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Master's Degree Program in  
**Data-Driven Marketing**

## **Nudges in Environmental Consumer Behavior: The Transportation Network Companies**

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Master Thesis

presented as partial requirement for obtaining a Master's Degree in Data-Driven Marketing

**NOVA Information Management School**  
**Instituto Superior de Estatística e Gestão de Informação**

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**NUDGES IN ENVIRONMENTAL CONSUMER BEHAVIOR: THE TRANSPORTATION  
NETWORK COMPANIES**

by

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Master Thesis presented as partial requirement for obtaining the Master's degree in Data-Driven Marketing, with a specialization in Marketing Intelligence

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## STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

*[Lisbon, 30<sup>th</sup> November]*

*Catarina Ferreira*

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## ABSTRACT

This study focuses on digital nudge tools and their impact on environmentally responsible purchase intention within the context of transportation network companies (TNCs). It explores the role of environmental concern, the mediation of attitudes towards the environment and normative influence in shaping pro-environmental purchase intention. Nudge tool theory is a well-established but growing concept, however, there is a gap in the literature concerning its impact on individual behavior in the TNC sector, particularly in Portugal. This research consists of an experiment focused on the study of digital nudge tools, and a questionnaire (N=380) to analyze the remaining variables as it intends to assess the influence of variables on environmentally responsible purchase intention. Findings resulted in the rejection of the proposed hypothesis, except hypothesis 1.2., which states that the nudge tool “changes to the default policy” affects control condition, regarding environmentally responsible purchase intention. The rest of the variables presented did not have a significant effect on environmentally responsible purchase intention. These results allow for further exploration on the impact of the comparison of different nudge tools.

## KEYWORDS

Sustainable consumer behavior; Private mobility; Digital nudge tools.

### Sustainable Development Goals (SDG):



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## **LIST OF ABBREVIATIONS AND ACRONYMS**

|             |  |
|-------------|--|
| <b>TNC</b>  | Transportation Network Companies               |
| <b>ERPI</b> | Environmentally responsible purchase intention |
| <b>EC</b>   | Environmental concern                          |
| <b>ATE</b>  | Attitudes towards the environment              |
| <b>NI</b>   | Normative influence                            |

# 1. INTRODUCTION

Climate change is a global emergency, one that is urgent and that can only be supported with international cooperation and well-met responses. The Paris Agreement, signed by 194 parties at COP21 in 2015, aims to mitigate climate change and postulates that all countries should create policies and set nationally determined contributions for climate action to move towards a net-zero emissions world (United Nations, 2022). The agreement established that there needed to be an urgency to limit global warming to 1.5°C. This can only be done by striving for a carbon-neutral economy, reducing emissions by 45% until 2030 (United Nations, 2019).

According to the European Federation for Transport and Environment, the transport sector has had the highest emissions since 1990 (T&E, 2021). Over the last few years, a new mode of transportation has emerged - ride-hailing. These services operated by Transportation Network Companies (TNCs) can substitute the use of personal vehicles and public transportation, changing transportation patterns and their environmental impacts (Taiebat et al., 2022). These companies, such as Uber and Bolt, have made requests for an effortless ride, practical, and almost instant with online accounts and apps (T&E, 2021).

A campaign led by the federation mentioned above (European Federation for Transport and Environment's #TrueCostofUber) showed that the increase in greenhouse gas emissions in cities was linked to the growth of the operation of ride-hailing services in those same cities (T&E, 2021). The answer to diminishing greenhouse gas emissions may be transitioning from conventional internal combustion engine vehicles to electric vehicles. These produce zero emissions at point use and are presented to be a hopeful solution to reduce emissions from transportation (Zhu et al., 2016).

Therefore, a combination of sustainable policies and strategies must be implemented to reduce emissions. With that, individuals can make sustainable decisions if the options are presented. Over the past few years, behavioral sciences have gained the spotlight in the execution of policy instruments by helping to define the policies that should be adopted to promote sustainable behavior, since these sciences can help to understand better the behavior of individuals and what influences their changes (Lehner et al., 2016).

Choice of architecture and nudges are promising tools to help uncover various sustainable behaviors and consumption (Sunstein et al., 2014). A nudge, by Thaler and Sunstein (2008), is a predictable alteration in people's choices and behavior, not changing their economic incentives. These are conscious alterations to the structure of choices that affect people's behavior, and that is done by modifying the surroundings that lead and enable people to make decisions, making them unaware of these effects on their actions (Lehner et al., 2016). Redesigning the options presented to the public is a way of nudging.

Nudge theory has risen in the last few years, however there is a lack of studies addressing its impact on individual behavior change in the context of private mobility (Lehner et al., 2016). The study of nudges and their application to environmental issues is growing. Over the last few years, nudge theory has increasingly been applied to online environments, shifting from the offline environments where it was initially developed (Guath, 2022). The study of nudging regarding ride-hailing at a global level is not widely explored, much less so in Portugal. As this study will be carried out in Portugal (and focused on Portuguese users), there will be a gap filled in the study of digital nudges and their impacts on TNCs. Ride-hailing platforms have grown considerably in the last decade, and their use will likely continue to increase over the years (Sheldon & Dua, 2024). There is a clear evolution of consumer consumption regarding the use of transportation, making the study of ride-hailing recent and hardly researched.

The present paper aims to explore the studies on nudging consumer behavior and carry out an experiment. It will spotlight TNCs, study nudges in apps used to call ride-hailing services and fill the research gap in this industry.

The research questions that are going to be explored are:

RQ1: How do nudges influence consumer's ride-hailing choices, making them more sustainable?

RQ2: How does consumer knowledge and the opinion of others affect sustainable ride-hailing choices?

The objective of the study is to focus on consumer's use of TNC apps in the Portuguese context (TVDE apps) and how those can be influenced by nudges regarding their choices in these apps. This paper aims to empirically investigate how consumers who use ride-hailing apps respond to environmental nudges. The following chapters will investigate consumer environmental behavior and nudge theory.

This paper includes an introduction to the study of nudges and their influence on environmental matters. Testing hypotheses through an experiment and questionnaire, further analyzing their results, and reaching a conclusion.

## 2. LITERATURE REVIEW AND CONCEPTUAL MODEL

Over the years, human behavior has been a central subject of study, particularly within the framework of behavioral theories. Among these is the theory of reasoned action and the theory of planned behavior, derived from the last one. The theory of planned behavior focuses on predicting and explaining human behavior in certain contexts. The theory of reasoned action and the theory of planned behavior share the study of the individual's intention to perform a specific behavior - generally, if the intentions are strong, the likelihood of the behavior being performed is increased. (Ajzen, 1991). The key difference between the two theories lies in the addition (to the last theory) of the concept of "perceived behavioral control". This concept refers to the individual's perceptions of how difficult it is to carry out their desired behavior. In the theory of planned behavior, perceived behavioral control, combined with behavioral intention, helps predict whether people achieve a certain behavior (Ajzen, 1991). The theory of reasoned action goes further by connecting beliefs, through attitudes and intentions, to actual behavior. It builds on the first theory, as it comprehends the difficulty of dealing with behaviors where people have limited control. Nonetheless, these theories fail to account for the attitude-behavior gap.

