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Digital Nudge Stacking and Backfiring: Understanding Sustainable E-Commerce Purchase Decisions

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Abstract

Background: *The consumption of 'fast fashion', which is expedited by cost-effective e-commerce systems, represents one of the major factors contributing to the acceleration of climate change. An emerging approach to steer consumers in the direction of more sustainable purchase decisions is digital nudging. This paper explores digital nudging in the context of green fashion e-commerce by testing the effectiveness of two nudging strategies on the decision to choose green fashion products (GFP) over regular fashion items.*

Method: *This study was conducted as a between-subject online experiment (n=320) with four conditions simulating an e-commerce scenario. The participants were presented with different products: one was ecologically friendly, and another was the regular option. Depending on their randomized group allocation, the participants experienced a default nudge, a social norm nudge, a combination of both strategies, or no nudge. In addition, we conducted 10 qualitative interviews to gain a deeper understanding of consumers' decision process.*

Results: *Our experiment failed to demonstrate statistically significant relationships between the various nudging strategies and GFP purchase decisions. However, additional explorative analyzes confirmed a backfire effect for the combination of nudging strategies. This reveals the previously overlooked influence of participants' identification on the effectiveness of digital nudging strategies. In addition, qualitative interviews revealed individual factors that influence sustainable e-commerce purchase decisions.*

Conclusion: *This study contributes to information systems research by explaining the differences in the effectiveness of different nudging strategies regarding high-involvement compared to low-involvement products. Moreover, it provides empirical evidence of a backfire effect resulting from a combination of digital nudging strategies (i.e., digital nudge stacking). Finally, the study underscores the leverage that individual factors have on both GFP purchase decision and the effectiveness of nudges.*

Keywords: Digital Nudging, Persuasive System Design, E-Commerce, Sustainability, Information Systems.

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Introduction

Over the past decades, climate change has become a serious threat to the global environment and human lives (Fawzy et al., 2020). Second only to the oil industry, the fashion industry constitutes the second largest contributor to environmental pollution (Dhir et al., 2021; Muthukumarana et al., 2018). A recent study has estimated that, combined, fashion manufacturers and retailers will produce a total of 1.6 gigatons of carbon dioxide by 2030 (Smith, 2022). This is especially relevant to the Asia-Pacific region as it is the leading region of clothing export with China occupying the top spot as the country with the highest clothing export value (Sabanoglu, 2022). Additionally, a significant portion of clothing manufacturers are located in this region and many international brands produce their clothes there (Ganbold, 2023). Especially in the Asia-Pacific region, trust in brands' sustainability claims is low and the overall sentiment regarding more sustainable fashion seems more conservative (Ganbold, 2023; KPMG, 2019). However, a large portion of customers worldwide agree that environmentally friendly behavior is crucial and have stated their willingness to purchase so-called green fashion products (GFP) – that is, fashion items that have been produced with ecological friendliness in mind – at higher prices than fast fashion (Haider et al., 2019; Moraes et al., 2012). Despite that, more recent research has revealed that ecologically produced fashion items only contribute to about 4% of all clothing items sold globally (Smith, 2022).

Extant literature has investigated how consumers' attitudes could be changed and how customers could be motivated to purchase more environmentally friendly fashion items (Gupta & Ogden, 2006). To this end, various researchers have implemented digital nudges in e-commerce settings (Hummel & Maedche, 2019; Kroll et al., 2019; Weinmann et al., 2016). Digital nudging has been defined as design changes made in a choice architecture that can steer and manipulate decision-making processes, subsequently modifying behavioral functions without restricting or mandating certain behaviors. Instead, digital nudges aim to simplify the decision-making process and enhance information transparency (Halpern, 2015; Thaler & Sunstein, 2009). Existing research has demonstrated that the implementation of digital nudges might be especially effective when attempting to steer the purchase decisions of online shoppers (Mols et al., 2015; Myers & Souza, 2020).

Nevertheless, research examining the effectiveness of digital nudges has predominantly been carried out by considering the e-commerce of low-involvement products (Bauer et al., 2006; Ingendahl et al., 2020), such as perishable goods (Demarque et al., 2015; Ingendahl et al., 2020) or amenities (van Gestel et al., 2020). In contrast, the research focusing on high-involvement products, such as fashion products, has often been overlooked. Research has shown that consumers tend to conduct a more thorough consideration process when buying high-involvement products such as cars or houses, the reason for this being a heightened fear of making a potentially wrong decision (Jiang et al., 2015; Prodanova et al., 2020; Mirbabaie et al., 2021). It is safe to assume that the impact of nudging strategies on these more complex purchase decisions might differ from the influence that nudges can have on low-involvement purchase decisions. Hence, the results found in the literature cannot simply be transferred to clothing items because the purchasing behavior of consumers varies between low- and high-involvement products. This is because of psychological aspects, such as the consumers' cognitive processes or emotional connections with the topic (Bauer et al., 2006). Subsequently, the present research article aims to answer the following research question:

RQ: *How does digital nudging affect consumers' purchase decisions in e-commerce in the context of GFP?*

To this end, we have conducted a quantitative between-subject online experiment (n=320), as well as 10 qualitative interviews. The online experiment was conducted first with the goal to test our hypotheses in a realistic e-commerce scenario, which could optimally be achieved in an online setting. After the online experiment, we conducted 10 qualitative interviews to gain

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a deeper understanding into consumers' thought processes when deciding for or against purchasing a GFP over a cheaper, non-sustainable clothing item.

Our results offer additional insights into the complex effects and implications of applying various nudging strategies to GFP. In this respect, the present research article theoretically contributes to the digital nudging literature by testing digital default nudges, social norm nudges and a combination of those strategies, often called digital nudge stacking. Analyzing the limitations and aptitudes of digital nudges in an e-commerce setting constitutes an important domain in information systems (IS) research. Regarding practice, the present research article extends the findings of the literature on the effectiveness of different nudging strategies when applied to fashion-focused e-commerce scenarios. Beyond doing this, our work yields practice-oriented suggestions for the design and application of choice architectures, here with the aim of further ecologically friendly purchase decisions without decreasing overall business profitability.

Theoretical Background

This section aggregates the findings of previous studies and extant literature upon which our research is based upon. More specifically, we will first introduce nudging – especially digital nudging – as a method to influence people's decision-making processes. The second section in this chapter then explicitly focuses on how nudging can impact and has impacted consumers' purchase decisions to be more environmentally friendly. Furthermore, this section also deals with previously identified cognitive barriers prohibiting consumers to purchase GFP.

