objectivity on how they might have answered questions in the study which could influence the overall results of the study.

Future Direction

In the future, it would be interesting to study the mediation effect of perceived gains and losses for symbolic and environmental attributes on not using a car to commute to work, instead of just on instrumental attributes like done in this study. This would be useful to elaborate on because it would further extend the ISE attributes model done by Noppers et al. (2014). By examining the mediation effect of perceived gains and losses in symbolic and environmental

attributes, we could see if the relationship between symbolic attributes and environmental attributes to not using a car to commute to work changes when perceived gains and losses is used as a mediator variable. Similarly to how instrumental attributes at first did not have a significant effect on not using a car to commute to work (in the multiple regression analysis), but once a mediation effect was done there was a significant effect between the two variables.

Conclusion

In conclusion, our research findings provide valuable insights into the factors influencing individuals' intention to use a car to commute to work. We have determined that symbolic attributes hold greater influence over individuals' intention to not use a car to commute to work compared to instrumental and environmental attributes. This highlights the significance of the intangible, symbolic aspects associated with car usage, such as social status or personal values. Moreover, our study has identified a mediating effect of perceived gains and losses in the relationship between instrumental attributes and the intention to not use a car to commute to work. This signifies that depending on how an individual perceives an instrumental attribute as a gain or a loss can influence the intention of not using a car to go to work. Our findings indicate that when individuals perceive a greater sense of loss in not using their car to commute to work, they are less inclined to not use it. When the perceived gains are prominent and the associated losses are deemed inconsequential, individuals are more likely to opt for alternative means of commuting, rather than using their car to commute to work. Understanding these dynamics can inform policymakers, urban planners, and transportation experts in developing strategies and interventions that promote sustainable transportation options and reduce car dependency.

Reference

Avineri, E., & Chorus, C. G. (2010). Editorial: Recent Developments in Prospect Theory-based Travel Behaviour Research. *European Journal of Transport and Infrastructure Research*, *10*(4). https://doi.org/10.18757/ejtir.2010.10.4.2896

Broaddus, A., Litman, T., & Menon, G. (2009). Transportation Demand Management (in chinese): Training Document; Sector Project Transport Policy Advice Services. http://transferproject.org/wp-content/uploads/2017/09/Transportation-Demand-Management.pdf

De Groot, J. I. M., & Thøgersen, J. (2012). Values and Pro-Environmental Behaviour. In John Wiley & Sons, Ltd eBooks (pp. 167–178). https://doi.org/10.1002/9781119241072.ch17

Dittmar, H. (1992). The social psychology of material possessions: to have is to be. Choice Reviews Online, 30(08), 30–4685. https://doi.org/10.5860/choice.30-4685

EUR-Lex - sustainable_development - EN - EUR-Lex. (2019). Retrieved May 2, 2023, from https://eur-lex.europa.eu/EN/legal-content/glossary/sustainable-development.html

Gonzalez-Ramirez, J., Arora, P., & Podestá, G. (2018). Using Insights from Prospect Theory to Enhance Sustainable Decision Making by Agribusinesses in Argentina. *Sustainability*, *10*(8), 2693. https://doi.org/10.3390/su10082693

Griskevicius, V., Tybur, J. M., & Van Den Bergh, B. (2010b). Going green to be seen: Status, reputation, and conspicuous conservation. *Journal of Personality and Social Psychology*, *98*(3), 392–404. https://doi.org/10.1037/a0017346

Ilieva, L. (2020). The Role of Education for Sustainable Urban Mobility. *ResearchGate*.

https://www.researchgate.net/publication/340649352_The_Role_of_Education_for_Susta

inable_Urban_Mobility

Liu, A., Wuest, T., Wei, W., & Lu, S. C. (2014). Application of Prospect Theory on Car

Sharing Product Service System. *Procedia CIRP*, *16*, 350–355.

https://doi.org/10.1016/j.procir.2014.02.022

Noppers, E. H., Keizer, K., Bolderdijk, J. W., & Steg, L. (2014). The adoption of

sustainable innovations: Driven by symbolic and environmental motives. *Global

Environmental Change-human and Policy Dimensions*, *25*, 52–62.

https://doi.org/10.1016/j.gloenvcha.2014.01.012

Noppers, E. H., Keizer, K., Milovanovic, M., & Steg, L. (2019). The role of adoption

norms and perceived product attributes in the adoption of Dutch electric vehicles and

smart energy systems. *Energy Research and Social Science*, *57*, 101237.

https://doi.org/10.1016/j.erss.2019.101237

United Nations Environment Programme. (2022). *Emissions Gap Report 2022*. UNEP -

UN Environment Programme. Retrieved June 30, 2023, from https://www.unep.org/

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk.

Econometrica, 47(2), 263-291.