Fazio (1986) addresses this gap by proposing that attitudes that lead to behavior are performed automatically instead of being planned. This leads to the inconsistency between attitudes and actual behaviors. When exploring environmental concerns, existing literature has been shown not to link the attitudes and behavior of the individuals (the attitude-behavior gap). Even if individuals, in theory, intend to perform pro-environmental attitudes (such as recycling, and concern about car pollution), these do not often translate into the same pro-environmental behavior (Gupta & Ogden, 2009).

The value-belief-norm theory of environmentalism (Stern, 1999) provides more insight by suggesting that to achieve pro-environmental behaviors, there needs to be a combination of values, beliefs and norms that align with this ultimate behavior.

### 2.1. ENVIRONMENTALLY RESPONSIBLE PURCHASE INTENTION

Purchase intention is one of the pillars of the buying process, consisting of deliberately planning to acquire a specific product or service. When analyzing green purchase intention, it refers to the willingness of individuals to consider and prefer green products or services over conventional ones (Chekima, et al., 2016).

Sustainable consumption behavior is an environmental behavior within the private sphere. Although these behaviors happen in the private sphere, they have tangible effects on the environment (Stern, 2000). This behavior is closely related to pro-environmental consumption behavior, which comprises the attitudes individuals adopt to support environmental sustainability. The value-belief-norm theory by Stern (2000), provides a widely accepted theoretical model to explain this behavior.

When analyzing intention, both pro-environmental intention and actual intention are measured by the theory of planned behavior by Ajzen (1991). Many studies point to the fact that consumers' purchase intention is influenced by attitudes, subjective norms and behavioral control.

What drives the consumer to purchase products or services that have a better environmental impact, is the consumer's psychology and purchase behavior, as well as their awareness towards green products (Bisoyi and Das, 2023). It is useful to address environmental concerns and reach pro-environmental behavior changes by understanding human behavior (Thomas-Walters, et al., 2022).

## **2.2. TRANSPORTATION NETWORK COMPANIES**

With the rise of the sharing economy that provides access to an on-demand shared form of mobility, a new mode of transportation has emerged - the transportation network companies (TNCs) (Diao et al., 2021). TNCs use online platforms and provide the consumer with the opportunity to request a personal ride on-demand.

Currently, there are two different options available, a personalized or a shared ride. The first consists of an individual ride, shared or not by a group, the second, is shared by consumers who are not associated, but have similar points of departure and arrival (e.g. UberX Share) (Diao et al., 2021). The use of mobile apps to order personalized rides is being frequently used in major cities. Ride-hailing is growing and becoming more significant due to its easy-to-use characteristics. (Olayode, et al., 2023)

The impacts of this industry have been instant and crucial (Gehrke, et al. 2019). A recent study of taxi trips in New York City, showed that sharing (taxi) rides, without assuming that the individuals are associated and would share the trips, could reduce traffic volume by 30% (assuming traffic in the city is unchanged) (Vazifeh et al., 2018).

The impact of TNCs on the positive change for urban sustainability is still under debate. Since the use of these services serves a different purpose for certain people, some users do not rely on ride-hailing services and use them sporadically, in case of an emergency. Other users see these services as an easy, on-demand way of transportation, leading to more congestion on the road with fewer people per-vehicle (compared to the use of public transport) (Diao et al., 2021). Additionally, there are more vehicles on the road with the rise of TNCs, and the rise of vehicles is not proportionate to the evolution of the population of cities. With this, the traffic density can be higher, with the travel demand from these services (Roy et al., 2018).

Previous research has shown that nudging is beneficial to reduce congestion on the roads, and to reduce pollution (FHWA, 2019).

## **2.3. NUDGES**

Thaler and Sunstein (2009) debate the idea of the brain's functioning and how there are two ways of thinking, the first being intuitive and automatic (named the automatic system, or system 1) and the second way of thinking is reflective and rational (named the reflective system, or system 2). System 1 is characterized by being instinctive, simple and automatic, while system 2 is more deliberate and responsible for supervised decisions. The automatic system is responsible for fast reactions and reflexes, and the reflective system is reserved for reasoned and deliberate choices (Thaler and Sunstein, 2009).

A nudge is introduced by Thaler and Sunstein (2014) to influence human behavior, in a predictable form, without changing their economic incentives. This is a strategy of methodically changing the environment of the consumer to change their choice (van Kleef et al., 2018). When applying nudging to sustainable consumption behavior, prior studies have defined a set of nudging tools. Lehner et al. (2016) present four environments of nudges: simplification and framing of information, changes to the physical environment, changes to the default policy, and the use of social norms. Zimmerman (2021) presents nudging mechanisms such as priming, goal setting, decoy, defaults, feedback and social comparison; each one of these is grouped chronologically, from the moment before the action takes place, to the moment after.

These nudges can also take place in an online environment, although here, people adopt different actions than the ones in the offline environment (Berger et al., 2022). Weinmann (2016) defined digital nudges as a tool to guide an individual's decisions in an online environment by making use of the design elements of the user's page. Online environments are favorable for the study of nudges, since there is the possibility to gather individual preferences almost instantly (Berger et al., 2022).

### **2.3.1. STUDY OF NUDGE TOOLS**

In the context of the study of nudges, as mentioned above, various types of nudges exist, varying in effectiveness also due to their context and implementation.

Generally, individuals often opt for the path of least resistance, making decisions based on pre-existing choices. Consequently, they are greatly influenced by defaults - standard choices - that determine their decisions without requiring active deliberation. (Lehner, et al., 2016) "Default" nudges prove to be effective in contexts with a higher likelihood of adherence to rules and where decision-making processes are more structured as demonstrated in many studies. In a study regarding the effects of water regulations, it was concluded that if the water is regulated, there is a reduced wastage of water (Banerjee et al., 2023; Peth et al., 2018). The default option leverages on the fact that it is, sometimes, the easiest option. As noted by Ebeling and Lotz (2015), this approach can effectively influence the study of environmental decision-making.

Using nudge tools is not only important to determine what information to present, but also to consider how this information is presented. Through nudge tools like “simplification and framing of information” simplification makes the information more straightforward, while framing consciously presents the information to appeal to specific values and attitudes of these individuals, influencing decision making (Lehner et al., 2016). Regarding these simplification nudges, Banerjee et al. (2023), presents the study by Waitrop and Pelletier (2016), which highlights the preference that children assume for simplified processes, over complex ones. In another study conducted by Ortiz et al. (2024), research concerning credit card debt reveals that, when presenting information in a simplified form, people demonstrated higher knowledge, increasing debt repayment levels.

