HOW CAN THE CONCEPT OF NUDGING BE USED TO PROMOTE SUSTAINABLE CONSUMER BEHAVIOR?

The influence of using dynamic social norms on consumers' travel behavior and the moderating role of environmental consciousness

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Dissertation written under the supervision of
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Dissertation submitted in partial fulfilment of requirements for the
MSc in International Management, at Universidade Católica Portuguesa and
for the MBA at Escola Brasileira de Administração Pública e de Empresas,
at Fundação Getúlio Vargas, 01/06/2022.

Abstract [English]

Title: How can the concept of nudging be used to promote sustainable consumer behavior?

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Due to the increasing threats arising from environmental issues, the need for sustainable development is getting more and more important. To encourage sustainable consumer behavior, the concept of nudging has increasingly caught the attention of the scientific community. In contrast to traditional consumer marketing, nudging aims for behavioral changes without providing any financial incentives. Among other aspects, social influence have been found to have a powerful impact on consumers' behavior.

This study examined the impact of a nudge intervention using social dynamic norms on the consumers' choice for a more sustainable travel option. It further investigated the moderating role of environmental consciousness on this relationship. For this purpose, the author developed a survey experiment featuring a hypothetical case study in which the participants faced a trade-off between a sustainable and an unsustainable travel mode (train vs. plane). The final sample counted 133 participants.

The results of the study suggest a positive relationship between the nudge intervention and the participants preference for the more sustainable travel mode. Although environmental consciousness had a significant positive effect on the consumers' preference for the sustainable travel mode, it did not moderate the relationship between the nudge intervention and the choice of travel mode. The findings of this study support previous observations that consumers are subject to social influence. Moreover, the results support the idea that nudge interventions could be an effective tool in lowering the perceived barriers in hindering sustainable consumer behavior.

Keywords: Nudging, Choice Architecture, Sustainable Consumer Behavior, Dynamic Social Norms, Social Influence, Environmental Consciousness

Abstrato [Português]

Título: Como o nugding pode ser usado para promover o comportamento sustentável do consumidor?

Subtítulo: Subtítulo: A influência do uso de normas sociais dinâmicas no comportamento de viagem dos consumidores e o papel moderador da consciência ambiental

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Devido às crescentes ameaças que surgem decorrentes de questões ambientais, a necessidade de um desenvolvimento sustentável é cada vez mais importante. Para incentivar o comportamento sustentável do consumidor, o conceito de nudging tem chamado cada vez mais a atenção da comunidade científica. Ao contrário do marketing de consumo tradicional, o nudging visa mudanças comportamentais sem fornecer incentivos financeiros. Entre outros aspectos, a influência social têm um impacto poderoso no comportamento dos consumidores.

Este estudo examinou o impacto de uma intervenção nudge usando normas sociais dinâmicas na escolha dos consumidores por uma opção de viagem mais sustentável. Investigou ainda o papel moderador da consciência ambiental nesta relação. Para tanto, o autor desenvolveu um experimento de pesquisa com um estudo de caso hipotético em que os participantes enfrentaram um trade-off entre um modo de viagem sustentável e um não sustentável (trem versus avião). A amostra final contou 133 participantes.

Os resultados do estudo sugerem uma relação positiva entre a intervenção nudge e a preferência dos participantes pelo modo de viagem mais sustentável. Embora a consciência ambiental tenha um efeito positivo significativo na preferência dos consumidores pelo modo de viagem sustentável, ela não moderou a relação entre a intervenção nudge e a escolha do modo de viagem. Os resultados deste estudo corroboram observações anteriores de que os consumidores estão sujeitos à influência social. Além disso, os resultados apoiam que as intervenções nudge podem ser uma ferramenta eficaz para reduzir as barreiras percebidas que impedem o comportamento sustentável do consumidor.

Palavras-chave: Nudging, Arquitetura de Escolha, Comportamento Sustentável do Consumidor, Normas Sociais Dinâmicas, Influência Social, Consciência Ambiental

List of Content

List of Tables

List of Figures

List of Abbreviation

CSR	Corporate Social Responsibility
EU	European Union
ESG	Environmental and Social Governance
GHG	Greenhouse Gas
LCC	Low-Cost Carrier
HSR	High Speed Railway
IPCC	Intergovernmental Panel on Climate Change
SCB	Sustainable Consumer Behavior
SDG	Sustainable Development Goal
TPB	Theory of Planned Behavior
UN	United Nation
UNFCCC	United Nation Framework Convention on Climate Change

1 Introduction

"We are the first generation to feel the impact of climate change and the last generation that can do something about it." (Obama at the U.N. Climate Change Summit 2014)

Despite the fact that scientists have been warning about the damaging impact of global warming for a long time (Broecker, 1975; Jones & Wigley, 1990) it seems that it took governments much longer to take action. Only in 1992, at the UN Conference on Environment and Development in Rio de Janeiro, the UN Framework Convention on Climate Change (UNFCCC) was initiated (Janßen & Langen, 2017). Whereas the limits to greenhouse gas (GHG) emissions under the UNFCCC treaty were not legally binding, they served as a benchmark to further negotiations. With the Kyoto Protocol (UNFCCC, 1997) the scope of environmental measures to stop global warming were further specified and became subject to a legally binding international treaty. In 2015, with the negotiation of the Paris Agreement governments reached the latest milestone (IPCC, 2015). Today, 192 countries and the European Union (EU) are participating in joint efforts to reduce their impact on climate change. According to the report of the IPCC (2015), we live in critical times close to reaching a tipping point from which the damaging effects of global warming cannot be reversed. To avoid a global ecological catastrophe, the Paris Agreement demands to keep the temperature increase blow 2°C, preferably 1,5°C until the year 2050.

Moreover, as the damaging impact of climate change is getting increasingly salient for the society at large (Frederiks, Stenner, & Hobman, 2015), growing social and pro-environmental movements like Friday for Future arise (Wallis & Loy, 2021). With an observed as well as predicted increase both in frequency and severity of natural disasters (e.g., wildfires, hurricanes or floodings) climate change represents not only an environmental issue but much more a societal issue (Benevolenza & DeRigne, 2019). The main strategy to prevent the irreversible change on a global scale is to drastically reduce greenhouse gas emissions caused by human behavior, which were found to be the main driver of global warming (Ripple et al., 2017). Against this background, research has identified three major sources of greenhouse gas emissions: energy consumption related to housing and living, food consumption (especially the consumption of meat and animal products), as well as transportation (Lehner, Mont, & Heiskanen, 2016; Klöckner, 2013). Therefore, studying consumer behavior could play a fundamental role in reducing greenhouse gas emissions.

One of the key questions in this context is the following: *How can we encourage sustainable consumer behavior at a global scale to avoid a natural disaster?* Scholars note that sustainable consumption comes with a potential trade-off between personal vs. collective benefits (Peattie, 2001). Furthermore, the so-called attitude-behavior gap is a commonly observed problem (Trudel, 2019; Taufique, Vocino, & Polonsky, 2017). It describes the phenomenon that individuals report pro-environmental attitudes but engage in behavior against their attitudes (Lee et al., 2020). The reason for such inconsistent consumer behavior could originate from multiple sources. Besides market barriers (e.g. availability or affordability) (Fifita, Seo, Ko, Conroy, & Hong, 2020) there could be individual (e.g. present bias and habit formation) (Trudel, 2019; Sparkman & Walton, 2017) as well as social obstacles (e.g. social norms or identity) (Dwyer, Maki, & Rothman, 2015; Abrahamse & Steg, 2013) that prevent consumers to engage in sustainable behaviors.

In the question of overcoming those barriers, the leverage of choice architecture and nudging has been increasingly catching the attention of scholars (Thaler & Sunstein, 2021; Gonçalves, Coelho, Martinez, & Monteiro, 2021; Schubert, 2017). The basic idea is to use insights of psychological and behavioral research to influence the behavioral decision-making process of consumers (Fischer et al., 2021). While past and current research is mostly focusing on energy and food related topics, transportation has been widely neglected (Lehner et al., 2016). However, with a direct impact GHG emissions, neither private nor industrial transportation should be underestimated. According to data provided by the European Environmental Agency (2019), transportation accounts more for a quarter (25.8%) of all GHG emissions in the EU. This includes emissions from fuel combustion of domestic and international aviation, road transport, railways and domestic navigation. To gain a deeper understanding on this topic, this dissertation project aims to close this research gap by focusing on choice architecture and its impact on sustainable consumer behavior.

Research Objective. The general objective of this dissertation project is to provide a deeper understanding on the concept of sustainable nudging. Firstly, I want to outline how it distinguishes from traditional marketing approaches, and how can it be used to promote a more sustainable consumer behavior (SCB)? More specifically, I want to find out how the use of dynamic social norms can be leveraged to promote more sustainable travel habits in consumers. Secondly, I want to demonstrate how an individual's environmental consciousness moderates this relationship. In the next chapter, I introduce the theoretical framework of my research.

2 Literature Review

To better understand the background of this dissertation project, this section provides an overview of the different concepts that were used to build the theoretical framework. At first, I introduce the concept of sustainability and how it distinguishes from the idea of sustainable development. Next, I outline the importance of sustainable consumption and how consumers' behavior is influenced by several factors. In this sense, I demonstrate which role environmental consciousness as well as (dynamic) social norms play. Lastly, I provide some background information on the travel behavior on European citizens. Connecting the different concepts underscores the importance of the research question once again.

2.1 Sustainability

Throughout the literature, researchers widely agree that sustainability is a multidimensional concept including environmental, social and economic aspects (Lee et al., 2020; Hosta & Zabkar, 2021; Goodland, 1995). However, some critics point out that research often fails to explicitly distinct between the single dimensions, and thus neglects the holistic concept of sustainability (Catlin, Luchs, & Phipps, 2017). While economic sustainability refers to the allocation and efficient use of natural, resources, environmental sustainability primarily considers the maintenance of environmental life-support systems which include atmosphere, water and soil (Goodland, 1995). In a similar way, Lee et al. (2020) define sustainability as "*the ability of biological systems to remain diverse and productive"* (p. 642). On the other hand, social sustainability refers to equity regarding the living standards within the society and thus is strongly influenced by economic and environmental circumstances (Moldan, Janoušková, & Hák, 2012). Amongst other things, these include gender equality, poverty as well as access to health care and education (Roy, 2021; Spaiser, Ranganathan, Swain, & Sumpter, 2017). This said, scientific research has been mainly focusing on environmental sustainability.

In an alternative approach to define sustainability, Reisch and Thøgersen (2015) mention Neumeyer's (2003) concept of the strong and the weak sustainability. While the strong sustainability approach primarily focuses on the conservation of nature and ecological system in its *"most pristine state possible, and, at extreme cases, even neglecting human societies"* (Ruggerio, 2021, p. 7), the weak sustainability approach focuses on sustaining economic systems using nature as a supply for natural resources and as an ecosystem service processing the residues of human activity (Ruggerio, 2021). Thus, when talking about sustainability within a consumption context, we usually refer to the weak sustainability approach.

When adding the factors economic growth and change processes, the concept of sustainability transforms into the idea of sustainable development (Roy, 2021; Olawumi & Chan, 2018). Although the terms sustainability and sustainable development are widely used as synonyms in the literature (Olawumi & Chan, 2018), some scholars point out that both concepts are contradicting by definition (Spaiser et al., 2017). One of the main arguments is that economic growth cannot be achieved on a planet with limited resources (Wang, Ghadimi, Lim, & Tseng, 2019). However, other scholars note that sustainability with a growing population can only be achieved through economic growth (Ruggerio, 2021) and technological development (Lorek & Spangenberg, 2014). This discrepancy calls for a more exact definition of sustainable development.