Using Digital Nudging to Motivate Decision-Making

The term nudging was originally coined by Thaler and Sunstein (2009), who suggested that, instead of imposing bans or mandating certain decisions, individuals could be motivated and guided towards making decisions that are preferred by the designers of such nudges. The subtle alterations and moderations of decisions are intended to yield positive consequences for the people subjected to these nudges (Hagman et al., 2015; Osman et al., 2020; Sunstein, 2014). As the world is getting more and more digital, and - especially in the context of e-commerce - an increasing number of decisions are taking place digitally. Weinmann et al. (2016) first coined the term digital nudging. The transition to digital nudging in many application cases has shifted the given to the topic in IS literature, as nudging traditionally is rooted in the field of behavioral economics (Arnott & Gao, 2022).

Digital nudging is characterized as the implementation of various design features that offer the system's users guidance and alter their decision-making process. Digital nudging can be used to reliably impact consumers' behavior while ensuring that they retain their individual freedom of choice (Meske & Amojo, 2020; Schneider et al., 2018; Weinmann et al., 2016). This aspect constitutes a prominent concept in the nudging literature called libertarian paternalism. This concept mandates that the decision for or against an option needs to be freely taken so that humans can choose to accept or reject any endorsement by the system, if they prefer (Gal et al., 2020; Mirbabaie et al., 2021; Thaler & Sunstein, 2009). Therefore, nudges can be defined as a design strategy 'encouraging or guiding behavior without mandating or instructing' (Halpern, 2015, p. 22). Research has been able to demonstrate that, through the implementation of nudges, disparities between humans' personal opinions and their actions can be overcome, and they can be persuaded to act upon their opinions (Thaler & Sunstein, 2009; van Gestel et al., 2020), even though there are also studies that imply nudges depend on other psychological factors (Dennis et al., 2020; Ho & Lim, 2018; van Bavel et al., 2019). Extant research even goes as far as implying that the effectiveness of digital nudges might become even higher in the future when virtual reality technologies become more relevant (Laukkanen et al., 2022).

In recent years, an increasing number of digital nudging strategies have been established. The literature has suggested three different strategies as the most prevalent and effective ones (Lehner et al., 2016; Zimmermann et al., 2021): the simplification or framing of information (Aldrovandi et al., 2015; Mirbabaie et al., 2021; Xiao et al., 2022), applying default policies (Lehner et al., 2016; Roozen et al., 2021) or using social norms (Lehner et al., 2016; Roozen et al., 2021). By simplifying or (re)framing the information provided to consumers, their decision-making process and individual attitudes towards a product can be altered. Studies have already proven this strategy to be effective (Charlier et al., 2021; Haki et al., 2023; Roozen et al., 2021; van Bavel et al., 2019), for example, by changing or simplifying the name or description of a product to be more attractive to a certain target (consumer) group.

Out of these three strategies, however, two specific ones seem to carry the highest relevance for the present research: default nudges, which preselect one certain option of the various options offered, and social norm nudges, which present customers with information suggesting a specific option as more socially accepted; both of these options have been identified as exceptionally effective strategies for altering purchase decisions in an e-commerce setting (Djurica & Figl, 2017; Mols et al., 2015; Myers & Souza, 2020). Out of these two, default nudges have been deemed the most impactful nudge because they can reliably encourage certain actions (Hummel & Maedche, 2019; Thaler & Sunstein, 2009). This is largely because these default nudges exploit intuitive and subconscious thought processes (Benartzi et al., 2017; Sunstein, 2014; Whyte et al., 2012).

Research has shown that the presentation of a preselected option results in a higher likeliness of that option being chosen because deviating from that preselection requires a larger cognitive effort than simply following the suggested option (Schneider et al., 2018; van Gestel et al., 2020). These default nudges can be implemented by either adding a tag such as ‘recommended’ to an option that designers want to nudge the users towards or by visually preselecting an option through a default checkmark, a different background or a colored border around the option (Qu & Chau, 2023). In contrast, social norm nudges aim to tie a preferred option to a moral responsibility by suggesting that choosing a specific option might be perceived as more morally and socially accepted than choosing other options (Babar et al., 2023; Haki et al., 2023; Myers & Souza, 2020; Serra-Garcia & Szech, 2022). This nudging strategy appears to be especially useful when attempting to nudge users into making a decision that designers deem morally superior to other alternatives (Serra-Garcia & Szech, 2022). Furthermore, in this type of digital nudging, the influence of a group of people’s opinion on an individual’s purchase decisions has been highlighted (Yang et al., 2017).

Following the literature, another relevant factor to consider when applying nudges to an e-commerce system or environment seems to be the involvement level of the product to be purchased (Bauer et al., 2006; Flores et al., 2014; Jiang et al., 2015; Ku et al., 2016; Liu et al., 2022). Generally, products can be split into two levels of product involvement: low-involvement and high-involvement products. Low-involvement products, such as groceries or a coffee-to-go, are usually perceived as having less severe consequences - for example, when purchasing the wrong or a lower quality product - and, therefore, are associated with a less complex decision-making process. Previous research on nudging has identified the good applicability and effectivity of nudges on consumers’ purchase decisions regarding low-involvement products (Hummel & Maedche, 2019; Ingendahl et al., 2020; Torma et al., 2018).

In contrast, high-involvement products - such as cars, big holiday trips or clothing items - are perceived as having more severe consequences when purchased and, therefore, are subject to much more complex decision-making processes than low-involvement products. Few studies have examined the applicability and effectiveness of nudges in the context of high-involvement products, yet it seems that, for high-involvement products, different nudging strategies might be more efficient than those used in the context of low-involvement products (Bauer et al., 2006; Cho, 2010; Flores et al., 2014). An example of this is an experiment

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conducted by Roozen et al. (2021) that showed that, although the verbal nudge they applied had a significant effect on the participants' purchase decisions, the visual nudge was considerably less influential. This can partially be explained by the fact that, in the case of high-involvement products, consumers usually invest a higher cognitive effort into the evaluation of a product, subsequently perceiving deviations, for example, in price, more sensitively (Bauer et al., 2006; Zaichkowsky, 1985). Beyond this, the literature has revealed that a combination of external factors - not necessarily nudges alone - have a significantly higher impact on the purchase decision when it comes to high-involvement products (Amarasinghe Arachchige et al., 2022).

Environmentally Sustainable E-Commerce Purchase Decisions

Generally speaking, decision-making processes are shaped by two cognitive process systems: the instantaneous, intuitive process (first system) and the more analytical, cognizant process (second system) (Halpern, 2015; Thaler & Sunstein, 2003, 2009). More specifically, this means that, in the context of certain scenarios, humans deliberately evaluate their actions, for example, when acquiring new skills. When executing actions, they have executed various times before or that require no additional thought, humans tend to make certain decisions more subconsciously and intuitively, without much evaluation of the situation. Nonetheless, these two systems do not always accurately predict the decision-making processes of humans, especially customers, in an e-commerce environment, because purchase decisions are often impacted by additional factors (Bauer et al., 2006; Sunstein, 2017; Thaler & Sunstein, 2009).