Lastly, referencing social norm nudges, social norms have a great influence in individual decision making. These norms leverage on the fact that humans are social beings and are motivated to conform to societal expectations (Lehner et al., 2016). The influence of social norms is often higher than financial incentives and gifts (Banerjee et al., 2023). This is shown in a study conducted in a Portuguese supermarket that concluded that people classified as “less healthy” are positively affected by the social norm nudge, whereas those with healthier habits showed an opposite outcome (Gonçalves, et al., 2021).

### **2.3.2. DIGITAL NUDGE TOOLS**

There are many different forms of influencing an individual’s behavior. Lehner et al. (2016) presents four tools. These are also mentioned in the work of Sunstein (2014).

The tools above mentioned are: 1) "simplification and framing of information", framing, as described, is a way of phrasing specific information to switch certain values and attitudes of people (Lehner et al., 2016); 2) “changes to the default policy” can lead the customer to pick the choice that is already chosen by default; and 3) the “use of social norms” is based in the idea that the individual is influenced by social norms. Lastly, (and 4th) the tool “changes to the physical environment” is mentioned but not included as a construct of this study, since the experiment is presented in digital form. These nudges and cues are tools that try to lead the consumer in a direction. Additionally, it is essential to compare them to a control condition - a scenario that remains unaltered in order to observe the impact of these nudge tools on decision-making behavior.

Thaler and Sunstein (2008) defend that nudges work because they address biases and errors in human behavior; these occur when actions do not require cognitive effort. Verplanken and Wood (2006) concluded that about 45% of our everyday actions are automatic behaviors. Nudges can be applied in such situations or when individuals feel overwhelmed by the number of choices. Behavioral sciences are used by businesses to influence consumer behavior; however, the term “nudge” originally describes a tool that promotes beneficial behavior for individuals or society (Lehner, et al. 2016).

Thus, it is proposed that:

H1.1: The digital nudge tool, "simplification and framing of information", significantly increases environmentally responsible purchase intention compared to a control condition.

H1.2: The digital nudge tool, "changes to the default policy", significantly increases environmentally responsible purchase intention compared to a control condition.

H1.3: The digital nudge tool, "use of social norms", significantly increases environmentally responsible purchase intention compared to a control condition.

## **2.4. ENVIRONMENTAL CONCERN AND ATTITUDES TOWARDS THE ENVIRONMENT**

Environmental concern is closely linked to an individual's awareness of environmental issues and their level of worry about environmental matters. According to findings, environmental concern can influence consumption behavior, leading to an increased sustainable consumption behavior (Saari et al., 2021)

"Green consumption" is related to environmentally responsible consumption, therefore consumers consider the environmental impact of their purchasing decisions and the usage of green products or services (Joshi & Rahman, 2015). In this study review in the field of green purchase behavior conducted by Joshi, Y. and Rahman, Z. (2015), it is highlighted that consumer environmental concern has a positive relation to consumer green purchase intention and behavior.

Moreover, consumer awareness is shown to motivate change in sustainable responsible consumption. Research suggests that if consumers become aware of the future consequences of their daily purchase decisions, this awareness can be critical in enhancing prudent consumer decisions (Buerke, 2017).

In order to predict future behavior, researchers can rely on an understanding of attitudes, since these are associated with consumer behavior. Shifting consumer's attitudes can drive desired behavioral outcomes. Environmental attitudes, which are an individual's cognitive and affective assessments of environmental protection, play a critical role in shaping environmental behaviors (Taufique, et al., 2017).

Environmental concern can be associated with sustainable consumption behavior including the ability of people to care and pay more for sustainable products and change certain behaviors to foster sustainability. Pro-environmental behavior can be defined as actions that are beneficial to the environment (Saari, et al. 2021).

With that, it is proposed that:

H2: Environmental concern is positively associated with environmentally responsible purchase intention.

Many studies point to the fact that, in terms of beliefs and values, individuals consider sustainability important; however, this commitment does not translate to actual behavior (Auger and Devinney, 2007; Gatersleben et al., 2002; Kollmuss and Agyeman, 2002; Verplanken and Roy, 2015; Young et al., 2010). Aside from the fact that interest and concern around sustainability is growing, and people can have more behavioral intentions, this doesn't mean that individuals will always go beyond their means to support sustainability (Saari, et al., 2021). This inconsistency is explored through the concept of the attitude behavior gap in sustainability.

The attitude behavior gap highlights the contradicting relationship between consumer's environmental values, and their pro-environmental purchase behavior. Even though environmental concern may be significant to individuals, this does not reflect on their pro-environmental actions (Stieglitz, et al., 2023). When reviewing other studies, Joshi, Y. and Rahman, Z. (2015) found that, while consumers often show concern for the environment and care for environmental matters, if they do not have a sense of responsibility towards the betterment of the environment, that does not always translate to pro-environmental behaviors and consumerism. Environmental attitudes and behavioral intention are not strongly linked, and environmental concern can be influential on the behavior of individuals (Saair et al).

Environmental knowledge is a core element that influences both environmental attitudes and pro-environmental consumer behavior. As highlighted by Taufique et al. (2017), environmental attitudes are shaped by environmental knowledge. Furthermore, when environmental knowledge and attitudes towards the environment are combined, they significantly enhance pro-environmental consumer behavior. However, there is discussion regarding the weak relationship between environmental attitudes and behavioral intention, while environmental concern is likely to impact behavior indirectly (Bamberg, 2003).

Studies suggest that there is a need for a mediator to bridge the gap between the influence of environmental concern on its promotion of sustainable consumption behavior among consumers (Saari, et al., 2021).

This leads to another hypothesis:

H2.1. The effect of environmental concern on environmentally responsible purchase intention is mediated by attitudes towards the environment.

## **2.5. NORMATIVE INFLUENCE**

Normative influence refers to the tendency of individuals to conform to the beliefs and thoughts of others in order to gain acceptance and avoid repercussions. Societally, a set of rules and standards are established, these vary from culture to culture (Saari, et al., 2019). Introducing social comparison theory, Festinger (1954), posits that individuals determine their social and personal worth based on comparison with other individuals. This theory is important to understand the impact of social norms and normative influence on individual choices.

To perceive the attitudes and norms of others is powerful in shaping an individual's behaviors and intentions (Schubert, 2017). And, naturally, as social beings, consumers are seeking what others do and comparing it to their peers, aligning their choices with those that are "approved" or "disapproved" societally, looking to conform to social expectations (Schubert, 2017). In the context of reference groups, these groups or group members can determine or influence one's attitudes and actions, serving as a comparison for people's decision-making (White & Dahl, 2006).

This matter extends to environmental causes, as shown in Gupta & Ogden's (2019) work. Here, the dimension "reference group influence" is particularly relevant. When approaching green purchase behavior, the sense of belonging to a group is important. When the group shows pro-environmental attitudes, the individual who aspires to belong to that group acts accordingly. However, when the opposite happens, that person is less prone to making pro-environment decisions.