2.1.1 Sustainable Development

In the Brundtland Report 'Our Common Future', the World Commission on Environment and Development defined sustainable development as growth which *"meets the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland, 1987, p. 16). Additionally, the report notes that such growth would imply limits that are *"imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities"* (Brundtland, 1987, p. 16). Although the definition of sustainable development has been developing over time, changes always have been tied to its core idea accounting for economic, environmental, and social equity (Moldan et al., 2012). According to Roy (2021) the goal of sustainable development is to ensure a basic level of life-quality for everyone by increasing income, improving health, and enhancing education. To make this development process more tangible, the United Nations defined seventeen sustainable development goals (SDGs) including 169 specific targets (United Nations, 2015). The achievement of each of these goals would represent an important milestone towards a sustainable global future.

Goal 12 is especially important for this study since it focuses on sustainable consumption and production. From an economic perspective, scholars argue that due to the growing pro-environmental movement, engaging in future oriented sustainability efforts can have a positive financial impact for the companies themselves (White, Habib, & Hardisty, 2019). Moreover, decision not to act could even lead to fatal consequences for the world's economy (Dikau & Volz, 2021). However, empirical evidence reveals that our consumption patterns were highly unsustainable over the past decades, depleting natural resources and the environment (United

Nations, 2021). Therefore, the development of our global standards over the past four decades, was an improvement, but not sustainable (Fischer et al., 2021; Lorek & Spangenberg, 2014).

And yet, on a global scale, we still face the challenge of a growing population and the fact that the majority of low and middle-income countries still claim their right to develop (Wang & Zhang, 2020). Against this background the question arises whether sustainable growth on a planet with limited space and resources is possible. To overcome this challenge, the OECD introduced the concept of economic decoupling (Moldan et al., 2012). The basic idea of economic decoupling is to achieve economic growth by reducing the use of natural resources (Hickel & Kallis, 2020). In the context of climate change, research is using GHG emissions (mainly CO_2) and GDP to measure sustainable economic growth (Ottelin, Heinonen, & Junnila, 2018). Similar to the sustainability concept, there are two types of economic decoupling – absolute and relative decoupling (Moldan et al., 2012). Absolute decoupling is characterized by a decrease in use of natural resources while creating economic growth. Relative decoupling in contrast only requires a lower rate of increase in the use of natural resources than the economic growth rate (Ottelin et al., 2018). Indeed, research suggests that some countries already achieved absolute decoupling on a national level (Wang & Wang, 2019), and relative decoupling seems to be possible on a global scale (Hickel, 2019). Nevertheless, predictive models indicate that under current conditions, even with a growth rate of 0%, we will most likely fail to reach the goal of the Paris Agreement keeping global warming under 2°C until 2050 (Hickel & Kallis, 2020). The only chance to still reach that goal would require the development of highly effective technology to reduce and mitigate GHG emissions (Nordhaus, 2019) as well as an immediate change of policies (Dikau & Volz, 2021). Furthermore, it would require a fundamental shift towards more sustainable consumer behavior (Hickel & Kallis, 2020).

2.1.2 Sustainable Consumption and Consumer Behavior

Based on the Brundtland definition of sustainable development, the term sustainable consumption was defined by the Oslo Symposium (1994) as *"the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations."* (Roy, 2021, p. 56). This stands in contrast to traditional marking approaches which have been encouraging highly unsustainable consumer behavior for a long time (Thomas, 2018).

Consequently, sustainable consumer behavior (SCB) aims to mitigate the impact consumers have on the environment without compromising life-quality. However, to make informed decisions, consumers must be aware of long-term consequences (Hosta & Zabkar, 2021). Furthermore, decisions are driven by the intention to limit environmental impact (Trudel, 2019) and benefit the society (White et al., 2019).

According to behavioral research, any type of behavior is influenced by multiple factors such as psychological processes, social norms, or external circumstances (Klöckner, 2013). Furthermore, socio-demographic characteristics potentially play a role in consumers' behavior (Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003). To explain SCB, the theory of planned behavior (TPB) (Ajzen, 1991) is still the most common approach to capture behavioral patterns (Hosta & Zabkar, 2021; Han & Stoel, 2017; Paul, Modi, & Patel, 2016). In its basic structure, the TPB model describes that the interaction between attitude towards a behavior, subjective norms and perceived behavioral control lead to a behavioral intention which was found to be the closest predictor for actual behavior (Ajzen, 1991). Based on the results of a literature review on sustainable behavior, White and colleagues developed the SHIFT framework (White et al., 2019). The framework states that SCB is influenced by the following five aspects: social influence, habits, individual self, feeling and cognition and tangibility. Thus, each aspect is further explained in detail.

Social Influence. From the field of sociological research, observations revealed that individuals are part of a social construct (Korte & Schäfers, 2006). According to Abrahamse and Steg (2013) the social influence describes to which extend *"our behavior is affected by what other people do, or by what other people think"* (p. 1773). Thus, both social norms and consumers' social identity are strongly linked to the engagement in SCB (White et al., 2019). Ajzen (1991) explains that subjective norms yield not only *"perceived social pressure but also personal feelings of moral obligation or responsibility to perform, or refuse to perform, a certain behavior"* (p. 199). Hence, the sustainable action of consumers is highly dependent on what in-group members are doing (Han & Stoel, 2017; Welsch & Kühling, 2009; Goldstein, Cialdini, & Griskevicius, 2008). Thus, to conform with the expectations of a certain group, the effect of 'social desirability' can often be observed in the context of SCB. It refers to the phenomenon that consumers tend to adopt prosocial behaviors in public settings (Green & Peloza, 2014). In contrast, consumers who do not want to be associated with out-group behavior will most likely not engage in such behavior (White, Simpson, & Argo, 2014).

Interestingly, research suggest that when members of one group see their group gets outperformed by an out-group, they tend to increase their (pro-environmental) behavior (White et al., 2014).

Habits. Furthermore, SCB is also influenced by an individual's past behavior and habits (Verplanken & Roy, 2016). Habits are trained and reoccurring automatic behavioral patterns triggered by contextual cues that function as mental shortcuts in a decision-making context (Kurz, Gardner, Verplanken, & Abraham, 2015). Behavioral science suggests that most humans are reluctant to change and tend to stick to prominent structures (status-quo bias) (Frederiks et al., 2015; Pichert & Katsikopoulos, 2008). Thus, once unsustainable habits are established, it can be challenging to change them, even if consumers want to adopt a more sustainable lifestyle (Walker, Thomas, & Verplanken, 2015). Against this background, Walker et al. (2015) mention that the discontinuity of habits can support behavioral change. Fundamental contextual changes leave a short temporal window to encourage new (sustainable) habit formation. However, perceived obstacles and barriers, both physical and psychological, can prevent consumers from taking the first step. Therefore, White and colleagues (2019) suggest making SCB as easy and intuitive as possible. The use of prompts[1] (Lehman & Geller, 2004) and (financial) incentives (Maki, Burns, Ha, & Rothman, 2016) are further approaches to motivate SCB.

Individual Self. The individual self describes a psychological construct that individuals use to assess themselves. Based on their personal moral code and values as well as social norms, they develop a self-concept which serves as benchmark for their appearance (van der Werff, Steg, & Keizer, 2014). According to Legere and Kang (2020), the self-concept refers to "*the perceptions consumers have of themselves as well as to the extent in which a [behavior] expresses imperative aspects of a consumer's self-image, identities, and values"* (p. 3). Overall, this self-identity tends to be on the positive side. To maintain consistency, consumers' behavior is usually aligned with that self-image (van der Werff et al., 2014). Another part of consumers' individual self is their self-interest. Accordingly, consumers will only engage in sustainable behaviors if they also get a benefit out of it (White et al., 2019).

Unfortunately, in many cases sustainable options come with a perceived liability with respect to convenience, functional performance, affordability, or durability (White et al., 2019). Hence, negative associations with sustainable options come with a low interest for SCB (Schwartz, Bruine de Bruin, Fischhoff, & Lave, 2015).

[1] Prompts are contextual cues provided as a reminder to perform a desired behavior

To tackle this issue, Edinger-Schons, Sipilä, Sen, Mende, & Wieseke (2018) suggest encouraging SCB by appealing to both environmental aspects (e.g., saving energy or water) and self-interest factors (e.g., monetary savings or personal health). Furthermore, perceived self-efficacy was found to be an important factor in consumers' propensity to adopt sustainable behavior (White, Macdonnell, & Dahl, 2011). The notion that one's sustainable action will make a difference is closely related to 'perceived control' (White et al., 2011) which is an integral part of the TPB forming behavioral intentions (Ajzen, 1991). Thus, the engagement in SCB increases when perceived obstacles are low (Peattie, 2001) and perceived impact is high (White et al., 2011). Finally, individual differences such as personality traits, personal norms or the environmental consciousness of consumers play a role in SCB (Prothero et al., 2011).

Feelings and Cognition. Moreover, research found that the engagement or disengagement in SCB can evoke either positive or negative emotions (White et al., 2019). Negative emotions in consumers occur when they feel a violation of their perceived moral obligation or responsibility towards the environment or social concepts due to their actions (Theotokis & Manganari, 2015). For example, Rees, Klug, & Bamberg (2015) found that guilt is positively related to pro-environmental behavior. In contrast, engaging in SCB (e.g., recycling efforts) can potentially decrease negative and increase positive emotions (Sun & Trudel, 2017). Positive emotions such as joy, pride or happiness, trigger hedonic feelings (Roy, 2021). However, when positive emotions are associated with unsustainable and negative emotions with sustainable behavior, it becomes challenging to encourage consumers to act sustainable (Amatulli, Angelis, Pino, & Guido, 2020). This is especially the case when consumers use certain products and services (e.g., luxury goods) to express themselves (Amatulli et al., 2020).

In addition, information and knowledge about SCB is crucial to assess the sustainable impact of a particular behavior (Taufique et al., 2017). The basic idea is to inform consumers on the sustainable performance of a product to support their decision (Torma & Thøgersen, 2021; Janßen & Langen, 2017). Therefore, the clarity and ease of information, as well as its source should be transparent. Furthermore, a study examining recycling behavior in the US revealed that depending on the target group (conservatives vs. liberals), differences in wording of a message (e.g., duty vs. fairness) can be key to achieve the same objective (Kidwell, Farmer, & Hardesty, 2013). In this sense, the framing of SCB can deliberately be used to address and reinforce social identities.

Tangibility. *T*angibility describes how close an individual perceives a certain situation. The closer the situation is perceived, the higher is the potential level of involvement (Spence, Poortinga, & Pidgeon, 2012). A serious problem with (un-)sustainable consumer behavior is that its negative effects do not show immediately, and the positive effects can only be observed in the future (Passafaro, 2020).

Because of this psychological distance there seems to be no tangible reward for the consumer behaving in one or the other way (Reczek, Trudel, & White, 2018). Catlin et al. (2017) note that consumers perceive social and environmental issues differently. While the social dimension of sustainability is mostly associated with short-term and local impacts, the environmental dimension is stronger associated with global levels and long-term effects (Hosta & Zabkar, 2021). Besides that, decisions are often affected by the present bias to maintain the status quo, disregarding potential future benefits (Trudel, 2019). By putting a temporal focus on environmental benefits (Reczek et al., 2018) and using vivid imagery (Marx et al., 2007) to create a concrete picture in consumers' mind, environmental issues could become much more tangible. Another way to address consumers and make them care about sustainable issues is to build a connection to local communities and point out personal relations or experiences to specific issues (White et al., 2019).

To completely integrate the concept of sustainability today's society, it is essential to first establish sustainable development on a global scale. To achieve this, consumers must be educated and empowered to engage in SCB. As just demonstrated at the SHIFT framework, SCB is influenced by multiple factors which can encourage or hinder consumers motivation to act sustainable. However, the two most important aspects are the customers' social environment and their individual self-concept, which hold the intrinsic drive to behave in a sustainable manner. In this sense, the paper introduces the role of environmental consciousness on SCB.