These variances in the way in which customers make decisions need to be acknowledged as possible forces moderating their processes. To explain these possible forces, Lamb et al. (2012) suggested four different factors that might influence the decision-making processes of humans: *cultural influences*, including the attitudes of and connections with various (sub)cultural or social classes; *individual influences*, such as gender, age and self-perception factors; *psychological influences*, consisting of factors like an individual's expertise, opinions and perspectives; and *social influences*, which are the values and attitudes set and lived by the personal environment of an individual.

To put these factors into the context of the present study, a higher status, greater income and better education have been identified as factors influencing environmental consciousness (Gupta & Ogden, 2006). Additionally, the literature has found that consumers who identify with opinion leaders who are outspokenly supportive of more ecologically friendly purchasing behavior indeed exhibit a more environmentally friendly purchasing behavior (Bly et al., 2015; Park & Lin, 2020). Research has also identified a high relevance for consumers to identify with a topic - in this case sustainability - and to have a positive attitude towards sustainable behavior to be motivated to purchase GFP (Hasbullah et al., 2022; Huh et al., 2014).

Regarding the psychological influences, a factor that might discourage such sustainable behavior is an overabundance of information provided to customers (Halpern, 2015; Mols et al., 2015; Mont et al., 2014). This is especially evident when customers are faced with topics that are complicated and would require more logic to comprehend. Specifically in the case of GFP, previous research has identified seven different cognitive barriers that might hinder consumers from translating their attitudes towards sustainably produced fashion into actually buying such clothing items (Lee, 2011; Song & Kim, 2018; Wiederhold & Martinez, 2018; Yang et al., 2022). Table 1 provides an overview of these cognitive barriers.

Table 1 – Overview of Cognitive Barriers	
Cognitive Barrier	**Explanation**
Price	GFP are usually more expensive than non-ecologically produced clothing, which especially for younger people represents a cognitive barrier (Smith, 2022; Wiederhold & Martinez, 2018).
Availability	Few established brands offer a wide range of sustainable clothing items and the brands that do are usually not widely known and do not receive the same amount of advertisement as the established brands (Wiederhold & Martinez, 2018).
Lack of Knowledge	Many consumers have an insufficient level of knowledge to judge the sustainability of an item and therefore feel overwhelmed by the material or manufacturing information offered. They therefore need to trust the brands' sustainability claims (Wiederhold & Martinez, 2018).
Transparency and Trust	Many consumers do not want to trust brands' sustainability claims as they fear being subject to greenwashing. This is especially true for smaller, lesser-known brands. A lack of transparency regarding material and manufacturing conditions therefore represents a cognitive barrier (Venema et al., 2020; Wiederhold & Martinez, 2018).
Image	Many consumers do not consider GFP as fashionable and sometimes associate them with 'hippie people' (Wiederhold & Martinez, 2018, p. 424).
Consumption Habits	Many consumers tend to shop with a few, select brands and stores and consequently develop a loyalty towards those brands (Singh & Matsui, 2017; Wiederhold & Martinez, 2018). They might therefore be hesitant to shop with lesser-known sustainable brands.
Inertia	Consumers might be influenced by the assumption that their individual purchase decisions do not matter and that they cannot stop climate change (Wiederhold & Martinez, 2018).

The factors presented in this section have repeatedly been identified as inhibitors of the translation of customers' attitudes into more sustainable purchasing behavior. To combat these inhibitors, research has found little effectiveness regarding bans or mandates, with digital nudging being suggested as a compelling solution to steer customers' behavior without restricting their freedom of choice (Mols et al., 2015; Myers & Souza, 2020). The literature has echoed this notion, suggesting that IS can be used to positively influence environmentally friendly behavior (Dao & Abraham, 2021; Leung et al., 2019). The following section brings together the literature focusing on digital nudging in the context of ecologically friendly actions and consequently derives the hypotheses used for the present study.

Hypothesis Development

Research has demonstrated the aptitude of nudges in steering the behavior of individuals and impacting their decisions in both business contexts (Bammert et al., 2020; Buchmann & Haki, 2021), here with a focus on the users of a system (Henkel et al., 2019). Beyond that, some researchers have successfully implemented digital default nudges to promote ecologically friendly purchase decisions (Hummel & Maedche, 2019; Roozen et al., 2021). Therefore, it is sound to assume that such default nudges are capable of modifying customers' purchase decisions in a fashion e-commerce scenario. From this, we derive our first research hypothesis:

H1a: *Applying digital default nudges in fashion e-commerce scenarios leads to more consumers choosing GFP than they would in a scenario without a digital nudge.*

Beyond that, the literature has suggested that the process of making a decision is usually impacted by individuals' comparisons of their own attitudes and opinions with those of others (Aldrovandi et al., 2015; Claudy et al., 2013; Kretzer & Maedche, 2018; Turner et al., 1979). Because of this, it has further been demonstrated that social norm nudges might have a

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significant impact regarding ecologically friendly behavior: A study by Goldstein et al. (2008) has applied such nudging strategies to successfully motivate people to use hotel towels multiple times before asking for them to be exchanged for new ones. Another study carried out by Chakravarty and Mishra (2019) was able to reduce paper waste through nudging, and yet another study found that people could be encouraged to recycle their old items more frequently (Czajkowski et al., 2019). In this context, highlighting the work of Demarque et al. (2015) is also relevant: the researchers were able to prove that weak social norms also have an effect on the decision-making process by implementing both strong and weak social norms in an e-commerce environment. Consequently, both weak and strong social norms can be expected to encourage more sustainable purchase decisions. This yields our second hypothesis, which follows the structure of H1a:

H1b: *Applying digital social norm nudges in fashion e-commerce scenarios leads to more consumers choosing GFP than they would in a scenario that does not implement a digital nudge.*

Beyond these considerations, research has shown that so-called *nudge stacking*—a sequence of two or more nudges—may enhance the effect of the overall decision manipulation (Ingendahl et al., 2020; Kroll et al., 2019; Meske et al., 2022). This is also echoed by the findings of Dennis et al. (2020), who suggest that a combination of two popular nudging strategies was significantly more effective than the application of a single nudge. Furthermore, the findings of Ingendahl et al. (2020) and Kroll et al. (2019) have suggested that both social norms and default nudges increase the number of chosen environmentally friendly products, while the findings from a study conducted by Charlier et al. (2021) underlined that digital social norm nudges are especially effective when applied in conjunction with a second nudge strategy. Amarasinghe Arachchige et al. (2022) found that a combination of strategies might be especially effective when applied to high-involvement products. The assumption can be made that implementing a mix of social norms and default nudges has the potential to encourage more sustainable purchase decisions by increasing the purchase recurrence of GFP. Therefore, we derive our third research hypothesis:

H2: *Applying both a default nudge and social norm nudge in fashion e-commerce scenarios leads to more consumers choosing GFP than they would in a scenario with a single nudging strategy or no nudge at all.*

All three research hypotheses have been combined into a comprehensive research model, as shown in Figure 1. This research model aims to analyze the effect of digital nudging strategies on the selection frequency of GFP.