Therefore, a third hypothesis is proposed:

H3: Reference group's norms significantly influence consumer's environmentally responsible purchase intention.

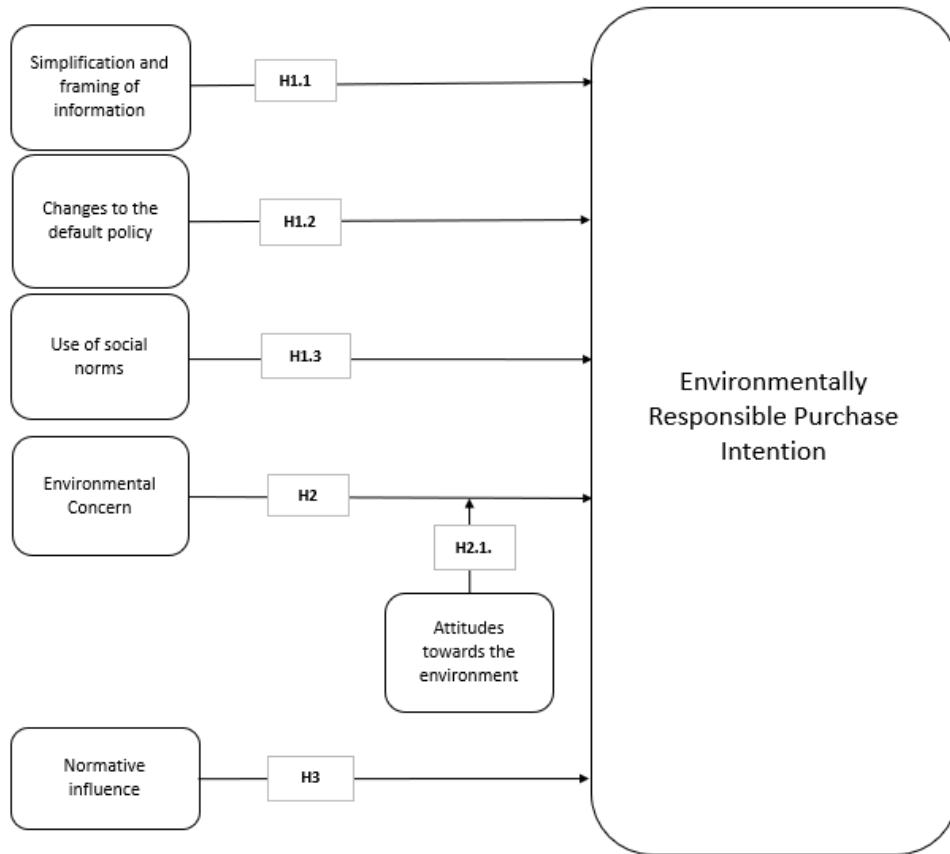


Figure 1-Research model

Table 1-Definition of constructs

| Constructs                                | Definition   | Source               |
|---|--|----------------------|
| Simplification and framing of information | Simplification makes the information simpler, while framing consciously presents the information to appeal to specific values and attitudes of these individuals | Lehner et al. (2016) |
| Changes to the default policy             | Defaults are what determine individual's their decisions without   | Lehner et al. (2016) |

|  |  |                        |
|--|--|------------------------|
|  | requiring active deliberation  |                        |
| Use of social norms                            | Social norms refer to the fact that individuals are motivated to conform to societal expectations, complying with norms                      | Lehner et al. (2016)   |
| Environmental concern                          | Environmental concern refers to individual's awareness of environmental issues and their ability to change certain behaviors.                | Saari et al. (2021)    |
| Attitudes towards the environment              | Individual's cognitive and affective assessments of environmental protection   | Taufique et al. (2017) |
| Normative influence                            | Complying with the expectations of a group which could reduce potential punishment or build close relationships with that same group         | Wang et al. (2019)     |
| Environmentally responsible purchase intention | Responsible environmental behavior offers long-term benefits for the consumer; besides, these also value eco-friendly products increasingly. | Kumar et al. (2021)    |

### 3. METHODOLOGY

#### 3.1. QUESTIONNAIRE DESIGN AND PROCEDURE

The methods employed in this study were experimental and descriptive quantitative research. The experimental design included experimental manipulation (experimental research) and a survey questionnaire (descriptive research).

The questionnaire collected demographic indicators including gender, age, level of education and economic status. Younger people (VanLiere & Dunlap, 1980) with high education level (Samdahl & Robertson, 1989) and high economic status (Mohai, 1985), are more likely to take pro-environmental actions (Ebreo, Hershey and Vining, 1999). Economic status was divided into two variables: employment status and monthly income. The scales for monthly income were taken from Portal das Finanças (Autoridade Tributária e Aduaneira, 2024).

The questionnaire is divided into four constructs: environmental concern, pro-environmental consumer choice, normative influence, and environmental involvement. These questions are used to test hypotheses 2, 2.1. and 3, exploring how environmental concern influences the consumer purchase intention towards environmentally conscious decisions and if their attitudes towards the environment affect this relationship. Also, whether normative influences whether they make pro-environmental choices or not is questioned. These constructs and items were retrieved from established research, providing a solid theoretical foundation as specified in the table and were to some degree adapted to make them more relevant to the study of TVDE (platforms. These items follow a Likert Scale, from 1 (strongly disagree) to 7 (strongly agree).

Table 2-Table of constructs

| Construct   | Description   | Items | Source              |
|---|---|-------|---------------------|
| Environmentally Responsible Purchase Intention (ERPI) | I am planning to request an electrical ride in the future                             | ERPI1 | Kumar et al. (2021) |
|   | I plan to request electrical rides regularly  | ERPI2 |                     |
|   | I will make more of an effort to request electric rides in comparison to regular ones | ERPI3 |                     |
| Normative influence (NI)                              | I rarely purchase the latest services until my friend approve of them                 | NI1   | Wang et al. (2019)  |
|   | It is important that others like what I purchase                                      | NI2   |                     |

|   |  |  |      |                        |
|---|--|--|------|------------------------|
|   |  | When purchasing services, I generally purchase services that I think others will approve of            | NI3  |                        |
|   |  | If other people can see me using a service, I often purchase the service they expect me to             | NI4  |                        |
|   |  | I like to know what services make good impressions on others   | NI5  |                        |
|   |  | I achieve a sense of belonging by purchasing the same services as others purchase                      | NI6  |                        |
|   |  | If I want to be like someone, I often try to buy the same service that they buy                        | NI7  |                        |
|   |  | I often identify with other people by purchasing the same services they purchase                       | NI8  |                        |
| Environmental concern (EC)              |  | I am concerned about environmental issues  | EC1  | Saari et al. (2021)    |
|   |  | We worry too much about the future of the environment and not enough about prices and jobs             | EC2  |                        |
|   |  | People worry too much about human progress harming the environment                                     | EC3  |                        |
|   |  | Many of the claims about environmental issues are exaggerated  | EC4  |                        |
| Attitudes towards the environment (ATE) |  | There is nothing the average citizen can do to help stop environmental pollution                       | ATE1 | Taufique et al. (2017) |
|   |  | My involvement in environmental activities today will help save the environment for future generations | ATE2 |                        |
|   |  | It is essential to promote green living  | ATE3 |                        |
|   |  | I strongly support that more environmental protection works are needed                                 | ATE4 |                        |
|   |  | Environmental protection issues are none of my business  | ATE5 |                        |
|   |  | It is very important to raise environmental concern among people                                       | ATE6 |                        |