2.1.3 Environmental Consciousness

Environmental consciousness is defined as *'the degree to which a person is oriented toward concern for the environment'* (Garvey & Bolton, 2017). A recent meta-analysis regarding the shift of environmental concern suggests that demographic factors, such as gender, age and education play a central role for an individual's level of environmental consciousness (Lou, Li, Xia, & Zhu, 2022).

Although the relationship between societal affluence and environmental concern remains unclear (Lou et al., 2022), observations by Benedetta & Vincenzo (2020) indicate that the importance level of environmental concern of European citizens seems to be robust even in times of economical and societal crises. Furthermore, research indicates that environmental consciousness has an influence on one's sustainable behavior (Dunlap, van Liere, Mertig, & Jones Robert E., 2000; Han & Stoel, 2017). For example, a study by Hartmann & Apaolaza-Ibáñez (2012) found an influence of environmental consciousness on the purchase intention of green energy.

Other studies suggest a moderating role of environmental consciousness on the consumed amount for regular vs. green products (ironically, consumers high in environmental consciousness tended to overuse the green product) (Lin & Chang, 2012) or on the motivation to an intended revisit for ecotourism vacation destinations (Huang & Liu, 2017). Environmental consciousness is commonly measured with the new environment paradigm (NEP) scale developed by (Dunlap & van Liere, 1978). A revised version of the NEP scale features 15 statements of which eight items have a pro-environmental and seven anti-environmental tendency (Dunlap et al., 2000). Hawcroft and Milfont (2010) identified 69 studies using the original or revised scale to *"measure individuals' attitude towards environmental issues"* (Dunlap & van Liere, 1978, p. 12). The expression of such concern highly depends on an individual's personal environment. Therefore, the importance of social norms will be discussed in the next section.

2.2 Social Norms

Generally, a norm is defined as an objective standard that is used as a reference for subsequent repetitions. The term "social norm" originates from the field of sociology and defines specific rules of behavior according to which an individual should act within a group (Korte & Schäfers, 2006). Accordingly, social norms serve, among other things, as the basis for our legislation and thus establish a legally binding framework to which we as society orient ourselves (Korte & Schäfers, 2006). If individuals violate these rules of conduct, they must expect sanctions or punishment, socially or legally (White et al., 2019; Abrahamse & Steg, 2013). This expresses the fact that such behavior is not tolerated by the rest of the group. From the fields of social psychology and behavioral science it is known that individual behavior is often influenced by certain norms (normative behavior) (Abrahamse & Steg, 2013).

In social psychology, the subjective perception of behavior and ultimately its execution by an individual is significantly influenced by descriptive and injunctive norms . As a result of these norms, the normative rules of behavior thus only play a subordinate role (Korte & Schäfers, 2006).

2.2.1 Descriptive and Injunctive Social Norms

Descriptive norms describe the perceived behavior that most people in a group perform in a particular situation (Richter, Thøgersen, & Klöckner, 2018). For example, this can help individuals to orient themselves in an environment in which the normative rules of behavior are not known (Korte & Schäfers, 2006). On the other hand, descriptive norms can also influence or change people's attitudes toward a particular behavior (Münscher, Vetter, & Scheuerle, 2016). In contrast, injunctive norms describe what a person thinks is "right" or "wrong" behavior that would be accepted or rejected by a personal reference group (family, friends, society, etc.) (Abrahamse & Steg, 2013). If the observed behavior is consistent with one's own values and interests, it is likely that the person will follow the behavior of a group (in-group). On the other hand, individuals may also distance themselves from a group's behavior, that share different values and interests (White et al., 2019). Which norms customers take as a reference for their behavior ultimately depends on their individual situation and with which group they identify (Trudel, 2019). The current status of a normative behavior is also called static norm (Sparkman & Walton, 2017).

2.2.2 Dynamic Social Norms

In contrast to a static norm, a dynamic norm refers to a norm that is increasingly changing over time (Sparkman & Walton, 2017). In other words, it describes behavior, which is still counternormative, but gets adopted by a growing number of individuals. For example, in the context of sustainable consumption, more and more individuals start to adopt a more sustainable lifestyle (e.g., reducing meat consumption). Yet, this group still represents a minority (Thürmer, Stadler, & McCrea, 2022). Therefore, focusing on the growing number of participants instead of the relative number of an entire population, dynamic norms could be used to endorse counternormative behavior (Loschelder, Siepelmeyer, Fischer, & Rubel, 2019). Against this background they found a positive relation between the use of dynamic norms on the use of disposable coffee cups (Loschelder et al., 2019). Further research conducted by Sparkman and Walton (2017) indicates that the use of dynamic norms could motivate consumers to reduce their meat and water consumption.

Next, the paper introduces the concepts of choice architecture and nudging, which have been increasingly caught the intention of the researchers attempting to promote SCB (Thaler, 2021).

2.3 Choice Architecture

As explained by Thaler, Sunstein, and Balz (2012), choice architecture is defined as the design of the environment within a decision-making context. Whether individuals are aware of it or not, whenever they make a choice, their decision-making process is influenced by internal and external cues (Thaler & Sunstein, 2021). Thus, initiatives involving choice architecture can support the achievement of environmental goals without compromising economic ones (Sunstein, 2015). Traditionally, choice architecture was limited to the physical environment. However, with the rise of the internet, choice architecture became increasingly important for the digital space as well (Kroll & Stieglitz, 2021). For example, by creating the user interface of a website, game, or other applications (digital choice architecture), the developer has a significant impact on the user's decision-making and experience (Weinmann, Schneider, & vom Brocke, 2016). The deliberate placement of cues or the change of an already existing environment in order to favor a specific outcome is called nudging and represents a sub-category of choice architecture (Thaler et al., 2012).

2.4 The Concept of Nudging

The concept of nudging was popularized through the book 'Nudge. Improving Decisions About Health, Wealth and Happiness' by Thaler & Sunstein (2008)[2]. Although the two authors did not invent the concept of nudging, they managed to catch the attention of the scientific community and public policy makers (Szaszi, Palinkas, Palfi, Szollosi, & Aczel, 2018). In their book, they define a nudge as *"any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives"* (Thaler & Sunstein, 2008, p.6). In line with the concept of libertarian paternalism, a nudge *"preserves freedom of choice but [...] steer[s] people in directions that will promote their welfare"* (Thaler & Sunstein, 2003, p. 179). Providing incentives beyond financial advantages as well as the priority of the individual's benefits are probably the most compelling difference. In contrast. traditional marketing tactics, usually aim to persuade consumers with the underlying goal to improve the company's economic performance (Rundle-Thiele et. al, 2019.

[2] As fundamental changes have taken place over the past decade, new insights were gained and more recent policy issues have been raised, Thaler and Sunstein published "Nudge. The Final Edition" in 2021 which is an updated version of their book.

The practical implementation of a such change in the choice architecture is called a 'nudge intervention'. Based on this idea, governments as well as private companies started to create behavioral insights teams also called "nudge-units" with the specific goal to address urgent societal issues (Chapman, Milkman, Rand, Rogers, & Thaler, 2021). The practical use of nudges first started as a tool to design new or better policies (Benartzi et al., 2017).

Against the concept of the '*homo economicus'* who has the capacity to evaluate complete information in order to derive a fully rational decision (Loschelder et al., 2019), behavioral research shows that human decision making is flawed by the lack crucial information and the influence of biases (Gonçalves et al., 2021). This leads to obvious and predictable errors in human decision making (Thaler, 2018). Moreover, as the cognitive capacity of the human brain is limited, we use external cues and heuristics to make quick decisions (Lehner et al., 2016; Machado & Davim, 2020). Thus, even the smallest change in the environment can change behavior, with an even greater effectiveness than economic incentives (Sunstein, 2015). By taking these circumstances into account, experts can correct for these constrains and create a choice architecture that leads to a desirable outcome (Schubert, 2017).

Nevertheless, there are some voices that deem nudging as an unethical practice. One of the main arguments is that a nudge alters the behavior of consumers without them realizing. Therefore, individuals encountering a nudge intervention are not fully conscious about their choice (Lin, Osman, & Ashcroft, 2017).

Critics argue that despite the preservation of free choice, decision makers would lose the autonomy over their choices (Schubert, 2017).Consequently, a nudge is a manipulation of someone's true intentions and behavior. According to Thaler and Sunstein (2021) there is no such thing as a neutral design when it comes to choice architecture. Even the active choice between the available options (without any default) is a tool of choice architecture called 'forced response' or 'required mandate' (Theotokis & Manganari, 2015). And in most cases this would certainly lead to a non-optimal outcome (Thaler & Sunstein, 2021). Furthermore, people are never forced to choose any particular option and therefore are still autonomous in their decision making (Thaler, 2018).

Schubert (2017) notes that the success of nudge interventions is highly dependent on the specific context and loose in effectiveness when individuals feel manipulated. However, there are not enough studies yet to reliably conclude the general effectiveness of nudging (Szaszi et al., 2018; Chapman et al., 2021).

Four different types of nudging are commonly identified: simplification and disclosure of information, changes in the physical environment, changes to the default policy, and the use of social norms (Lehner et al., 2016). In the following part of this research paper, each type and its relevance to sustainable behavior will be explained.

2.4.1 Simplification and disclosure of information

As described earlier, nudges are effective because they correct for biases and support the cognitive decision-making process (Lehner et al., 2016). However, a rational decision can only be made when the decision maker has the necessary knowledge or access to relevant information regarding a specific situation (White et al., 2019). In reality however, consumers often face untransparent and complex situations due to information overload or the omission relevant information (Kroll & Stieglitz, 2021). To make information more understandable, a rule of thumb is to provide information as easy and intuitive as possible (Thaler, 2021). In the context of sustainable consumer behavior, to know if one's choice of a product or service is more sustainable than another, the decision must consider the environmental impact of each choice (e.g., how much CO_2 is emitted during a flight vs. a train ride).

2.4.2 Change of Physical Environment

Another type of nudging is the change of the physical environment. It is based on the idea of making a particular option more visible, accessible and convenient to the consumer (Lehner et al., 2016). Kroll and Stieglitz (2021) point out that the same concept can also be used for digital spaces. Traditional marketing research suggests that items that are placed on eye-level can have a positive impact on sales (Chen, Burke, Hui, & Leykin, 2021). This knowledge can be leveraged to promote environmentally friendly products and services (Bucher et al., 2016; Kroese, Marchiori, & Ridder, 2016). An alternative example is provided by Pucher and Buehler (2008), who found that interest in cycling engagement in urban areas could be increased by providing (free) access to bike stations or well-planned traffic planning (e.g., bike lanes).

2.4.3 Changes to the Default Policy

The third type of nudge intervention is the change of the default. A default describes a provided pre-selection of standards concerning a policy, product or service with possibility to opt-in or opt-out on certain features or options (Theotokis & Manganari, 2015). It is a common practice and represents a suggestion made by the provider based on the expectation what most consumers would choose in the situation to gain the highest benefit (Thaler & Sunstein, 2021).

Against the background of the present bias (Trudel, 2019) indicating that individuals tend to stick with the status-quo, even if there could be lager long-term gains in the future (Frederiks et al., 2015), scholars call for 'green defaults' to encourage SCB (Thaler & Sunstein, 2021; Kaiser, Bernauer, Sunstein, & Reisch, 2020).

2.4.4 Using Social Norms and Feedback

The fourth type of nudging is the use of social norms and feedback. As outlined previously, social norms have a great impact on consumers' behavior (Abrahamse & Steg, 2013). Furthermore, the provision of feedback about one's sustainable performance gives consumers the opportunity to compare their current behavior to their past behavior but also to any given reference group. Seeing progress but also further potential can motivate consumers to engage in SCB (Abrahamse & Steg, 2013).