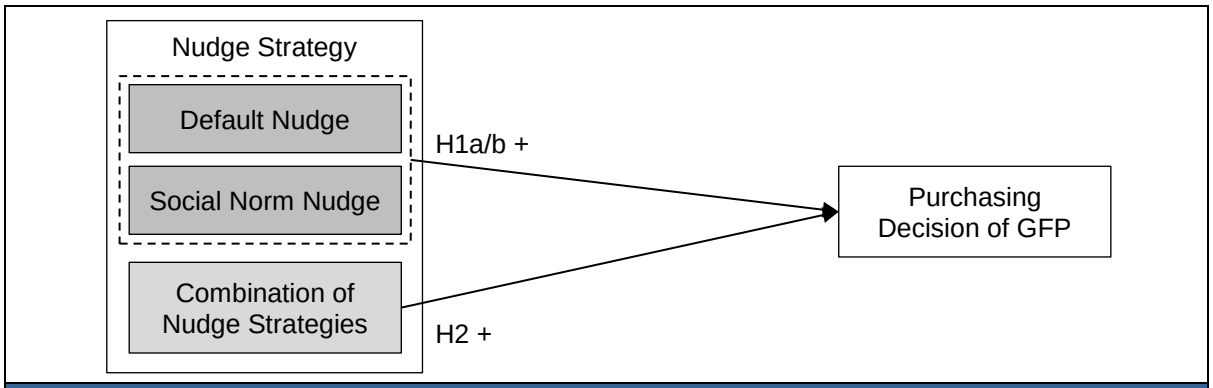

Figure 1 – Overview of the Research Model

Research Design

The first part of this section explains the research design of the online experiment, outlining the data acquisition process, the experimental task, the questionnaire's structure, and the stimulus material. The second part deals with the research design of the qualitative interviews by detailing the data collection process, the interview guide, the (expanded) stimulus material, and the analysis steps used to transcribe and examine the interviews.

This mixed methods approach has been chosen to not only collect quantitative data on whether digital nudges might significantly influence consumers' GFP purchase decisions, but to also gain a deeper understanding into the cognitive processes triggered when deciding for or against the purchase of an environmentally friendly fashion item. While quantitative studies allow for a representative sample to be examined using statistical analysis tools and methods, they do not offer the depth required to understand why consumers choose or avoid GFP over other clothing items.

Quantitative Online Experiment

To test the hypotheses derived in the previous section, we conducted an online study, mimicking a realistic fashion retail scenario. The present study was constructed as a between-subjects design, with four different treatment groups acting as the individual conditions. These treatment groups were arbitrarily assigned and included a *control group*, a group being exposed to a *digital default nudge*, another group experiencing a *social norm nudge* and, finally, one group undergoing a *combination of nudges*. Data was collected by sharing an online questionnaire realized through the survey tool *LimeSurvey* in a time frame of 33 days (between December 15, 2020, and January 21, 2021).

Data Sample and Analysis

Participants were recruited through personal contacts, colleagues from work, fellow students, and social media; they were able to partake in the experiment using both personal computers and mobile devices (such as smartphones, tablets, and laptops). The allocation to experimental conditions was automated and randomly performed by the survey tool. After the data collection time frame had ended, the survey data were then downloaded and imported into SPSS (version 29) for data cleansing and analysis. The most recent version of SPSS was chosen as it is one of the most widely used data analysis tools.

Questionnaire Structure

Participants first encountered a realistic e-commerce scenario in which they were presented with six different products: a backpack, a pair of pants, a t-shirt, a beanie, a pair of sneakers and a winter jacket. Each of these products was offered in two variants: one 'regular' variant and one that was portrayed as more environmentally friendly. The experiment task was to make a purchase decision for one variant per product.

After having made these six purchase decisions, the participants were questioned regarding their perceived autonomy when making the purchase decisions, which was followed by a testimony regarding their individual identification with ecologically friendly behavior. Finally, the demographic information included the participants' income, gender, age, and occupation. Table 2 provides an overview of the measured variables.

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Table 2 – Measurement of Variables

Variable	Definition	Measurement
GFP Selection	The GFP Selection describes whether a participant decided for purchasing the more sustainable fashion item.	Participants were able to choose either a non-sustainable fashion product (a value of 0 was assigned) or a GFP (a value of 1 was assigned). This binary variable exists for each of the four groups, and for each GFP choice.
Perceived Autonomy	The Perceived Autonomy describes how autonomous or manipulated the participants felt during the experiment, and whether they felt like their autonomy was ensured.	Participants' perceived autonomy was measured using the autonomy-subscale of the Basic Psychological Needs in Exercise Scale (BPNES) (Vlachopoulos et al., 2010). A Likert scale with five points ranging from 'strongly disagree' (1) to 'strongly agree' (5) was used to assign values to the variable.
Identification with Ecological Friendliness	The Identification with Ecological Friendliness describes to what extent participants identify with environmental issues and ecologically sustainable behavior.	Participants' identification with ecological friendliness was measured using the scale of group identification - the group being ecological friendliness - developed by Brown et al. (1986). A Likert scale with five points ranging from 'strongly disagree' (1) to 'strongly agree' (5) was used to assign values to the variable.
Nudging Type	The Nudging Type describes which of the four nudging strategies (no nudge, default nudge, social norm nudge, nudge combination) participants were exposed to during the experiment.	The nudging type was measured by translating the participant group (1, 2, 3, or 4) to the corresponding nudging type. The participant group was automatically assigned to each participant by the survey tool the moment participants started the online experiment. Participant group 1 equaled the control group, participant group 2 equaled the default nudge, participant group 3 equaled the social norm nudge, and participant group 4 equaled the nudge combination.