The studies were distributed through the Qualtrics platform, and disseminated by personal social media such as WhatsApp, Instagram, Facebook and LinkedIn. A pre-test was conducted to detect and fix possible issues. This was distributed to 20 participants. From this pre-test, response options and minor issues were resolved. The final versions were distributed through personal contacts and email, resulting in a total of 471 responses, 380 of those being valid. The questionnaire focused on people over 18 years old, who were Portuguese and that have used a TVDE service before. Missing values were handled, excluding them from the research. In most of these cases, respondents did not finish the questionnaire or responded “no” to the first filter question: “have you ever requested a ride-hailing (TVDE) service?”. These individuals were not able to continue the questionnaire.

The data was processed using IBM SPSS® Statistics. As an initial step to understand the scope and characteristics of respondents, a descriptive analysis was conducted.

More than half of the respondents are female (60.5%). Concerning education, the population is highly educated, with a cumulative percentage of 79.2% of individuals hold at least a bachelor’s degree. Specifically, the respondents with a bachelor’s degree make up the largest group (48.7%), contrasting with a few individuals (0.8%) with primary education.

Most respondents are employed (57.1%), and their economic status is varied - the majority (32.6) being in the middle-income bracket (from €1124 to €2664 per month), followed by the group of respondents who earn from €821 to €1123 per month (21.6%). This group of respondents presents a mean age of 33 years, with a standard deviation of 13,92, indicating a wide age distribution with the presence of both younger and older respondents.

### **3.2. SAMPLING AND DATA COLLECTION**

For the experimental manipulation, the participant was presented with four ways to request a ride-hailing service: 1) highlighting with green and sustainable icons the more sustainable options (simplification and framing of information) 2) pre-selecting the most sustainable ride (changes to the default policy) 3) including a piece of information indicating the “most wanted” ride (use of social norms) 4) presenting all the options to request a ride, without any nudge tools (control condition). This experimental procedure was conducted before the survey, in the same session, to ensure that the people who answered the survey also participated in the experiment.

The goal of the experiment was to understand whether nudge tools influence the selection of the most pro-environmental option of the options normally presented in a ride-hailing platform; this option would be an electric ride. Thus, the study aimed to test hypothesis 1.1, 1.2, and 1.3, understanding whether there is a difference in the choices between the conditions presented to the respondent, meaning whether digital nudge tools significantly increase pro-environmental choice compared to a control condition.

Table 3-Digital Nudge Tools

| Digital Nudge Tool                                 | Hypothesis | Source               |
|--|------------|----------------------|
| Simplification and framing of information (fig. 3) | H1.1.      | Lehner et al. (2016) |
| Changes to the default policy (fig. 4)             | H1.2.      |                      |
| Use of social norms (fig. 5)                       | H1.3.      |                      |

The experiment was implemented with the app “Bolt” structure, since this company has shown to make environmental efforts to reduce environmental impact. This is shown in Bolt’s green plan by pushing the use of scooters, having more electric rides, and other modes of transport that are more environmentally friendly (Bolt, 2019). Also, the app has a greener design, making the questionnaire design process easier.

A control condition (fig 2) is presented to assess the influence of the nudges or not, understanding the internal validity of the study. With this, it is possible to draw conclusions of cause-and-effect about the data (Leedy & Ormond, 2015).

The software used to build the questionnaire and to perform the experiment was Qualtrics. The Qualtrics platform was chosen to perform experimental manipulation since it has a randomizer tool. This enables randomly exposing each participant to one of four ways to request a ride in a TNC app.

## 4. RESULTS AND DISCUSSION

To better understand the variables of this study, a descriptive table was retrieved with the values of the number of participants, mean, standard deviation, median, minimum and maximum value, and skewness and kurtosis of all 4 variables.

In the table, we can see that the variable that presents the highest mean score (4.77) is environmentally responsible purchase intention (ERPI).

The fact that the mean and median of the variables are approximately equal in value reflects symmetry in this data. Through this analysis of symmetry and Kurtosis, it was possible to conclude that there is a normal distribution, following the criteria by Kline (2011). For the minimum and maximum answers, all variables span the entire scale (from 1 to 7), except for attitudes towards the environment (ATE) which goes from 1 to only 5.

Environmentally responsible purchase intention has the highest mean implicating that respondents have a high intention of performing environmental purchases. However, this may not translate to reality, supported by Stieglitz et al. (2023), discussing that concern may not reflect on pro-environmental actions by individuals.

Table 4-Descriptive Statistics

| Variable | n   | Mean | SD   | Median | Min | Max | Skewness | Kurtosis |
|----------|-----|------|------|--------|-----|-----|----------|----------|
| ERPI     | 380 | 4.77 | 1.50 | 4.67   | 1   | 7   | -0.29    | -0.41    |
| NI       | 380 | 3.07 | 1.36 | 3      | 1   | 7   | 0.29     | -0.64    |
| EC       | 380 | 3.24 | 1.29 | 3.33   | 1   | 7   | 0.32     | -0.17    |
| ATE      | 380 | 2.43 | 1.07 | 2.33   | 1   | 5   | 0.41     | -0.97    |

Table 3 presents the results of the nudge tools experiment, on a descriptive level. Generally, the choices made by the respondents are centered around the options of the standard ride and the electric one. In the control condition, these are closely distributed, with 39.6% of the individuals opting to request a standard ride given the scenario, and 47.3% choosing the electric one.

When introducing the nudge tools (changes to the default policy, simplification and framing of information and use of social norms), the difference becomes more significant. The “changes to the default policy” tool is the one that performs better in pro-environmental behavior, totaling 76.9% of the choice to the electric ride. 63.9% of individuals presented with the condition “simplification and framing of information” chose to request an electrical ride,

and 67% of people presented with the “use of social norms” one, chose to request the same ride. Use of social norms and simplification and framing of information lead to very similar performances across the table, having similar impact on behavior of respondents.

Every nudge tool condition performed better on the choice of a pro-environmental ride (an electric one) than the control condition. This is in line with Lehner et al. (2016) nudge tool collection, affirming that individuals choose the path of least resistance and if the information is simple and appealing, respondents will lead to that choice. Overall, these options encourage pro-environmental decisions.