The effectiveness of social norms in promoting SCB has been subject to several studies (Chapman et al., 2021; Han & Stoel, 2017). For example, Goldstein et al. (2008) used social norms in the context of towel reuse in hotels to reduce water consumption. Moreover, other scholars found a positive relationship between the use of social norms and energy consumption (Allcott, 2011; Dwyer et al., 2015). Furthermore, Gonçalves et al. (2021) reported that social norms can increase the purchase of fruits and vegetable. However, they did not test if those purchases replace unsustainable options or if they were just purchased in addition. Additional support is provided by Sparkman & Walton (2017) suggesting that dynamic social norms potentially reduce consumers interest in and actual meat consumption as well as Loschelder et al. (2019) who observed a reduction of disposable coffee-to-go cups after displaying dynamic social norms in an office kitchen. Despite strong evidence regarding the effectiveness of social norms as nudge interventions (Farrow, Grolleau, & Ibanez, 2017), some research suggests that its effects are insignificant (Hosta & Zabkar, 2021). Furthermore, Melnyk, van Herpen, and van Trijp (2010) note, that the effect of social norms could be weaker when behavior is displayed in a private stetting (opposed to public setting).

Aligned with the research question of my dissertation project, I created a nudge intervention using dynamic social norms within the particular context of travel behavior. Hence, to fully understand the theoretical framework of my hypotheses, some background on consumers' travel behavior and transportation network in Europe is provided in the next section.

2.5 Consumers' Travel Behavior in Europe

Although the demand for travels and transportation decreased due to COVID-19, it is expected that these number catches up with pre-pandemic level by 2024 (European Environmental Agency, 2020). Considering the discontinuity of unsustainable habits, this could be a great opportunity to encourage the formation of new habits and thus promote SCB (Passafaro, 2020). Regarding domestic and international aviation, short-distance flights are especially harmful to the environment because of their unproportionally high GHG emissions occurring from the start and landing process (European Environmental Agency, 2020). Only the use of a private (diesel) car used by a single passenger is more harmful to the environment than air travel. In comparison, the environmental costs of railway travel are only one-third, mainly due to noise pollution and other sustainability factors and not due to the emission of GHGs (European Environmental Agency, 2020).

Hence, encouraging more consumers to take the train instead of the airplane in a travel context could help to lower GHG emissions in the EU (D'Alfonso, Jiang, & Bracaglia, 2015). In fact, the high-speed-railway (HSR) network in Europe is one of the world's most extensive ones, and yet it is threatened by the growing competition coming from the aviation industry and low-cost carrier (LCC) business (Jiang & Li, 2016). By offering flights across the European continent at low fares and a short travel time, LLC airlines such as Ryanair or EasyJet provide great incentives for consumers to engage in unsustainable travel behavior. As the market for LLC seems so attractive, the HSR sector started to come up with their own versions of low-cost offerings (Delaplace & Dobruszkes, 2015). According to the European Environmental Agency (2020), price, travel time, convenience, frequency, and reliability of a connection are important factors influencing the travel choice of customers. However, D'Alfonso et al. (2015) point out that the improvement of those factors could come at the cost of sustainability.

In addition, by increasing the attractiveness of the HSR network, additional demand could be generated. This would come with the undesirable effect of an increased pressure on the environment instead of its relief (D'Alfonso et al., 2015). Thus, encouraging consumers to switch their preferred travel mode to a more sustainable option should be the primary goal of nudge interventions.

Development of hypotheses. As previously outlined in the theoretical framework, individuals are part of a complex social structure. Therefore, their behavior is strongly affected by social influence in order to conform with certain norms, and values. Although SCB is in absolute terms still minor to traditional consumer behavior, environmental responsibility has been gaining acceptance in wide parts of the society (Diamantopoulos et al., 2003). Especially in the past decade, the on-going movement towards sustainable behavior has become a dynamic social norm (Hosta & Zabkar, 2021). Current literature indicates that the use of dynamic social norms could potentially help to motivate SCB (Sparkman & Walton, 2017). By choosing more sustainable transportation options, consumers have a direct positive impact on their environmental footprint. Based on this reasoning, I developed the first hypothesis:

H_1: The use of a dynamic social norm as nudge intervention is positively related to the consumers' intention to engage in sustainable travel behavior

Additionally, literature suggests that environmental consciousness plays an important role in forming pro-environmental behavioral intentions (Dunlap et al., 2000). From another perspective, individuals must display a certain level of concern towards environmental issues to identify with pro-environmental behavior / groups (C. Wang et al., 2019). Thus, the combination of social pressure and a high [low] level of environmental consciousness could strengthen [weaken] the effect of the nudge intervention. Moreover, there are studies already suggesting a moderating role of environmental consciousness on SCB (Huang & Liu, 2017; Garvey & Bolton, 2017; Lin & Chang, 2012). Therefore, my second hypothesis is:

H_2: When environmental consciousness is high (compared to low), the positive relationship between nudge intervention and consumers' intention to engage in sustainable travel behavior is stronger.

A table with the corresponding null hypotheses can be found in appendix 1.

3 Research Methodology

After the research objective of this dissertation project was defined, the hypotheses were developed based on the literature framework. I chose a quantitative research approach as my research methodology. To validate my hypotheses, I developed an online survey experiment to collect the necessary data. The participation link to the survey experiment was mainly distributed via social media within my extended personal network. I chose to distribute the survey online because of its convenience regarding time, costs, and reach. The survey was distributed in two languages: English and German. The participation in this study was fully voluntarily and anonymously.

3.1 Dependent and Independent Variables

To test my hypotheses, I accordingly derived the dependent and independent variable for each of my hypotheses. Thus, for my first hypothesis (H_1), I defined the use of a nudge intervention (displaying the choice options with vs. without a dynamic social norm) as independent variable. As dependent variable, I defined the consumers' level of intention for the (sustainable) travel mode. For my second hypothesis (H_2), I examined the moderating role of environmental consciousness. Thus, the independent variables were defined by using a nudge intervention, the consumers' level of environmental consciousness as well as the interaction of those two variables. The dependent variable for H_2 is defined as the consumers' level of intention for the (sustainable) travel mode. Demographics variables were used as control variables to generate a more comprehensive model. After defining the independent and dependent variables for each hypothesis, I developed a survey experiment which allowed me to collect data and to measure the defined variables.

3.2 Experimental Design

For the experiment, I developed a hypothetical case scenario which would put the participant in a situation he / she had to make a choice between two options to travel (train ride vs. flight) (Szaszi et al., 2018). I simplified the case scenario to the extent that any financial incentive was eliminated (choosing one or the other option, the travel costs were paid by the company). This is, because research found that beside reliability and frequency of a connection, factors like price, convenience and travel time play a crucial role when it comes to choose travel habits (European Environmental Agency, 2020). Therefore, I also manipulated the arrival time at the destination of each option in the sense that the train ride arrived more or less at the same time (22.15pm) as the flight (20:55pm).

Thus, the participant would not lose any leisure time at the weekend destination in Vienna and only had to consider the (in)convenience of the travel time when choosing the train ride over the flight (average travel time: 8h train vs. 3h flight) (Jiang & Li, 2016). From another perspective, the participant had to evaluate the trade-off between a quick but environmental unfriendly flight and a long but sustainable train ride. Below, the case scenario is fully described:

> 'Imagine, you are working as a project manager at tech start-up company based in Berlin. To kick-off a new project, your boss asks you to travel to Vienna (ca. 685km) to attend an important business meeting. Although, the meeting is only scheduled for next Monday, your boss offers you to cover the business travel costs even if you decide to already travel on Friday after work. You decide to take his offer and enjoy the weekend as leisure. In the company's internal travel booking system, you have the following two options:
>
> **Option A:** Direct train, average estimated travel time 8 hours
>
> **Option B:** Direct flight, average estimated travel time 3 hours
>
> To your convenience, transport from the airport / train station to your hotel is already arranged. Whichever option you choose, both are fully paid by your company.'

The participants for the between subject experiment were chosen via convenient sampling. After the case scenario was shown, each of the participants was randomly assigned to either the control or the treatment group.

Each group was then presented with the option of taking a train or taking a flight. For additional visual stimulation, I respectively created a symbolic train and flight ticket. The flight ticket below (figure 1) combined with a note saying: '*Quick and Comfortable! Arrive at you destination well rested!'* was shown to both groups.

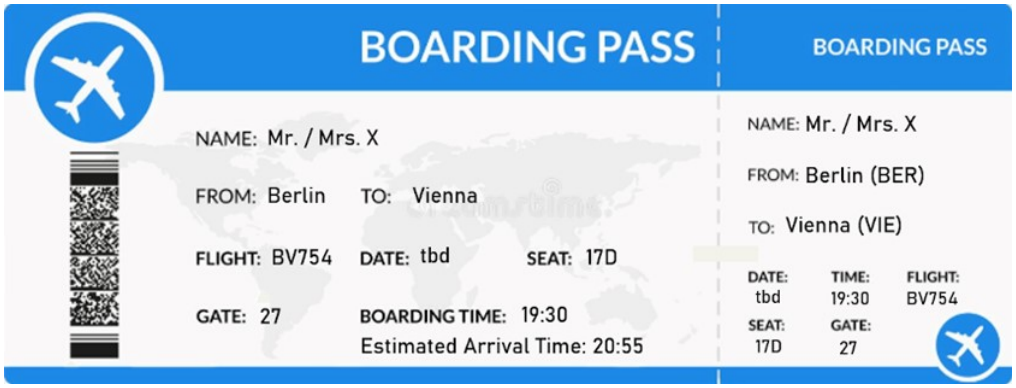

Figure 1: Flight Ticket Case Scenario

The train ticket (figure 2) however was shown either with or without a nudge intervention. While the control group saw the train ticket without a dynamic social norm statement, simply saying: *'Enjoy the ride and contribute to a better environment!'*, the treatment group saw the train ticket combined with a dynamic social norm statement, saying: *'To contribute to a better environment, travelling by train has become more popular among your colleagues. Enjoy the ride!'* The colleagues were thought of a relatable reference group to the respondent.

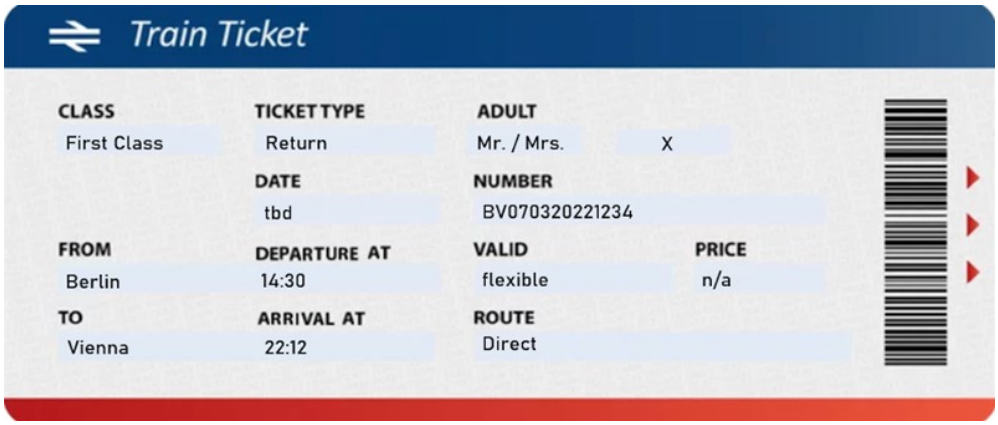

Figure 2: Train Ticket Case Scenario

After each travel option was shown to the groups, they were asked to indicate their tendency to choose one of both options.