Stimulus Material

Comparability between the variants needed to be ensured, and any biases because of individual attitudes towards certain brands or styles needed to be avoided. Therefore, the two variants of each product looked almost identical, and they had the exact same product name. The main discerning factor between the variants was the product prices, as well as the description regarding the products' material composition. Importantly, to ensure a robust comparability between the experimental conditions, all participants were exposed to the same products (same prices, same aesthetics, and same names). The only aspect that was varied between experimental conditions was whether a nudge was present and if a nudge was present, which nudging type was used.

To increase the realism of the variants, the more environmentally friendly option was labelled as more expensive than the non-sustainable one. This represents the fact that more sustainably produced products are generally more expensive, with many consumers being ready to pay higher prices for a smaller ecological footprint option (Cecchini et al., 2018; Henninger et al., 2016; Lestari & Nita, 2021). Additionally, the material composition was labelled, for example '100% cotton' (varying across the different products). The more sustainable product was furthermore declared as a higher quality product with less of an environmental impact by an additional sentence, for example, reading 'produced with sustainable cotton' or 'environmentally friendly materials.' The digital nudging strategies were also immediately implemented into the e-commerce environment. For the treatment group *default nudge*, the survey tool allowed for implementing the default options that appeared as preselected radio buttons. Here, the GFP was chosen as the default option to be displayed as preselected.

On the other hand, for the treatment group's *social norm nudge*, additional information was added to the item intended to be perceived as more environmentally friendly. Specifically, the sentence added was framed in a green box and read 'x% of past customers have chosen this product'. Each GFP shown to the participants read a different percentage of people having chosen the product to make it more realistic (rarely do different products have the same number of people who bought them). Additionally, we chose different levels of social norm nudges: To represent a low level of social norm nudge, the text in the green box showed either 20% or 34%, for the representation of a medium level it showed either 46% or 52%, and to express a high level of social norm nudge, either 71% or 90% were shown. An example of this e-commerce environment that was used as stimulus material can be seen in Figure 2 below, with all products being displayed in the Appendix.

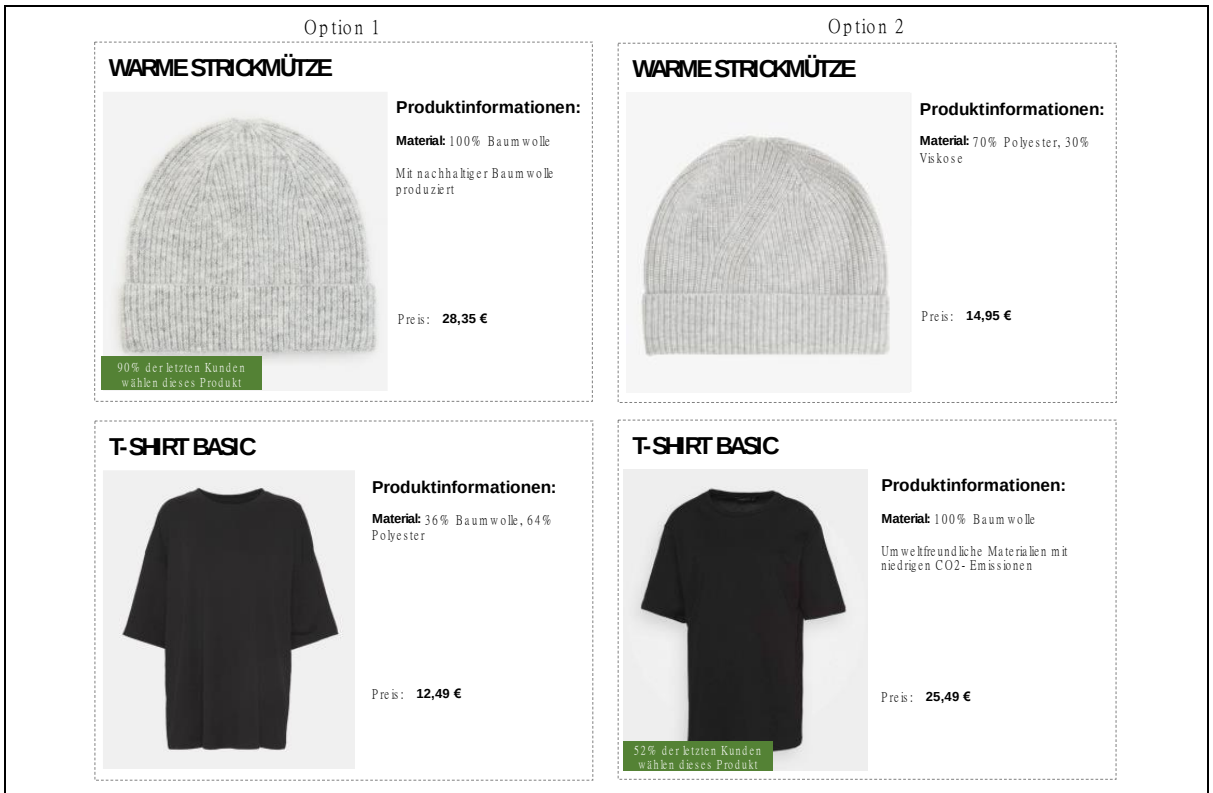

Figure 2 – Exemplary Stimulus Material from the Experiment

Qualitative Interviews

To advance the understanding of what factors influence consumers' purchase decisions when shopping online for clothes, we decided to follow a qualitative research approach as a follow-up study to our original experiment. These interviews were all conducted virtually via video conferencing tools and participants were recruited via email, social media, and face-to-face conversations. The interviews were each conducted individually in February of 2023.

Data Sample and Analysis

We applied a purposeful sampling technique and used several inclusion and exclusion requirements: Individuals who have never purchased clothes online, who do not buy their own clothes or who have never bought anything online were excluded, as these individuals are likely not going to be affected by nudges on e-commerce platforms. This means that all individuals who have already purchased clothes online or regularly do so were suitable interview candidates as they represent the target audience (consumers of online fashion retail).

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Choosing users of a system for an evaluation of said system is a common approach for sampling interviewees (Fox & Connolly, 2018; Guzman, 2019; Maier et al., 2015).

Beyond that, we made sure to balance out the distribution of genders by acquiring the same amount of female and male interviewees. Regarding the age of participants, we decided to only interview individuals who were over the age of 18, combining this with the prerequisite that they had to earn their own money so that their individual budget for clothes was determined by their occupation. Regarding this, we also aimed for a heterogenous group of different occupations to inquire about the influence that individual budgets might have on GFP purchase. Additionally, we aimed at not only interviewing young consumers, who buy online more frequently than older people (eurostat, 2023), but balance the demographics. An overview of the sample can be found in Table 3.