Levy, J. S. (1996c). Loss Aversion, Framing, and Bargaining: The Implications of

Prospect Theory for International Conflict. *International Political Science Review*, *17*(2),

179–195. https://doi.org/10.1177/019251296017002004

*Reckien, D., Creutzig, F., Fernandez, B., Lwasa, S., Moreno-Leguizamon, C., McEvoy, D.,

& Satterthwaite, D. (2017). Climate change, equity and the Sustainable Development*

Goals: an urban perspective. Environment and Urbanization, 29(1), 159–182.

https://doi.org/10.1177/0956247816677778

Saltık, Ö., Rehman, W. U., Söyü, R., Değirmen, S., & Şengönül, A. (2023). Predicting loss

aversion behavior with machine-learning methods. Humanities & Social Sciences

Communications, 10(1). https://doi.org/10.1057/s41599-023-01620-2

Steg, L. (2005). Car use: lust and must. Instrumental, symbolic and affective motives for

car use. Transportation Research Part A-policy and Practice, 39(2–3), 147–162.

https://doi.org/10.1016/j.tra.2004.07.001

What is carbon neutrality and how can it be achieved by 2050? | News | European

Parliament. (2023, December 4).

https://www.europarl.europa.eu/news/en/headlines/society/20190926STO62270/what-is-c

arbon-neutrality-and-how-can-it-be-achieved-by-2050

World Bank Climate Change Knowledge Portal. (2021). Retrieved May 4, 2023, from

https://climateknowledgeportal.worldbank.org/overview

Appendix A

Invitations to Participate in the Study

Figure A1

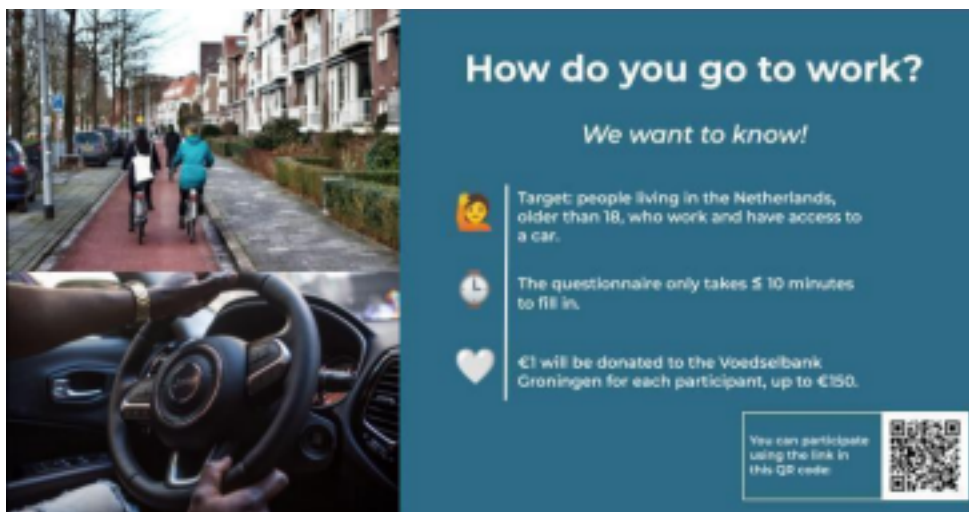*Printed Version, in English, of the Invitation to Take Part in the Study*

Figure A2

Printed Version, in Dutch, of the Invitation to Take Part in the Study

Figure A3

Invitation Sent through Social Media, with a Web Link to the Questionnaire

Appendix B

Questions About the Evaluation of Attributes and Perceived Gains and losses

Figure B1

Questions About the Evaluation of Attributes of Not Using a Car to Go to Work

Opinions about not using a car

We want to know your opinion about <u>NOT</u> using a car for commuting and instead choosing other means of transportation. For example, using a bike, public transport, or even walking to work.

Please, give your opinion about each sentence.

<u>NOT</u> using a car...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I don't have an opinion
... fits with what I find important in life.	O	O	O	O	O	O
... emits few greenhouse gases.	O	O	O	O	O	O
... is comfortable.	O	O	O	O	O	O
... is reliable.	O	O	O	O	O	O
... is safe.	O	O	O	O	O	O
... fits with how I want to see myself.	O	O	O	O	O	O
... shows who I am.	O	O	O	O	O	O
... emits few harmful particulates.	O	O	O	O	O	O
... is environmentally friendly.	O	O	O	O	O	O

Question About Use of a Car in the Future

Use of a car in the future

Previously, you answered that you have access to a car, which you can use to go to work or for other activities. Now, we would like to ask you a question about your car use in the future.

When you think about your near future, how do you feel about <u>NOT</u> using a car?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I intend NOT to use a car in the future <u>to go to work</u>.	O	O	O	O	O

Figure B3

Questions About the Perceived Gains and Losses for Instrumental Attributes

Gain and loss

Some people may experience policies that restrict you from using your car to go to work as an overall gain because it is in line with what they find important life, for example because it may work against negative environmental impacts or because it gives them a nudge to use other, healthier forms of transportation such as the bike. Others may experience such a policy as an overall loss, because needing to commute to work without a car affects their autonomy and sense of flexibility since

they need to rely on public transport, which may not be 100% reliable.

We would like to know how you would perceive policies which restrict your car use. Please rate the following statements to what extent you would perceive them as more of a loss than a gain (-3 till -1 is loss and 1 till 3 is considered a gain)

Rate the following statements to what extent you perceive them as a loss or gain (-3 till -1 is loss and 1 till 3 is considered gain)

	More as loss			neutral		More as gain	
	-3	-2	-1	0	1	2	3
How do you perceive your autonomy and convenience being impacted by not being able to use a car to commute to work?							
How do you perceive your commuting costs being impacted by not being able to use a car to commute to work?							