Materials and Procedure

The survey experiment was built with the web program Qualtrics and included thirteen questions which were divided in four parts: introduction, experiment, follow-up, and demographics. After a short explanation regarding the purpose of the study (examination of consumers' travel behavior), the respondent was informed that the participation in this study was completely voluntary and anonymous. There were no financial or any other incentives to participate in the study. A full description of the survey can be found in the appendix 3. Before the final version of the survey was sent out, it was pre-tested several times to ensure internal validity and that all questions were phrased in a understandable way. Besides that, the randomization settings were checked to ensure a similar sample size of control and treatment group at the end of the data collection.

Measures

Sustainable travel behavior. The preference for sustainable travel behavior of the participants was measured three times. Firstly, the participant had to indicate their preference for a travel mode *'Which of both options do you tend to choose?'*.

On a 100-point slider scale (neutrally set at 50) participants could adjust the slider answer towards their preference. The point scale / slider option was chosen to prevent any bias in the wording of the question itself. Besides that, it allowed to collect a finer graded picture of the participant's choice. Thus, the decision would be as neutral as possible. Secondly, to make sure that the slider option for was understood right, the participant specifically was asked: *'How likely is it that you will choose Option A (Train) over Option B (Flight)?'*. The question was intended to check whether the previous given answer was coherent. The options of the seven-point Likert scale were 1= Extremely unlikely; 2= Moderately unlikely; 3= Slightly unlikely; 4= Neither likely, nor unlikely; 5= Slightly likely; 6= Moderately likely or 7= Extremely likely. And thirdly, the preference for sustainable travel behavior of the participants was measured after the disclosure of information regarding the environmental impact of each travel mode (flight vs. train): *'With this knowledge, how likely are you now to choose Option A (train) over Option B (flight)?'*. Again, a seven-point Likert scale (reaching from 1= Extremely unlikely; to 7= Extremely likely) was used as measure to make the responses comparable.

Environmental consciousness. As suggested by the literature (Passafaro, 2020), environmental consciousness was measured with the revised 15-item NEP scale. This scale was validated and found to be appropriate to measure a one-dimensional environmental construct like environmental consciousness (Dunlap et al., 2000). Accordingly, the participant was asked *'Please indicate to which extent do you agree or disagree with the following statements'*. On a five-point Likert scale the participant had the following options to position himself / herself to the given statements: 1=strongly disagree; 2=mildly disagree; 3= unsure; 4= mildly agree; and 5= strongly agree. Exemplary items are: *'The earth has plenty of natural resources if we just learn how to develop them'* or *'Humans are severely abusing the environment'* (Dunlap et al., 2000). The full NEP scale with each statement listed can be found in the appendix 2.

Control Variables were gender (0= male; 1= female), age (1= under 18y; 2= 18y to 27y; 3= 28y to 37y; 4= 38y to 47y; 5= 48y to 57y; 6= over 57y), monthly disposable net income (1= below 500€; 2= 501€ to 1000€; 3= 1001€ to 1500€; 4= 1501€ to 2000€; 5= 2001€ to 2500€; 6= 2501€ to 3000€; 7= over 3000€), level of education you have completed (1=Primary School; 2= Secondary School; 3= Undergraduate Degree; 4= Graduate Degree; 5= PhD or higher), living-area (1= urban; 2= sub-urban; 3= rural). To reduce the risk of unanswered questions, all five questions regarding gender, age, income, education, and living-area had the option 'Prefer not to say'. For a better understanding of the following statistical analysis, appendix 4 provides an overview with the description of each variables used.

4 Data Analysis and Results

For the statistical data analysis, I used the software SPSS Version 28 (IBM). Within the timeframe of the 21st of March to the 1st of May 2022 (6 weeks), I recoded 161 responses. Of those 161 responses, I had to discard 28 responses due to incomplete or inconsistent records (e.g., comparing values of 'choice of travel mode' and 'choice of travel mode (pre)). This left me with a final sample size of 133 valid responses (82,6%).

I then created a dummy variable 'treatment' (0 = control and 1 = treatment) to divide my sample into control and treatment group. Further preparation of the data set included the reverse coding of the seven anti-environmental statements of the NEP scale and the computation of a new variable 'environmental consciousness' representing the overall environmental consciousness of the respondent. To verify the validity of the scale, I calculated Cronbach's Alpha (0,822) which indicated that the scale was reliable.

On top of that, I created a dummy variable 'academic' (0= non-academic; 1= academic) for education as well as dummy variables for the living-area ('area_urban', 'area_suburban' and 'area_rural').

Participants. In my final sample, 75 respondents are female (56,4%). Regarding age, 71 respondents are between 18 and 27 years old (53,4%), while the average of the 'age' variable is 3,16 indicating the average age of my sample being between 28 and 40 years. The average of 'income' variable is 4,23 indicating that average income of my sample is between 1500€ and 2500€. In terms of education 85 respondents of the sample have an undergraduate degree or higher. Thus, 62,7% of my sample have an academic background. Regarding the living area of the respondents there is a split in 46,6% living in an urban area and 39,8% living in rural areas. The rest of the participants indicated that they were living in a sub-urban area. Lastly, the biggest share of respondents has as expected German nationality (66,2%), followed by Austrian (6,8%), UK (6%), France (5,3%), Italy and Portugal (4,5% each). Below, a more detailed description of the sociodemographic characteristics of my sample can be found (table 1).

Sociodemographic characteristics of respondents by group

	Control (n = 67)	Treatment (n = 66)	*P-value*
Gender, No (%)			.671
Male	27 (40.30)	29 (43,94)	
Female	39 (58.21)	36 (53.73)	
Age in years, No (%)			.490
under 18	1 (1.49)	1 (1.52)	
18 to 27	35 (52.24)	36 (54.55)	
28 to 37	9 (13,43)	11 (16.67)	
38 to 47	5 (7.46)	3 (4.55)	
48 to 57	6 (8.96)	6 (9.09)	
58 to 67	7 (10.45)	9 (13.64)	
above 67	4 (5.97)	0	
Education, No (%)			0,928
non-academic background	24 (35.82)	20 (30.30)	
academic background	43 (64.18)	46 (69.70)	
Household income, No (%)			.503
below 500€	4 (5.97)	8 (12.12)	
500€ to 1000€	13 (19.40)	5 (7.58)	
1001€ to 1500€	9 (13.43)	12 (18.18)	
1501€ to 2000€	7 (10.45)	12 (18.18)	
2001€ to 2500€	12 (17.91)	6 (9.09)	
2501€ to 3000€	9 (13.43)	12 (18.18)	
above 3000€	11 (16.42)	10 (15.15)	
Living Area, No (%)			.076
urban	27 (40.30)	35 (52.03)	
sub-urban	8 (11.94)	10 (15.15)	
rural	32 (47.76)	21 (31.82)	
Nationality, No (%)			.299
Austria	4 (5.97)	5 (7.58)	
Denmark	1 (1.49)	2 (3.03)	
France	4 (5.97)	3 (4.55)	
Germany	48 (71.64)	40 (60.61)	
Italy	3 (4.48)	3 (4.55)	
Luxembourg		1 (1.52)	
Netherlands	1 (1.49)		
Portugal	1 (1.49)	5 (7.58)	
Spain	2 (2.99)		
Switzerland		1 (1.52)	
Ukraine		1 (1.52)	
UK and North Ireland	3 (4.48)	5 (7.58)	

ANOVA tests were used to compare means. Chi-Squared tests were used to compare distributions.

Table 1: Sociodemographic characteristics of respondents by group

4.1 Dynamic social norms as promoter for more sustainable travel choices

To test if the use of dynamic social norms has a significant positive impact on the choice of travel mode, I developed a hierarchal linear regression model with three blocks of independent variables and the choice of travel mode as dependent variable (measured with a 100-point scale; 0= airplane 100= train). Below, the regression summary provides an overview of the corresponding coefficients to each model (table 2).

Regression Summary (Hypothesis 1)

	'choice of travel mode (pre)' as dependent variable		
Variables	**1**	**2**	**3**
constant (intercept)	28.800	-51.519	-53.420
gender [a]	7.794	5.277	6.037
age	5.297**	4.175*	4.383*
income	-1.590	-1.867	-1.974
education [b]	14.539*	11.321	11.708
sub-urban area [c]	8.229	10.623	10.889
rural area [c]	12.958	12.955*	15.216*
environmental consciousness		22.325**	20.670**
treatment			13.202*
R^2	.139	.256	.295
$adjusted\ R^2$	.096	.212	.248
F $Statistics$	3.261** [d]	5.892** [e]	6.226** [f]
ΔR^2		.117**	.039*

notes: n= 133. The coeffiencts are unstandardized Betas; *p < 0.05; ** p < 0.01
a: 0= male, 1= female; b: 0=non-academic, 1= academic; c: reference= area_urban
d: df= 6, 121; e: df= 7, 120; f: df= 8, 119

Table 2: Regression Model Summary for H_1

The overall exploratory power of the third model is relatively low (adjusted R^2= 0.248). Only 24.8% of the variance in the dependent variable can be explained by this regression model. While the exogeneity of predictors was given and the test for heteroskedasticity (White-Test; p=0.31) was non-significant (the null-hypothesis of homoskedasticity was not rejected), the test for normality (Shapiro Wilk; p< 0.05) turned out to be significant (the null hypothesis of normality was rejected).

Thus, the residuals were not normally distributed. In addition, all independent variables were checked for multicollinearity. Neither the Pearson correlation values (< 0.7) (table 3) nor the VIF-values (< 10) indicated any concerning signs.

Pearson Correlation

Variables	choice_ travel_ mode	treatment	environ- mental_con	gender	age	income	education	sub-urban area	rural area
choice of travel mode									
treatment	.192								
environmental consciousness	.401	.109							
gender	.156	- .047	.103						
age	.268	- .078	.161	.085					
income	.039	.000	.101	- .253	.371				
education	.086	.050	.112	- .021	- .174	.143			
sub-urban area	.023	.024	- .072	.071	- .005	- .069	- .062		
rural area	.178	- .159	.044	- .053	.357	.220	- .284	- .301	

Table 3: Correlation matrix regression model for H_2

The results for the first model indicate that the effect of the control variables 'age' on the respondent's choice of travel mode is highly significant (β= 5.297; p< 0.01) and the effect of 'education' is significant (p< 0.05). By adding 'environmental consciousness' to the second model, the positive effect of 'age' becomes weaker and significant only (β= 4.175; p< 0.05). Furthermore, the effect of 'education' becomes insignificant (p= 0.07) while living in a rural area (vs. urban area) becomes significant (β= 12.955; p< 0.05). 'Environmental consciousness' itself seems to have a highly significant positive effect on the dependent variable (β= 22.325; p< 0.001). The third model reveals that being in the treatment group seems to have a significant positive effect on the respondent's choice of travel mode (β=13.202; p< 0.05). Thus, compared to the control group (β= 53.420), respondents from the treatment group showed a higher preference in choosing the more sustainable travel option. Besides that, the effect of 'age' (β= 4.383; p< 0.05) and 'rural area' (β= 15.216; p< 0.05) remains significant, respectively 'environmental consciousness' remains highly significant (β= 20.670; p< 0.01). Moreover, as indicated in the regression summary, the remaining control variables 'gender', 'income', 'education' and 'rural area' in the third model do not seem to have any significant effect on the respondent's choice for the more sustainable travel mode (train). Therefore, the result of this first hierarchical linear regression model indicates that H_1 is supported.

Robustness check. However, to check the robustness of my results, I used the variable 'choice of travel mode (pre)' as alternative dependent variable (measured with a seven-point Likert scale; from 1= extremely unlikely to 7= extremely likely). With the same approach as before, I built a hierarchical linear regression model to test if the difference between the control group (M= 3.99) and the treatment group (M= 5.02) is significant.

The alternative regression model has a slightly higher explanatory power than the previous model (R^2= 0.271 vs. 0.248). Although the results for the alternative regression model are similar to the results before, there are three changes noteworthy to mention. Firstly, the positive effect of 'rural area' only becomes significant (β= 0.837; p< 0.05) in the third model. Secondly, 'education' becomes significant (β= 0.743; p< 0.05). Thus, according to the alternative regression model, having an academic background seems to increase the preference for the more sustainable travel mode. And lastly, the positive effect of the treatment becomes highly significant (β= 1.087; p< 0.01). The regression summary of the robustness check can be found in the appendix 5.