Table 3 – Overview of the Interview Sample

Interview ID	Age	Gender	Occupation	Interview Duration
I1	28	female	Scientific Researcher	27 minutes
I2	24	female	Change Manager	16 minutes
I3	26	female	Student	20 minutes
I4	29	male	Scientific Researcher	17 minutes
I5	25	female	Business Development Employee	27 minutes
I6	26	male	Scientific Researcher	23 minutes
I7	51	male	Magistrate	11 minutes
I8	53	female	Elementary School Teacher	11 minutes
I9	27	male	Communications & Marketing Employee	12 minutes
I10	26	male	Logistics Employee	13 minutes
Average	**31.5**	**/**	**/**	**18 minutes**

The interview audio was recorded for later ad verbatim transcription, for which Microsoft Word was used.

Interview Guide

As we wanted to ensure a good comparability across all interviews, we conducted structured interviews following an interview guide. The purpose of these interviews was to enrich the knowledge derived from our quantitative online experiment with more information on what factors influence the purchase decision of consumers when shopping for clothes online. As part of the interview guide, interviewees were first asked about their online shopping behavior and whether they would rather shop for clothes online or in physical stores. Then, interviewees were shown the seven products and were asked to choose one of the two options whilst explaining their decision process and reasons for or against each of the options. Afterwards, participants were asked to report their own environmental consciousness by stating how important sustainability is to them and their decisions. Finally, the factors inhibiting the purchase of GFP introduced by Wiederhold and Martinez (2018) were individually introduced to the interviewees, who were then questioned on whether each of the factors had any influence on their purchase decisions when buying clothes.

Supporting Stimulus Material

For the interviews, we decided to also incorporate the third major digital nudging strategy (Lehner et al., 2016; Zimmermann et al., 2021), the framing of information, amongst the default and social norm nudging strategies. To this end, we adapted the original stimulus material from the online experiment for use in the interview by including seven products in total. Each of this product, again, had a regular option and a more environmentally friendly option, which included one of the nudging strategies, resulting in seven total products to represent every nudging strategy, as well as every possible combination of strategies.

As for the implementation of the nudging strategies, we used the same implementation for the social norm nudge as in the online experiment. The default nudge was implemented by adding a border around the GFP (see Figure 3 below). This implementation has been used in previous studies and can therefore be considered suitable for this nudging strategy (Qu & Chau, 2023).

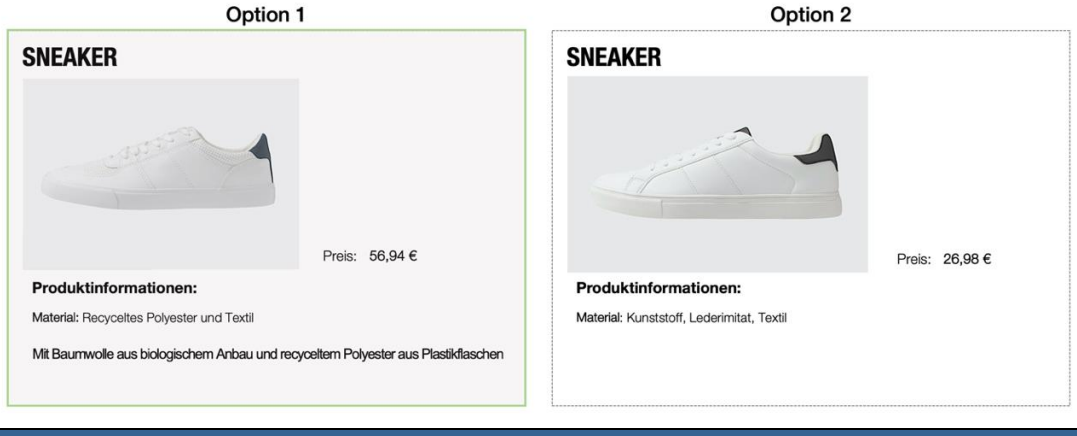

Figure 3 – Default Nudge Implementation in the Interview Stimulus Material

The reframing of information was implemented by the addition of a text box reading “With the purchase of this [product name] you contribute to a healthier planet” in German (see Figure 4 below). This implementation has been used in previous experiments (Charlier et al., 2021; Roozen et al., 2021). The full stimulus material can be found in the Appendix.

Figure 4 – Reframing of Information in the Interview Stimulus Material

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Results of the Online Experiment

Descriptive Statistics

The unadjusted sample size included 404 responses to the questionnaire. When cleansing the data, 84 questionnaires had not been finished, resulting in the removal of these 84 data sets, resulting in a sample size of 320 responses. The remaining participants' responses were then further checked for missing values (e.g., any empty fields), out of the range values (e.g., an unlikely age like greater than 120) and entry errors (e.g., faulty entries or corrupted data). However, there were no additional responses that had to be removed for any of these reasons. Finally, the responses were checked for response biases, such as errors of extreme or central tendency (Furnham, 1986; Nederhof, 1985), which also resulted in no further removals. Therefore, the final sample size used for analysis was 320 responses.

Out of these responses, 249 (77.8%) identified as female and 71 (22.2%) as male, with no participants identifying as diverse or other. The sample's mean age was 32.19 years, with a standard deviation of 11.05 years. The participants were evenly assigned to the treatment groups, with 87 participants each in the groups *default nudge*, a *social norm nudge* and a *combination of nudges*. The only exception was the group *control*, which only had 59 participants. To ensure a good informative value, each scale was checked for its internal reliability: Both the autonomy subscale of Brown et al. (1986) and the scale measuring identification with ecological issues yielded good internal reliability (α = .73 and α = .77, respectively). Overall, the participants perceived a high freedom of choice (M = 3.94, SD = 0.84) and demonstrated a high self-reported identification with ecologically sustainable actions, here with a mean value of 4.07 and standard deviation of 0.58.

Overall, the participants selected 3.83 out of 6 GFP, with a standard deviation of 1.55 across the treatment groups. A closer inspection reveals that those participants who experienced a social norm nudge exhibited the highest GFP selection (M = 4.09, SD = 1.42), with participants who experienced a stacking of nudges selecting the lowest number of GFP (M = 3.53, SD = 1.59). All GFP selection values are shown in Figure 5.