It is also important to note that XL and Pet rides are the least chosen options. This could be related to the fact that these rides are meant for larger groups and to bring your pet in the car, respectively. On the other hand, apart from standard and electric rides, many respondents chose the comfort and the executive option, suggesting a preference for higher quality cars. However, these four options are less susceptible to nudges, as seen in the table, in comparison to electric and standard choices.

Table 5-Descriptive analysis of digital nudge tools

| Conditions | Control  |      | Changes to the default policy |      | Use of social norms |      | Simplification and framing of information |      |
|------------|----------|------|-------------------------------|------|---------------------|------|---|------|
|            | <i>n</i> | %    | <i>n</i>                      | %    | <i>n</i>            | %    | <i>n</i>                                  | %    |
|            | Standard | 36   | 39.6                          | 19   | 18.3                | 23   | 26.1                                      | 28   |
| Electric   | 43       | 47.3 | 80                            | 76.9 | 59                  | 67.0 | 62  | 63.9 |
| XL         | 2        | 2.2  | 0                             | 0.0  | 0                   | 0.0  | 2   | 2.1  |
| Pet        | 2        | 2.2  | 0                             | 0.0  | 0                   | 0.0  | 1   | 1.0  |
| Comfort    | 5        | 5.5  | 3                             | 2.9  | 5                   | 5.7  | 4   | 4.1  |
| Executive  | 3        | 3.3  | 2                             | 1.9  | 1                   | 1.1  | 0   | 0.0  |

**4.1. CONSTRUCT’S RELIABILITY AND VALIDITY**

To understand how closely related the items of a construct are, the internal consistency - Cronbach alpha - was measured. For the constructs Environmental Responsible Purchase Intention and Normative Influence, the value was over 0.7, which are following the threshold

presented by Hair et al. However, the constructs Environmental Concern and Attitudes Towards the Environment, presented values below 0.7 ( $\alpha = 0.465$  and  $\alpha = 0.072$ , respectively).

Based on this, it was necessary to remove and invert some items. EC1 (I am concerned about environmental issues) was removed and the items ATE2 (My involvement in environmental activities today will help stop environmental pollution), ATE3 (It is essential to promote green living), ATE4 (I strongly support that more environmental protection works are needed) and ATE6 (It is very important to raise environmental concern among people) were inverted. With this, the Cronbach alpha value was presented to be over 0.7, presenting a high level of internal consistency. These details can be seen in table 5.

#### 4.2. RELATIONSHIP BETWEEN VARIABLES

With the objective of understanding if there were significant correlations between the variables under study, Pearson's correlation coefficients were calculated. The results can be seen in table 4.

Table 6-Correlation table

| Variable  | 1        | 2       | 3       | 4 |
|---|----------|---------|---------|---|
| 1. Environmentally responsible purchase intention | —        |         |         |   |
| 2. Normative influence                            | 0.019    | —       |         |   |
| 3. Environmental Concern                          | -0.058   | 0.301** | —       |   |
| 4. Attitudes towards the environment              | -0.392** | 0.355** | 0.345** | — |

\*  $p < .05$ . \*\*  $p < .01$ .

Following the guidelines by Cohen (1988), the correlation between environmentally responsible purchase intention and attitudes towards the environment is moderate  $r(378) = -.392$   $p < .01$ . It is a negative correlation, the strongest of all the values in the table and statistically significant.

It can also be observed that there is a moderate positive correlation between respondent's attitudes towards the environment and their compliance with the normative influence  $r(378) = .355$ ,  $p < .01$ . In other words, the more the individual develops strong environmental attitudes, the more likely they will be to follow normative influence. We can also observe that having attitudes towards the environment increases environmental concern  $r(378) = .345$   $p <$

.01. Environmental concern and normative influence follow that same trend, having a moderate correlation and being statistically significant  $r(378) = .301, p < .01$ .

When evaluating hypothesis 2, 2.1 and 3 of this study, we did not find a statistically significant correlation between environmental concern and environmentally responsible purchase intention ( $r = -0.058, p < 0.01$ ). There is also no statistically significant correlation between normative influence and environmentally responsible purchase intention ( $r = 0.019, p < 0.01$ ). Therefore, both hypotheses 2 and 3 are not confirmed. Since H2.1. is a mediator related to hypothesis 2 and this last one was rejected, hypothesis 2.1. is also automatically rejected.

Environmentally responsible purchase intention and attitudes towards the environment having a negative moderate correlation, indicates that participants who rate their environmentally responsible purchase intention lower tend to rate their attitudes towards the environment higher. This result could be indicative of the attitude behavior gap, highlighting the inconsistency between considering environmental matters important and not translating that concern into pro-environmental actions.

The outcome for hypothesis 2 further explores this dichotomy where individuals' perception of their environmental concern is not aligned with their environmentally responsible purchase intention. Consumer's concern is not aligned with their purchasing behavior revealing the contradicting relationship between intention and actual behavior (Stieglitz, et al., 2023).

Regarding H3, this result contrasts with supporting literature review. It is mentioned that normative influence can shift individual's behaviors, although, in this sample, that is not confirmed. This contradicts some existing literature, where it is shown that normative influence has an impact on environmental actions. However, in the study performed by Wang et al. (2016), had a younger average age. Given that the sample of this study involves people with an average age of 33 years, these participants may not be easily influenced by other people's opinions or societal norms. Moreover, the concept of normative influence is based on having certain behaviors that follow the norm to be accepted by the group, and to avoid possible repercussions (Saari, et al., 2019) However, in an online shopping environment, individuals cannot observe the choices of others, therefore cannot assess or judge those choices. As a result, individuals may opt not to select the "best" option as they are not pressured by their peers that typically influences such decisions.

### **4.3. ASSOCIATION**

To understand whether ride-hailing choices and nudge tools are associated, it was performed a chi-squared test for association, to associate each nudge tool to the control condition.

Regarding the analysis of the control condition and the simplification and framing of information condition  $\chi^2(5) = 7.699, p = .174$  there is no statistical significance ( $p > .05$ ), meaning that the variables are not related.

In the analysis of the association between the control condition and changes to the default policy nudge tool,  $\chi^2(5) = 20.308, p = .001$  we can understand that,  $p < .05$ , indicating that there is statistical significance between these two variables.

Lastly, concerning the control condition and the use of social norms nudge tool,  $\chi^2(5) = 10.327, p = .066$ , the  $p > .05$ , not being able to consider this association statistically significant.

We can conclude that there appears to be no meaningful effect of the nudge tools “simplification and framing of information” and “use of social norms” on ride-hailing choices in this study.

However, the nudge tool “changes to the default policy” produces a significant effect on the control condition. This finding combined with the results of Table 5, where we can see that there is a major difference (within the nudge tool “changes to the default policy”) between the participants who chose a standard ride (18.3%) and the ones who chose the electric ride (76.9%) – which is the most environmentally responsible choice – results in the possibility to support hypothesis H1.2.: “The digital nudge tool, ‘changes to the default policy’, significantly increases environmentally responsible purchase intention compared to a control condition”.