As in the previous model, the exogeneity of predictors and homoscedasticity (White-Test; p= 0.09) were given but the requirement for normality of the residuals (Shapiro Wilk; p< 0.05) was violated. Thus, to account for the validation of normality, I run the same regression models with the HC4 parameter estimates with robust standard errors (Hayes & Cai, 2007) for both dependent variables (see Appendix 6 and 7). Although some values were slightly different, there was no change in the significance of effects. This implies that the interpretation for the previous model can be considered as appropriate. Therefore, the results indicate that my first hypothesis H_1 is supported, and it seems that the use of a dynamic social norm does have a positive impact on consumers' choice of travel mode.

4.2 Environmental Consciousness as moderator

To test my second hypothesis (H_2) and see if environmental consciousness was functioning as a moderator for sustainable consumer behavior, I conducted a moderation analysis using a hierarchical linear regression with three blocks for the independent variables. Only the third model included the interaction effect of the treatment and environmental consciousness. For the moderation model, the 'choice of travel mode' was chosen as dependent variable. To create the interaction effect between the treatment and environmental consciousness, I first mean-centered 'environmental consciousness' and then computed the moderation effect. The choice of mean-center 'environmental consciousness' was made, to avoid potential multicollinearity effects. Besides that, in case that the interaction effect of the moderator was not significant I could still interpret the main effect of the variables. Since 'treatment' is coded as dichotomous dummy variable, I decided to not center it to sustain its grouping effect.

Again, the regression summary below provides an overview of the corresponding coefficients to both models (table 4). With an adjusted R^2 of 0.246 of the third most comprehensive model, the overall exploratory power remains relatively low. Only 24.6% of the variance in the dependent variable can be explained by this regression model. Although insignificant (p= 0.40), there is even a decline in the exploratory power compared to the second model.

Moderation Model - Regression Summary (Hypothesis 2)

	'choice of travel mode' as dependent variable		
Variables	**1**	**2**	**3**
constant (intercept)	28.800	-53.420	28.338
gender[a]	7.794	6.037	5.858
age	5.297**	4.383*	4.361*
income	-1.590	-1.974	-2.141
education[b]	14.539*	11.708	12.282*
sub-urban area[c]	8.229	10.889	11.575
rural area[c]	12.958	15.216*	15.661*
treatment		13.202*	13.121*
environmental consciousness		20.670**	16.996*
treatment x environmental consciousness			8.377
R^2	.139	.295	.299
$adjusted\ R^2$	0.96	.248	.246
F $Statistics$	3.261**[d]	6.226[e]	5.597**[f]
$\Delta\ R^2$		.156**	.004

notes: n= 133. The coeffiencts are unstandardized Betas; *p < 0.05; ** p < 0.01
a: 0= male, 1= female; b: 0=non-academic, 1= academic; c: reference= area_urban
d: df= 6, 121; e: df= 8, 119; f: df= 9, 118

Table 4: Moderation model summary for H_2

While the exogeneity of predictors and homoscedasticity for the moderation model was given (White-Test; p= 0.40), the test for normality (Shapiro Wilk; p< 0.05) turned out to be significant. Thus, the residuals were not normally distributed. In addition, all independent variables were checked for multicollinearity. Neither the Pearson correlation values (< 0.7) (table 5) nor the VIF-values (< 10) indicated any concerning signs.

Pearson Correlation

Variables	choice_ travel_ mode	treatment x environmental _con	treatment	environ-mental_con	gender	age	income	education	sub-urban area	rural area
choice of travel mode										
treatment	.192									
environmental consciousness	.401	.109								
treatment x environmental consciousness	.303	.089	.669							
gender	.156	- .047	.103	.071						
age	.268	- 0.78	.161	.151	.085					
income	.039	.000	.101	.152	- .253	.371				
education	.086	.050	.112	.021	- .021	- .174	.143			
sub-urban area	.023	.024	- .072	- .101	.071	- .005	- .069	- .062		
rural area	.178	- .159	.044	.027	- .053	.357	.220	- .284	- .301	

Table 5: Correlation matrix regression model for H_2

As already tested for hypothesis 1, the results of the first two models indicate that the effect of the control variables 'age' on the respondent's choice of travel mode is highly significant (β= 5.297; $p< 0.01$) and the effect of 'rural area' is significant (β= 15.216; $p< 0.05$). Furthermore, the effect of the 'treatment' on the dependent variable is significant (β= 13.202; $p< 0.05$) and 'environmental consciousness' is highly significant (β= 20.670; $p< 0.01$). After adding the interaction effect between the treatment and the moderator variable to the second model, the results indicate only a non-significant interaction effect of the moderator variable on 'treatment' ($p=0.41$). Thus, environmental consciousness does not seem to have a moderating role on the effect of dynamic social norms and the consumer's choice of travel mode. Nevertheless, the second model still suggests a significant positive effect of the 'treatment' (β= 13.121; $p< 0.05$) as well as a significant positive effect of 'environmental consciousness (β= 16.996; $p< 0.05$). Furthermore, in the third model the variables 'age' (β= 4.361), 'education' (β= 12.282) and 'rural area' (β= 15.661) all seem to have a significant positive effect ($p< 0.05$) on the dependent variable. This indicates that being in a higher age category, having an academic background (vs. non-academic) as well as living in a rural area (vs. urban area) seems to positively influence consumers in choosing a more sustainable travel mode.

However, since I wanted to test the moderation effect of environmental consciousness, but the results suggest that there is no significant effect of the interaction 'treatment x environmental consciousness, my second hypothesis (H_2) is not supported. Thus, in this specific research context, environmental consciousness does not function as a moderator variable between the treatment and the choice of travel mode. Accordingly, being high in environmental consciousness (compared to low) did not strengthen the positive relationship between nudge intervention and consumers' intention to engage in sustainable travel behavior.

Robustness check. To check the robustness of these results, I used the variable 'travel_mode_pre' as alternative dependent variable. Again, no signs of multicollinearity between the independent variables were found.

The explanatory power of the alternative moderation model is slightly higher than it was with (R^2= 0,267 vs. 0.246). Nevertheless, the alternative moderation model did not reveal any new insights, apart from the observation that both the effect of the 'treatment' (β= 1.083) and 'environmental consciousness_mc' (β=1.147) become highly significant (p< 0.01). However, since there is still no significant moderation effect indicated (p= 0.52), H_2 is still not supported. The alternative regression summary of the robustness check for the second hypothesis can be found in the appendix 8.

As in the previous model, the exogeneity of predictors and homoscedasticity (White-Test; p= 0.12) is given. Interestingly, the test for normality of the residuals (Shapiro Wilk; p= .07) in this alternative moderation model was non-significant and the thus null hypothesis (assumes normality) is not rejected. This indicates that the residuals are normally distributed. To account for the validation of normality in the first model with 'travel_mode_intention' as dependent variable, I ran the moderation model with the HC4 parameter estimates with robust standard errors to check for the robustness of the results (see Appendix 9). For the second model with 'travel_mode_pre' as dependent variable, although normality and homoscedasticity were given, I applied the HC3 parameter estimates with robust standard errors (Hayes & Cai, 2007) (see Appendix 10).

For an additional robustness check, I ran both models with the SPSS PROCESS plug-in (version 4.1 by A.F. Hayes) using the parameter estimates with robust standard errors respectively. Similar to the tests before, some values slightly differed but no changes in the significance of the effects could be observed. Both robustness checks indicate that the previous interpretation of the results and the conclusion not to support H_2 seems to be reasonable.

Exploratory Research. Further analysis reveals that participants reported the train ride as the more sustainably responsible travel option. Assuming for equal variances (Levene's test; p= 0.060), the result of an independent t-test (see Appendix 11) suggests that the participants assigned a higher level of responsibility for the option 'travelling by train' (M= 4.05; SE= .060), than of the option 'travelling by airplane' (M= 2.20; SE= .064; t(264); p≤ 0.001).

Besides that, the result of a paired samples t-test indicates that individuals show a significantly higher average in their preference to take a more sustainable travel option after information regarding the environmental impact of both travel options was disclosed (M= 5.20, SE =.158) compared to before seeing the information (M= 4.50; SE= .181; t(132); p≤ 0.001,) see Appendix 12).

However, it should be mentioned that the difference between 'tr-+avel_mode_pre' and 'travel_mode_post' did violate the assumption of normality (Shapiro-Wilk: p≤ 0.001). Furthermore, five cases of outliers (out of 133 cases) were detected. However, latter observation was ignored for the interpretation of the results.

The results suggest that the disclosure of information regarding the environmental impact of each transportation option (flight vs. train) could affect consumers' choice of transportation mode. In the next chapter, the results of my research project are summarized into the main findings.

4.3 Main Findings

As a quick reminder, the overall objective of this dissertation project was to outline the differences between nudging and traditional marketing tools. Moreover, I wanted to find out how the use of dynamic social norms can be leveraged to promote more sustainable travel habits in consumers and how an individual's environmental consciousness moderates this relationship.

The two main differences are that nudging is based on the idea of changing behavioral patterns without providing and financial incentives and without limiting options. Moreover, and perhaps the more convincing argument is that nudging prioritizes the benefits of the individual itself (or in some cases the benefit of the collective). In contrast, traditional marketing tools are undertaken with the underlying objective to increase the sales of a product or service, and thus benefit the company in the first instance.

Regarding my hypotheses, I found that participants of the treatment group showed a higher preference for the more sustainable travel option (train ride). This indicates that the use of dynamic social norms is effective in promoting sustainable travel behavior. Thus, my first hypothesis was supported. However, I could not conclude that environmental consciousness had a moderating effect on this relationship based on the statistical results. Thus, my second hypothesis was not supported. Below, table 6 shows the summarized results for both hypotheses.

H_1	The use of a dynamic social norm as nudge intervention is positively related to the consumers' intention to engage in sustainable travel behavior	supported
H_2	When environmental consciousness is high (compared to low), the positive relationship between nudge intervention and consumers' intention to engage in sustainable travel behavior is stronger.	not supported

Table 6: Summary of test results for each hypothesis

The support of H_1 indicates that the leverage of social influence could be a promising approach to motivate consumers to engage in more sustainable travel behavior. The non-support of H_2 confirms previous observations made by other researchers that many of the findings regarding SCB are highly dependent on the specific situational context (Schubert, 2017). Further findings suggest that providing (access to) relevant information on environmental impact can help to encourage SCB. Furthermore, respondents with an academic background and higher in age showed higher intention to use the more sustainable travel mode. Moreover, I found that living in a rural area (vs. urban area) seemed to increase the intention for using the more sustainable travel mode. How the findings of my research add to existing research and how these insights can be utilized will be discussed in the next chapter.

5 Discussion

The findings of my dissertation project provide a valuable insight to the general SCB literature. Especially the main effect of dynamic social norms within a travel context adds to the existing knowledge about choice architecture and nudging. However, it should be mentioned that the findings of my research are tied to this specific context and may not be generalizable. Moreover, the question remains if the participants were even able to make an informed decision without access to relevant background information regarding the environmental impact of each travel option. Unfortunately, such information is often hidden from consumers (Hosta & Zabkar, 2021). Although the participants reported that taking the train was the sustainably more responsible travel option, there were probably some indicators such as noise pollution or the destruction of natural habits which were not considered for their decision. Therefore, the provision of information regarding the environmental impact of their travel choices could motivate individuals to behave more sustainably (European Environmental Agency, 2020). To to increase the acceptance of provided information, Ungemach, Camilleri, Johnson, Larrick, and Weber (2018) suggest that choosing the right framing of environmental messages could effectively help to make pro-environmental benefits more salient.