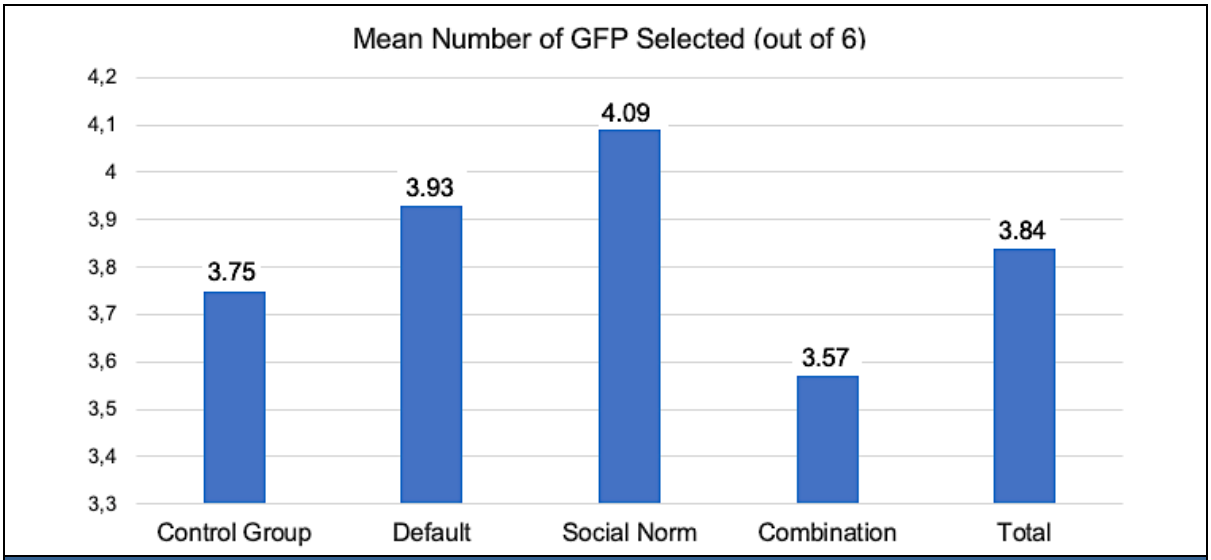

Figure 5 – Distribution of Average GFP Purchase by Group

Analysis of Digital Nudging Strategies

Prior to calculating any analyzes, the GFP selection variable needed a transformation: As part of the interview guide, the participants' GFP selection was measured as a binary value (1 for GFP chosen, 0 for GFP not chosen) for each product. This resulted in six variables (one per item) for each of the four groups, leading to 24 individual variables. A new variable summarizing these 24 individual GFP decisions was calculated: Depending on the participants' nudging type group, the corresponding six GFP selections were added up. The new variable had a value between 0 (no GFP was selected) and 6 (all six GFP were selected).

With this new GFP selection variable, we calculated a one-way ANOVA, which used this new variable as the dependent variable and the treatment (nudging) groups as the independent variable. This analysis revealed that there was no statistically significant difference between the treatment groups ($F(3,316) = 2.132$, $p = .096$). Consequently, research hypotheses H1a, H1b, and H2 need to be rejected.

Exploratory Analysis

Because all three research hypotheses had to be rejected, we conducted additional analyzes to explore other conceivable influences. Initially, attention was given to a possible difference between the treatment groups in their self-reported attitudes towards acts of environmental consciousness. Another ANOVA was calculated to analyze whether there was such a deviation, yet the results demonstrated that any such a difference was not statistically significant ($F(3, 316) = 1.44$, $p = .231$). Yet another possible influencing factor was suspected in the participants' perceived freedom of choice. The calculated ANOVA returned a heterogeneous variance ($p = .157$), which lead to a further examination of the Welch test. As with personal identification with environmental consciousness, the perceived autonomy of the participants exhibited no significant difference ($F(3,316) = 1.32$, $p = .268$). Table 4 shows the mean values for perceived freedom of choice (autonomy) and the self-reported attitude towards environmental awareness (identity).

Table 4 – Average Indication for Individual Treatment Groups

Treatment Group	Autonomy (Wachner et al., 2020)		Identity (Brown et al., 1986)	
	M	SD	M	SD
Control Group	3.96	0.81	4.11	0.55
Default	4.05	0.86	4.05	0.54
Social Norm	3.96	0.85	4.15	0.56
Combination	3.81	0.81	3.98	0.64
Total	3.94	0.84	4.07	0.58

Because we suspected that an interaction between each of the nudging strategies and the value by which participants rated their individual attitude towards environmental awareness would be able to forecast the number of chosen GFP, running a moderation analysis seemed sensible. This analysis was executed by employing PROCESS, as suggested by Hayes (2018). The PROCESS model proved to be significant ($F(3, 316) = 15.49$, $p < .001$, variance resolution: 14.41%), but the result was unable to prove that the self-reported environmental awareness moderated an affiliation of treatment group and number of chosen GFP ($\Delta R^2 = 0.27\%$, $F(1, 316) = 0.92$, $p = .338$, 95% $CI[-0.377, -0.14]$). In such cases, Hayes (2018) recommends removing the interaction term from the equation. To implement this, we chose a linear regression analysis, which included the number of GFPs chosen as the dependent variable and the four treatment groups and their environmental awareness as the independent variables. All linear relationships are displayed in a scatterplot (Figure 6).

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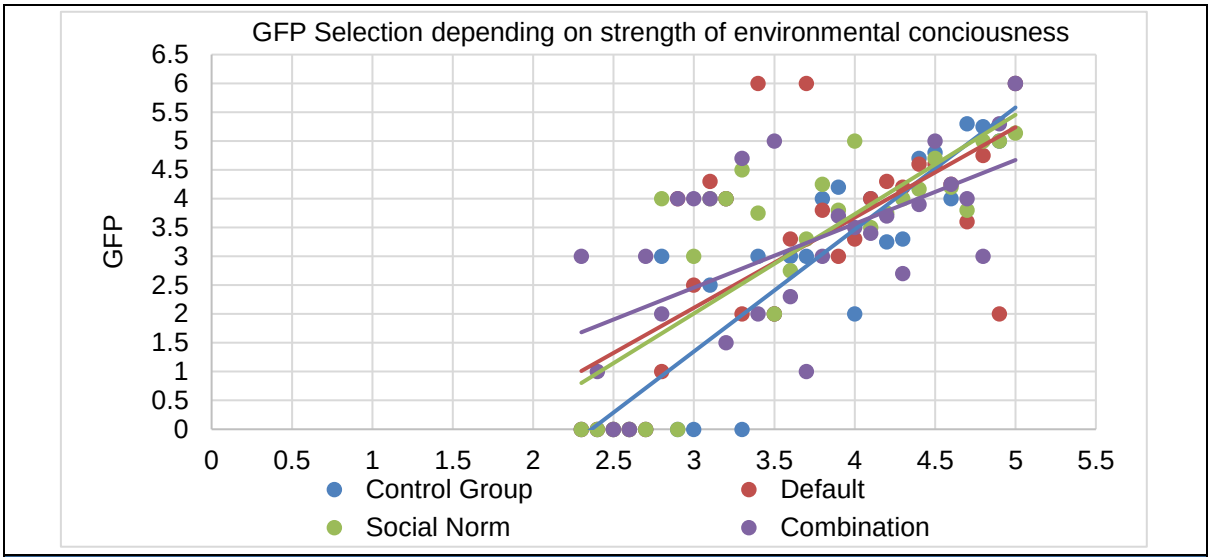