This supports the existing literature that suggests that individuals often follow the path of least resistance, falling for the pre-selected choice, since this choice does not require deliberation or effort (Lehner, et al., 2016).

Table 7 - Significance of hypothesis

| Hypothesis | Sig.      | Supported/not supported |
|------------|-----------|-------------------------|
| H1.1.      | $p > .05$ | Not supported           |
| H1.2.      | $p < .05$ | Supported               |
| H1.3.      | $p > .05$ | Not supported           |
| H2.        | $p > .05$ | Not supported           |
| H2.1.      | N/A       | Not supported           |
| H3.        | $p > .05$ | Not supported           |

## 5. CONCLUSION AND FUTURE RESEARCH

The aim of this study was to explore the impacts of nudges on ride-hailing choices, focusing on pro-environmental ride-hailing choices. The goal was to examine the influence of four nudge tools (changes to the default policy, use of social norms and simplification and framing of information) on the choices made by respondents when it comes to ride-hailing services. Additionally, it was also concentrated on individual's environmental concern, individual's attitudes towards the environment and its possible mediation effect between the concern and the pro-environmental intentions, and lastly normative influence as key factors to determine sustainable choices. The goal was to answer the research questions: How do nudges influence consumer's ride-hailing choices, making them more sustainable? And how does consumer knowledge and the opinion of others affect sustainable ride-hailing choices?

The two research questions and the influences mentioned were very in line with the literature review presented during the study. However, the results revealed no evidence of influence in this aspect.

Regarding the hypothesis presented, these also did not give significant results, being rejected, apart from hypothesis 1.2. This study provided multiple results contrasting existing literature, thereby suggesting alternative perspectives for future research.

### 5.1. RESEARCH CONTRIBUTIONS

As online purchasing continues to grow, it is more prevalent to prioritize online purchase behavior research. By focusing on the exploration of digital nudge tools, this study contributes to the development of this expanding field of research. Additionally, it contributes to the study of TNC platforms in Portugal, exploring TVDE services, as private mobility individual behavior change is still an understudied area of nudge tools.

It also extends the literature of digital nudge tools overall, as it comprises relations between already well-studied constructs in this area. Doing so allows opportunities for the exploration of how these tools operate in an online setting, an area that is still understudied, especially in Portugal. By integrating nudge tools in TNC apps, this study opens new opportunities to understand how nudge tools can be applied in digital e-commerce environments, especially in a specific area such as mobile applications.

### 5.2. MANAGERIAL IMPLICATIONS

From a managerial perspective, the findings of this study have practical implications for the TNC apps and the way these could be designed and presented. In a shopping environment, individuals are faced with many decisions and options to choose from. Weinman et al. (2016) proposes that digital nudging and design-oriented information systems will significantly influence each other in the future. Information systems designers must recognize that interfaces will always guide people in certain directions. They must understand the behavioral effects that influence this so that nudging is done intentionally (Weinman et al., 2016).

Furthermore, managers should prioritize and recognize the importance of nudges and how to encourage consumers to make more sustainable choices. Digital nudges open a wide range of experimental strategies by combining, including or excluding certain nudges, given the context and necessity for each. This focus on driving consumers towards pro-environmental behaviors, can also help companies to align with necessary corporate environmental goals.

The changes to the default policy nudge tool, compared to the control condition, produced a statistical significance, thus this could be explored by managers, implementing this tool on a digital level, where it could be more effective than the other tools presented in this study.

However, managers should take into consideration the ethical repercussions of nudging. Bovens in Grüne-Yanoff (2019), raises this important matter. Companies should be held accountable and take responsibility for the application of nudges, as consumer trust can be broken if organizations are not transparent about the manipulation of consumer's choices.

### **5.3. LIMITATIONS OF THE STUDY AND FUTURE RESEARCH**

Despite its contributions, this study is not without limitations. First and foremost, the inability to prove almost all the hypothesis proposed is a limitation. However, this can be seen as an opportunity for future research. Future works could explore alternative approaches in terms of methodology, such qualitative methods, which could offer deeper insights into understanding of the topic. Additionally, further research could explore the effectiveness of combining nudges and understanding whether it could amplify pro-environmental choices. Another valuable direction could involve comparison of nudges, not only relating to control nudge, but also evaluating the effect of the interaction between nudge tools.

The sample size of this study may limit the results as it was confined to only Portuguese respondents and people within a specific social circle. The narrowing of a demographic is not ideal, and future research could use a more diverse robust sample. It is also important to note that respondents focused their choices mostly on the "standard" and "electric" options, with the other options receiving lower frequencies. This can be a limitation and impact the robustness of the results.

There is also the fact that TVDE services are relatively new to the Portuguese scheme. Even though individuals who answered the questionnaire were previous consumers of TNC apps, this doesn't allow us to know that they are frequent users and know how to navigate these platforms properly. This uncertainty may impact on the findings regarding the first three hypothesis. Future research could build on this by expanding the study to other countries where the use of these services is more common.

In addition, another important topic to mention is the possible ambiguity in the terminologies used. "Pro-environmental", "sustainable", "eco-friendly", and similar terms can have different meanings for different respondents, their impact could vary depending on how these words

are framed. This is a complex instance resulting in shifts in the perception of the consumers. Carlson, Grove, & Kangun, (1993) and Cummins, Reilly, Carlson, Grove, & Dorsch, (2014) state that consumers often consider environmental claims to be unclear, ambiguous and vague, this may reduce the effectiveness of nudge tools.

This study could also be limited by its online approach, suggesting that further research could compare the effectiveness of nudges in both online and offline environments. As indicated by Berger et al. (2022), while it is simpler to gather individual preferences in online behavior, this behavior studied in an offline environment can produce different results. Future research should analyze the impact of contexts such as online vs. offline environment and identify additional factors that may moderate or mediate the effectiveness of nudges in the context of pro-environmental actions.

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## APPENDIX A

“This is to certify that

Project No.: **DDMKT2024-11-156029**

Project Title: **Nudges in Environmental Consumer Behavior**

Principal Researcher: **Catarina Ferreira**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 11/15/2024.