Nevertheless, my results suggest that consumers are affected by social influence which is in line with previous research findings (Abrahamse & Steg, 2013; Dwyer et al., 2015). Furthermore, my findings indicate that consumers are willing to adopt behavioral patterns even if they are still counternormative, which was pointed out by Sparkman & Walton (2017). Moreover, my findings provide one more case suggesting that nudge interventions using dynamic social norms could be an effective tool to promote SCB (Lehner et al., 2016; Gonçalves et al., 2021).

Although there are cases in the SCB literature which identified environmental consciousness as a moderator in the context of other pro-environmental behavior (Lin & Chang, 2012; Garvey & Bolton, 2017; Huang & Liu, 2017), my research could not support this claim. There could be multiple reasons why environmental consciousness did not strengthen the positive effect of the nudge intervention. One potential explanation for this result could stem from the aforementioned attitude-behavior gap (Sunstein, 2015) or the social desirability bias, in which respondents self-reported a higher level of environmental concern than is actually applicable (Green & Peloza, 2014). Another explanation could stem from the self-other trade off (White et al., 2019). In this scenario, individuals would feel that their disadvantages exceed the benefits for the community. Indeed, research suggests that prosocial incentives provide less motivation to engage in a certain behavior (Chapman et al., 2021). Under those circumstances, environmental consciousness would only play a subordinated role.

Against this background, it is thinkable that variables which also account for the individual's personal benefits such as comfort and convenience (Wang, Liu, Kim, & Kim, 2019) could have a moderation effect on the social norms. Especially within a travel context, those factors have found to be relevant for the choice of transportation (Lehman & Geller, 2004; European Environmental Agency, 2020). Moreover, they play a central role in (dis-)encouraging SCB (Diamantopoulos et al., 2003), as well as providing a non-financial incentive, which is fundamental to the concept of nudging (Benartzi et al., 2017). Furthermore, my findings reveal that the disclosure of information regarding environmental impact could potentially encourage consumers to choose an alternative, more sustainable travel option. However, such information would only effective if the consumer perceives it as credible and relevant (Taufique et al., 2017; Torma & Thøgersen, 2021).

6 Conclusion

SCB is a complex construct influenced by many different factors. Despite its importance, SCB is still hindered by several obstacles and barriers. Although nudges can offer support in a change of consumer behavior, governments as well as companies must provide the fundamental infrastructure to make SCB more attractive. Thus, to advance sustainable development globally, much more than nudges must happen. Public education would be a critical key driver to raise environmental knowledge and awareness to establish the necessary environmental (and social) concern to current global issues such as climate change and its negative impact on the natural and human ecosystems. On top, building environmental concern within consumers is necessary to intrinsically motivate people to actively participate in sustainable behavior (Han & Stoel, 2017).

Managerial Implications. To get closer in achieving the SGDs step by step, governments must eventually build a robust framework for sustainable development cross-national. Only with this fundamental structure, private organizations as well as our society itself can effectively take responsibility and realize the necessary change. Therefore, two steps are particularly important. In a first step, individuals, communities, and private organizations must be educated. Raising awareness is fundamental to increase the interest in sustainability issues among all stakeholder groups. And then in the second step, the attitude-behavior gap must be addressed by reducing the (perceived) barriers and obstacles to a minimum to encourage SCB (Trudel, 2019). Additionally, use nudge interventions support consumers' decision-making processes and reduce remaining biases. Both steps would support the efforts to establish SCB as normative behavior and therefore influence an individual's behavior accordingly through descriptive and injunctive norms.

To get relatively quick results, one concrete suggestion could be the development of a broadly designed sustainability education / awareness campaign that help individuals and organizations to understand what is at stake, making it more tangible as well as triggering their environmental consciousness. In the long term, these campaigns should be fundamentally integrated in the education system starting in kindergarten. Furthermore, in the process of making SCB more attractive, the private sector plays a critical role in making sustainable options more available and accessible. Not only by providing more sustainable produced products / services, but also offering sustainable after-sale support such as repair or disposal services (e.g., Patagonia offers a free repair service and second-hand shop for its products).

Implementing CSR and ESG structures within the corporate processes could help to encourage such initiatives (Wang et al., 2019). Therefore, governments or private organizations like the "B-Corporation" provide mentoring and consultancy programs, to help companies (especially small and mid-sized enterprises) to transform their businesses and empower them to monitor their own sustainable performance (UNFCCC, 1997). In addition, there is a need for a transparent and unified labelling system to inform consumers about the environmental impact of their consumption choices (Prothero et al., 2011). Of course, every measurement should be tested for its effectiveness, feasibility, and viability.

Future Research. Since participants only responded to a hypothetical case scenario, I suggest that the experiment needs to be tested in the real-life environment (field-experiment). This would not only allow to capture results accounting for all the complexity that comes with SCB but also provide new evidence about the effectiveness of nudges (Chapman et al., 2021). Moreover, as outlined previously, the potential moderating role of comfort and convenience should be examined to gain a deeper understanding of consumers' travel behavior. In addition, it would be interesting to see if self-efficacy regarding sustainable travel behavior holds a moderating role on social norm interventions (Passafaro, 2020). Furthermore, to gain a deeper understanding of this topic, the effectiveness of dynamic social norms should be explored within the context of alternative modes of transportation (e.g., private cars electric vs. combustion, bikes and busses). In contrast, future research could also examine different nudge intervention on the trade-off scenario plane vs. train travel. As my findings indicated, the effects of consumers' educational background, (both academic and as issue related knowledge), and the living area on travel choices should be subject of future research. On top of that, I would encourage scholars to actively research on "why" consumers are motivated and what would motivate them to engage in sustainable behavior (Trudel, 2019). Depending on social identities and influences as well as type of decision-making (low vs. high involvement) the underlying requirements for nudge interventions could differ.

(De-) Limitations. As any other research project, this research is also subject to various limitations. Besides the time and budget restrictions of this dissertation project, the research is subject to various biases. Firstly, the sampling bias, by choosing the method of a convenient sampling, the participants were mainly found in my extended personal network, thus both the size as well as the diversity of the sample is highly limited, which makes the result not representable for the entire population.

Secondly, due to the nature of this research, even though the survey was anonymous, some of the self-reported answers are likely affected by their self-concept and social desirably bias. Moreover, the delimitation of my dissertation project is defined by the scope of my research. Firstly, to represent SCB I choose the choice of a sustainable transportation mode within a travel context. Although the topic is relevant, it only covers a small facete of SCB. More specifically I choose the trade-off between air travel and railway travel for short distance travels. Secondly, I simplified the contextual environment by taking out factors like price to reduce complexity of the study, making it easier for the participants to understand the case scenario. Thirdly, as geographical scope of my research, I choose Europe (participants with a European nationality or who are currently living in Europe), since the European LLC and HSR networks are one of the most developed in the world (Jiang & Li, 2016)

Lastly, perhaps the most critical limitation is the fact that I was not able to create an experiment that allowed me to observe real-life behavior. By creating a hypothetical case scenario, I was only able to collect data about the participants intention to perform a sustainable behavior (behavioral intention). Although behavioral intention is a close predictor for actual behavior, the behavior attitude gap shows that there can be differences in reported intentions and the actual behavior itself. Besides that, the experiment did not allow to make any conclusions about the long-term effect of the nudge intervention. Thus, no statement about potential habit forming can be made. Therefore, this experiment should be conducted in a real-life environment to account for the full complexity that comes with SCB.

As a final remark, I would like to highlight that the implementation of nudge interventions on its own will not be enough to promote SCB in the long run, nor will it be sufficient to educate the society on the importance / severity of environmental issues. However, combined with other measures, laws and regulations, it can support the on-going movement towards a more sustainable future and help us to achieve the SDG globally. Nonetheless, new policies and nudge interventions should be introduced with cautions because the comparison between traditional marketing efforts and nudging clearly shows that there is only a very fine line between persuasion, manipulation, and nudging. Especially in the context of sustainability, the benefits for individuals and the collective might differ. Thus, literature needs to be precise and distinguish between the best thing to do and the right thing to do (Richter et al., 2018). Thus, we need to ask: *'Will the actions we take today perhaps backfire in the future?'*

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Appendices

Appendix 1: Corresponding null hypotheses to H_1 and H_2

H_0 to H_1	The use of a dynamic social norm as nudge intervention is NOT positively related to the consumers' intention to engage in sustainable travel behavior
H_0 to H_2	When environmental consciousness is high (compared to low), the positive relationship between nudge intervention and consumers' intention to engage in sustainable travel behavior IS NOT stronger.

Appendix 2: Revised NEP scale (Dunlap et al., 2000)

1. We are approaching the limit of the number of people the Earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will insure that we do not make the Earth unlivable.
5. Humans are seriously abusing the environment.
6. The Earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities, humans are still subject to the laws of nature.
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.
11. The Earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

Appendix 3: Full description of the survey

Introduction

Dear Participant,

thank you for your interest in participating in this survey. My name is Moritz Dreßler and I am doing my Master's degree at the Católica Lisbon School of Business and Economics. For my master's thesis, I am investigating consumers' decision making regarding their travel habits. I would therefore like to thank you in advance for your support. This survey will take about 5 minutes to complete.

The survey is completely anonymous, and it will not be possible to trace your answers back to you. All data collected will be kept confidential and used for research purposes only. Your participation is voluntary, and you are allowed to stop the survey at any time without providing any reason.

If you have any questions regarding the survey, please feel free to contact me at the following e-mail address: 152120016@alunos.lisboa.ucp.pt.

Thank you for your time! :)

Q1: I am a European Citizen or currently live in Europe. I read and understood the consent from above and I agree to participate in this study:

- ○ I agree, begin the study
- ○ I do not agree

Experiment

Important: Please read the following scenario carefully.

Imagine, you are working as a project manager at tech start-up company based in Berlin. To kick-off a new project, your boss asks you to travel to Vienna (ca. 685km) to attend an important business meeting. Although, the meeting is only scheduled for next Monday, your boss offers you to cover the business travel costs even if you decide to already travel on Friday after work. You decide to take his offer and enjoy the weekend as leisure. In the company's internal travel booking system, you have the following two options:

Option A: Direct train, average estimated travel time 8 hours

Option B: Direct flight, average estimated travel time 3 hours

To your convenience transport from the airport / train station to your hotel is already arranged. Whichever option you choose, both are fully paid by your company.

Q2: I understood the case and want to make a choice:

○ Yes

○ No

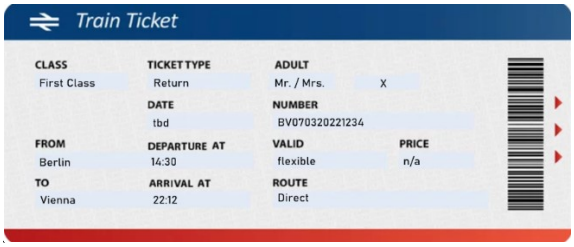
Please look carefully at the two given options below and answer the question honestly at the end. Remember, there is no or right answer, only your personal preference!

EITHER

Control Group: OPTION A: Enjoy the ride and contribute to a better environment!

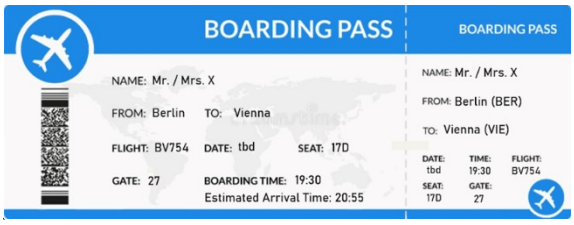
OR

Treatment Group: OPTION A: To contribute to a better environment, travelling by train has become more popular among your colleagues. Enjoy the ride.



AND

OPTION B: Quick and Comfortable! Arrive at you destination well rested!



Q3: Which of both options do you tend to choose?

Adjust the slider towards your preference 0 = Flight and 100 = Train:

	Option B (Flight)	**Option A (Train)**
Your Tendency ()		

Q4: How likely is it that you will choose Option A (Train) over Option B (Flight)?

	Extremely unlikely (1)	Moderately unlikely (2)	Slightly unlikely (3)	Neither likely nor unlikely (4)	Slightly likely (5)	Moderately likely (6)	Extremely likely (7)
Your choice	○	○	○	○	○	○	○

Q5: Please indicate, how environmentally responsible it is to engage in the following behavior?

	very unresponsible (1)	somewhat unresponsible (2)	neither unresponsible nor responsible (3)	somewhat responsible (4)	very responsible (5)
Travelling by airplane	○	○	○	○	○
Travelling by train	○	○	○	○	○

Follow-Up Questions

Thanks for making your choice. Now, please look at the following information:

According to the European Environment Agency, the impact of travelling by plane is three times more damaging to the environment than taking the train.

Q6: With this knowledge, how likely are you now to choose Option A (train) over Option B (flight)?

	Extremely unlikely (1)	Moderately unlikely (2)	Slightly unlikely (3)	Neither likely nor unlikely (4)	Slightly likely (5)	Moderately likely (6)	Extremely likely (7)
Your choice (1)	○	○	○	○	○	○	○

Revised NEP Scale Environmental Consciousness

Q7: Please indicate to which extent do you agree or disagree with the following statements:

	Strongly Disagree (1)	Mildly Disagree (2)	Unsure (3)	Mildly Agree (4)	Strongly Agree (5)
We are approaching the limit of the number of people the earth can support (1)	○	○	○	○	○
	○	○	○	○	○
Humans have the right to modify the natural environment to suit their needs (2)	○	○	○	○	○
When humans interfere with nature it often produces disastrous consequences (3)	○	○	○	○	○
Human ingenuity will insure that we do NOT make the earth unlivable (4)	○	○	○	○	○
Humans are severely abusing the environment (5)	○	○	○	○	○
The earth has plenty of natural resources if we just learn how to develop them (6)	○	○	○	○	○
Plants and animals have as much right as humans to exist (7)	○	○	○	○	○
The balance of nature is strong enough to cope with the impacts of modern industrial nations (8)	○	○	○	○	○

Despite our special abilities humans are still subject to the laws of nature (9)	○	○	○	○	○
The so-called "ecological crisis" facing humankind has been greatly exaggerated (10)	○	○	○	○	○
The earth is like a spaceship with very limited room and resources (11)	○	○	○	○	○
Humans were meant to rule over the rest of nature (12)	○	○	○	○	○
The balance of nature is very delicate and easily upset (13)	○	○	○	○	○
Humans will eventually learn enough about how nature works to be able to control it (14)	○	○	○	○	○
If things continue on their present course, we will soon experience a major ecological catastrophe (15)	○	○	○	○	○

Demographics

Q8 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Q9: What is your age?

- ○ under 18 years (1)
- ○ 18 to 27 years (2)
- ○ 28 to 37 years (3)
- ○ 38 to 47 years (4)
- ○ 48 to 57 years (5)
- ○ 58 to 67 years (6)
- ○ above 67 years (7)
- ○ Prefer not to say (8)

Q10: What is your monthly disposable net income?

- ○ below 500€ (1)
- ○ 500€ to 1000€ (2)
- ○ 1001€ to 1500€ (3)
- ○ 1501€ to 2000€ (4)
- ○ 2001€ to 2500€ (5)
- ○ 2501€ to 3000€ (6)
- ○ above 3000€ (7)
- ○ Prefer not to say (8)

Q11: What is your highest level of education you have completed?

- ○ Primary School (1)
- ○ Secondary School (2)
- ○ Undergraduate Degree (3)
- ○ Graduate Degree (4)
- ○ Post-Graduate Degree (PhD or higher) (5)
- ○ Prefer not to say (6)

Q12: In which area do you live?

- ○ Urban Area (1)
- ○ Sub-Urban Area (2)
- ○ Rural Area (3)
- ○ Prefer not to say (4)

Q13: What is your nationality?

▼ Afghanistan (1) … Zimbabwe (195)

Appendix 4: Overview of variables used in the data analysis

Variables	**Description**
treatment	dummy variable; 0= control group; 1= treatment group
choice of travel mode	preference of travel mode (intentions; 100-point slider scale)
choice of travel mode (pre)	choice of railway travel over air travel before disclosure of environmental information (7-point Likert scale)
travel_mode_post	choice of railway travel over air travel after disclosure of environmental information (7-point Likert scale)
environmental_con	respondent's overall environmental consciousness
environmental_con_mc	environmental_con mean centered
treatment x environmental consciousness_mc	treatment x environmental_con_mc
gender	dummy variable for gender (0= male; 1= woman)
age	age categories (1= under 18y to 6= over 57y)
income	income categories (1= below 500€ to 7= over 3000€)
academic	dummy variable for education (0= academic; 1= non-academic)
area (urban)	dummy variable for living area (0= rural/suburban; 1= urban)
area_suburban	dummy variable for living area (0= rural/urban; 1= suburban)

Appendix 5: Robustness check. Alternative model regression summary for H_1

Alternative Regression Model Summary (Hypothesis 1)

	'choice of travel mode (pre)' as dependent variable		
Variables	**1**	**2**	**3**
constant (intercept)	2.582	-2.675	-2.831
gender [a]	0.519	0.354	0.416
age	0.320*	0.247*	0.264*
income	-0.063	-0.081	-0.090
education [b]	0.921*	0.711	0.743*
sub-urban area [c]	0.426	0.583	0.605
rural area [c]	0.651	0.651	0.837*
environmental consciousness		1.461**	1.325**
treatment			1.087**
R^2	.125	.250	.317
$adjusted\ R^2$	.082	.206	.271
F $Statistics$	2.885* [d]	5.719** [e]	6.896** [f]
ΔR^2		.125**	.067**

notes: n= 133. The coeffiencts are unstandardized Betas; *p < 0.05; ** p < 0.01
a: 0= male, 1= female; b: 0=non-academic, 1= academic; c: reference= area_urban
d: df= 6, 121; e: df= 7, 120; f: df= 8, 119

Appendix 6: Robustness check for 'travel_mode_int' (HC4) – H_1

Parameter Estimates with Robust Standard Errors

Dependent Variable: travel_mode_int

Parameter	B	Robust Std. Error [a]	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	-53,420	16,983	-3,145	,002	-87,049	-19,791
treatment	13,202	5,168	2,554	,012	2,968	23,436
Environmental_Con	20,670	4,747	4,354	<,001	11,270	30,069
gender	6,037	5,417	1,114	,267	-4,690	16,764
age	4,383	1,858	2,359	,020	,703	8,062
income	-1,974	1,431	-1,379	,170	-4,807	,860
academic	11,708	5,624	2,082	,040	,571	22,845
Dummy_Area_2	10,889	6,809	1,599	,112	-2,594	24,372
Dummy_Area_3	15,216	6,196	2,456	,015	2,948	27,484

a. HC4 method

Appendix 7: Robustness check for 'travel_mode_pre' (HC4) – H_1

Parameter Estimates with Robust Standard Errors

Dependent Variable: travel_mode_pre

Parameter	B	Robust Std. Error[a]	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	-2,831	1,017	-2,784	,006	-4,845	-,818
treatment	1,087	,326	3,332	,001	,441	1,733
Environmental_Con	1,325	,290	4,564	<,001	,750	1,899
gender	,416	,339	1,227	,222	-,256	1,089
age	,264	,118	2,242	,027	,031	,497
income	-,090	,089	-1,003	,318	-,267	,087
academic	,743	,361	2,056	,042	,027	1,458
Dummy_Area_2	,605	,421	1,436	,154	-,229	1,439
Dummy_Area_3	,837	,399	2,096	,038	,046	1,627

a. HC4 method

Appendix 8: Robustness check. Alternative moderation regression summary for H_2

Alternative Moderation Model - Regression Summary (Hypothesis 2)

	'choice of travel mode (pre)' as dependent variable		
Variables	**1**	**2**	**3**
constant (intercept)	2.582	-2.831	2.408
gender [a]	0.519	0.416	.408
age	0.320*	0.264*	.263*
income	-0.063	-0.090	-0.098
education [b]	0.921*	0.743*	0.770*
sub-urban area [c]	0.426	0.605	.638
rural area [c]	0.651	0.837*	.858*
treatment		1.087**	1.083**
environmental consciousness		1.325**	1.147**
treatment x environmental consciousness			.404
R^2	0.125	.317	0.319
$adjusted\ R^2$	.082	.271	.267
F $Statistics$	2.885* [d]	6.896 [e]	6.146** [f]
ΔR^2		.192**	.002

notes: n= 133. The coeffiencts are unstandardized Betas; *p < 0.05; ** p < 0.01
a: 0= male, 1= female; b: 0=non-academic, 1= academic; c: reference= area_urban
d: df= 6, 121; e: df= 8, 119; f: df= 9, 118

Appendix 9: Robustness check. Moderation model for 'travel_mode_int' (HC4) – H_2

Parameter Estimates with Robust Standard Errors

Dependent Variable: travel_mode_int

Parameter	B	Robust Std. Error[a]	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	-38,863	23,050	-1,686	,094	-84,509	6,782
treatment	13,121	5,206	2,520	,013	2,812	23,431
Environmental_Con	16,996	6,182	2,749	,007	4,754	29,239
Moderator_treat_env_con	8,377	9,085	,922	,358	-9,615	26,369
gender	5,858	5,424	1,080	,282	-4,883	16,598
age	4,361	1,863	2,341	,021	,673	8,050
income	-2,141	1,456	-1,470	,144	-5,025	,743
academic	12,282	5,651	2,173	,032	1,090	23,473
Dummy_Area_2	11,575	6,931	1,670	,098	-2,149	25,300
Dummy_Area_3	15,661	6,296	2,488	,014	3,194	28,128

a. HC4 method

Appendix 10: Robustness check. Moderation model for 'travel_mode_pre' (HC3) – H_2

Parameter Estimates with Robust Standard Errors

Dependent Variable: travel_mode_pre

Parameter	B	Robust Std. Error[a]	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	-2,129	1,423	-1,496	,137	-4,947	,689
treatment	1,083	,340	3,186	,002	,410	1,756
Environmental_Con	1,147	,390	2,938	,004	,374	1,921
Moderator_treat_env_con	,404	,564	,717	,475	-,713	1,521
gender	,408	,352	1,159	,249	-,289	1,105
age	,263	,122	2,150	,034	,021	,505
income	-,098	,094	-1,039	,301	-,284	,088
academic	,770	,376	2,051	,042	,027	1,514
Dummy_Area_2	,638	,438	1,455	,148	-,230	1,506
Dummy_Area_3	,858	,420	2,043	,043	,026	1,690

a. HC3 method

Appendix 11: Independent T-Test: Comparing level of responsibility for each travel option

Group Statistics

	Travelling by Airplane	N	Mean	Std. Deviation	Std. Error Mean
Level of Responsiblity	Travelling by Airplane	133	2,20	,733	,064
	Travelling by Train	133	4,05	,695	,060

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Level of Responsiblity	Equal variances assumed	3,575	,060	-21,120	264	<,001	<,001	-1,850	,088	-2,022	-1,677
	Equal variances not assumed			-21,120	263,250	<,001	<,001	-1,850	,088	-2,022	-1,677

Appendix 12: Paired Samples T-Test – Disclosure of information

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	travel_mode_pre	4,50	133	2,088	,181
	travel_mode_post	5,20	133	1,821	,158

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	travel_mode_pre - travel_mode_post	-,707	1,013	,088	-,881	-,533	-8,043	132	<,001	<,001