It is the Principal Researcher’s responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via an amendment or progress report, of

- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 11/15/2024

NOVA IMS Ethics Committee

[ethicscommittee@novaims.unl.pt](mailto:ethicscommittee@novaims.unl.pt)”

APPENDIX B

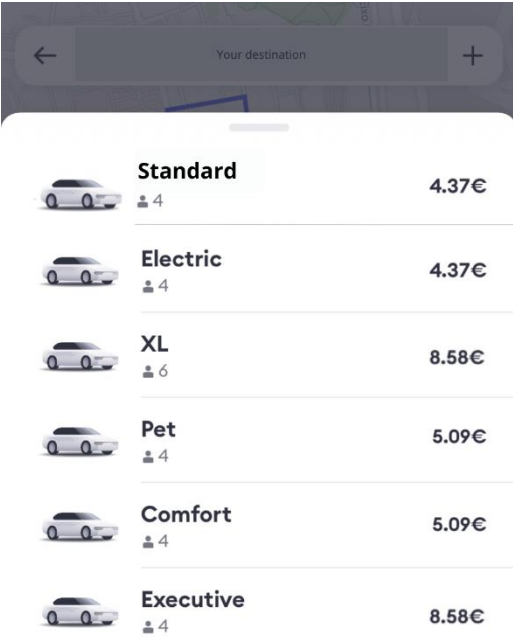


Figure 2-Control

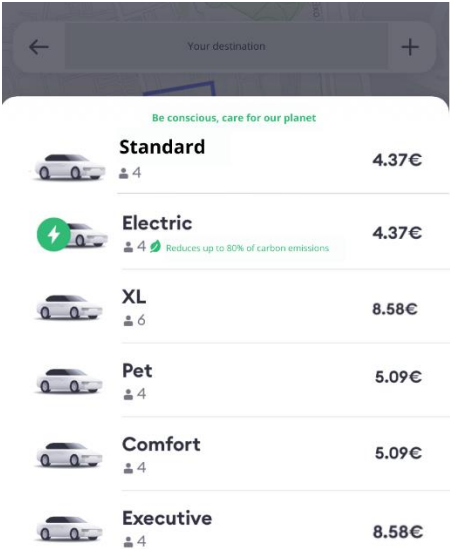


Figure 3-Simplification and framing of information

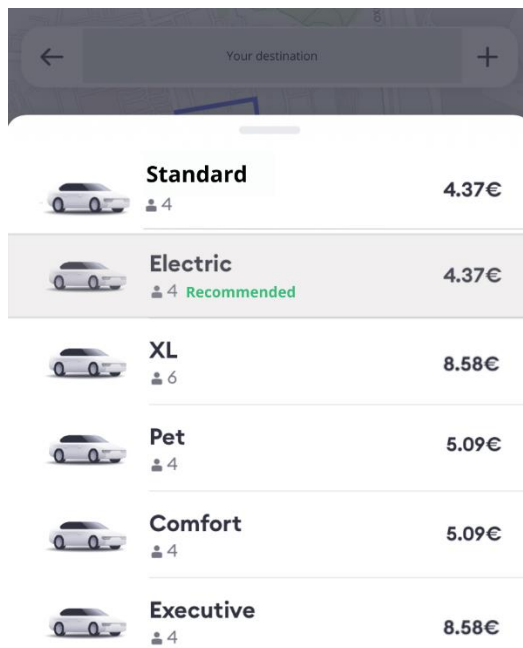


Figure 4-Default

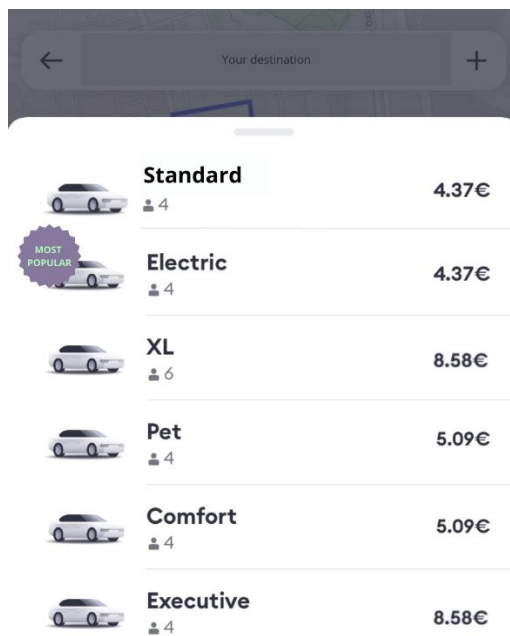


Figure 5-Social Norms

## APPENDIX C

Table 8-Sociodemographic Characteristics

|                                  | <i>n</i> | %    |
|----------------------------------|----------|------|
| <b>Gender</b>                    |          |      |
| Female                           | 230      | 60.5 |
| Male                             | 148      | 38.9 |
| Non-Binary                       | 1        | 0.3  |
| Prefer to self-describe          | 1        | 0.3  |
| <b>Employment status</b>         |          |      |
| Student                          | 88       | 23.2 |
| Working Student                  | 52       | 13.7 |
| Employed                         | 217      | 57.1 |
| Unemployed                       | 8        | 2.1  |
| Retired                          | 15       | 3.9  |
| <b>Highest educational level</b> |          |      |
| Primary education                | 3        | 0.8  |
| Secondary education              | 76       | 20   |
| Bachelor's                       | 185      | 48.7 |
| Postgraduate                     | 53       | 13.9 |
| Master's                         | 59       | 15.5 |
| Doctorate                        | 4        | 1.1  |
| <b>Income</b>                    |          |      |
| Until €820                       | 36       | 9.5  |
| From €821 until €1123            | 82       | 21.6 |
| From €1124 until €2664           | 124      | 32.6 |
| From €2665 until €5470           | 44       | 11.6 |
| From €5471 until €20067          | 8        | 2.1  |
| More than €20067                 | 6        | 1.6  |

I don't have a source of income

80

21.1

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Table 9-Age

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|     | Mean  | Std. Deviation |
|-----|-------|----------------|
| Age | 33.46 | 13.916         |

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Table 10-Cronbach's Alpha

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| Variable | Cronbach's Alpha |
|----------|------------------|
| ERPI     | 0,867            |
| NI       | 0,918            |
| EC       | 0,725            |
| ATE      | ,072             |

---

Table 11 - Chi-square control condition vs simplification and framing of information

|                              | Value              | df | Asymp. Sig. (2-sided) |
|------------------------------|--------------------|----|-----------------------|
| Pearson Chi-Square           | 7.699 <sup>a</sup> | 5  | .174                  |
| Likelihood Ratio             | 8.878              | 5  | .114                  |
| Linear-by-Linear Association | .348               | 1  | .555                  |
| N of Valid Cases             | 188                |    |                       |

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is 1.45.

Table 12 - Control vs changes to the default policy

|                              | Value               | df | Asymp. Sig. (2-sided) |
|------------------------------|---------------------|----|-----------------------|
| Pearson Chi-Square           | 20.308 <sup>a</sup> | 5  | .001                  |
| Likelihood Ratio             | 22.030              | 5  | <.001                 |
| Linear-by-Linear Association | .008                | 1  | .928                  |
| N of Valid Cases             | 195                 |    |                       |

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .93.

Table 13 - Control vs use of social norms

|                    | Value               | df | Asymp. Sig. (2-sided) |
|--------------------|---------------------|----|-----------------------|
| Pearson Chi-Square | 10.327 <sup>a</sup> | 5  | .066                  |
| Likelihood Ratio   | 11.950              | 5  | .035                  |

|                              |      |   |      |
|------------------------------|------|---|------|
| Linear-by-Linear Association | .006 | 1 | .940 |
| N of Valid Cases             | 179  |   |      |

---

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .98.

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