Figure 6 – Distribution Demonstrating the Moderation Effect of Social Identity on Number of Selected GFP

This model was able to prove that there was indeed a significant link between the participants' environmental awareness (B = -1.01, p < .001) and number of chosen GFP. There was no significant link between the various digital nudges and number of GFPs chosen (B = -0.04, p = .615). Specifically, by increasing the value of environmental awareness by one unit, the number of chosen GFP increased by 1.01 units on average. When examining the individual treatment groups more closely, the number of chosen GFP increased most strongly in the group that had no nudges applied in their e-commerce scenario (B = 1.61) and least strongly in those scenarios that implemented a stacking of nudges (B = 0.94). A lower-than-average increase in the chosen GFP could be observed in the treatment groups that experienced a default nudge (B = 0.78) or social norm nudge (B = 0.79).

To test for other possible influences, we conducted an ANCOVA with the previously mentioned newly calculated GFP selection variable as the dependent variable, the treatment group as the independent variable and participants' perceived autonomy, identification with ecological friendliness, gender, education level, income, occupation, and age as covariates. This analysis revealed, that except for two, none of these covariates moderated the influence of treatment group on GFP selection. Participants' perceived autonomy (F(1,308) = 19.054, p < .001, partial η^2 = .058) and identification with ecological friendliness (F(1,308) = 41.862, p < .001 partial η^2 = .119), however, did have a moderating effect on the influence of treatment group on GFP selection. However, the Bonferroni-corrected post-hoc analysis did not provide a reliable statement over which groups differed in the GFP selection, as shown by the below Table 5.

Table 5 – Bonferroni-Corrected Post-Hoc Test

I Group	J Group	Sig.	Mean Difference I-J	95% Confidence Interval	
				Lower Bound	*Upper Bound*
Control Group	Default Nudge	>.999	-.206	-.829	.417
	Social Norm Nudge	>.999	-.256	-.882	.370
	Nudge Combination	>.999	-.006	-.631	.620

A simple test for contrast effects also did not yield statistically significant results (F(3,308) = .703, p = .551, partial η^2 = .007).To further investigate the influencing factors on GFP selection, we conducted multiple probit regression analyzes using the participants' purchase decision as a binary dependent variable with a value of 1 if a participant decided to purchase

the GFP and 0 if they chose the less sustainable option. The nudging type was used as an independent variable, with the perceived autonomy and sustainability identification as control factors. The probit regression analyzes were first calculated for each product. This revealed that for the control group, the identification with sustainability significantly impacted the GFP selection of products 3 ($B = 2.37$, $p < .001$) and 5 ($B = 1.61$, $p < .001$). According to the omnibus test, both models were significant ($p < .001$). Regarding the default nudge, for product 2 ($B = 0.46$, $p < .001$) the fitted model was significant according to the omnibus test ($p < .01$). For the social norm nudge, the identification with sustainable behavior had a significant impact on the nudge's effectivity in the choice of product 6 ($B = 0.60$, $p < .05$). The fitted model was again significant ($p < .05$). Finally, for the combination of nudging strategies, the identification with sustainable behavior had a significant impact on the nudge's effectivity in the choices of product 3 ($B = 0.75$, $p < .01$), product 5 ($B = 0.85$, $p < .01$) and product 6 ($B = 0.47$, $p < .05$). All three models were significant ($p < .001$, $p < .001$, and $p < .05$ respectively). Furthermore, the perceived autonomy also impacted the nudge combination's effectivity when choosing an option for product 5 ($B = 0.55$, $p < .01$) with a significant model ($p < .001$).

We also conducted additional probit regression analyzes, pooling all six GFP selections into one binary dependent variable: If a participant chose all six GFP, the variable received the value 1, else it received the value 0. As with the previous set of analyzes, we again used the nudging type as an independent variable, with the perceived autonomy and sustainability identification as control factors. This revealed that the control group's purchase decision was significantly influenced by the identification with sustainable behavior ($B = 1.95$, $p < .005$). The fitted model was significant ($p < .001$). When pooled, the effectivity of the default nudge was neither affected by the perceived autonomy ($p = .74$), nor the identification with sustainability ($p = .782$). This stands in contrast with the social norm nudge, which's effectivity was indeed positively impacted by the identification with sustainability issues ($B = 0.83$, $p < .005$). The omnibus test was also significant for this model ($p < .005$). Finally, the effectivity of the combination of nudging strategies was also positively affected by the reported individual identification ($B = 0.66$, $p < .05$), with a significant omnibus test ($p < .005$).

We also attempted to find demographic influences on the purchase decision of GFP. To this end, we conducted a T-test with participants gender (either male or female) as the independent variable and the pooled GFP purchase variable as the dependent variable. This test revealed no significant effects of the participants' gender on GFP purchase. Beyond that, we conducted a MANOVA with participants' age, occupation, income, and education as independent variables and the pooled GFP purchase variable as the dependent variable. The examination of Wilks' Lambda showed that the model was significant for the participants' age ($p < .001$) and income ($p < .001$), as well as the interaction between education and income ($p < .05$) and occupation and income ($p < .001$).

Upon further inspection, participants' age had a significant effect for both the default nudge ($F(4, 42) = 1.62$, $p < .05$) and social norm nudge ($F(4,42) = 1.86$, $p < .01$). Participants' income also influenced both the default ($F(6,42) = 3.67$, $p < .01$) and social norm ($F(6,42) = 2.62$, $p < .05$) nudging strategy. The interaction between education and income had a significant influence on GFP selection for the default nudge ($F(24,42) = 2.36$, $p < .001$). The interaction between participants' education and income had a significant effect on the control group ($F(12,42) = 2.73$, $p < .01$), social norm nudge ($F(12,42) = 3.47$, $p < .001$) and combination of nudges ($F(12,42) = 2.21$, $p < .05$).

Findings of the Interviews

On average, interviewees chose 5.3 out of 7 GFP, with participants choosing at least three GFP (I4, I9, I10) as a minimum and seven GFP (I1, I2, I6) as a maximum. Female participants (I1, I2, I3, I6, I8) chose an average of 5.2 out of 6 GFP, while male participants (I4, I5, I7, I9,

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I10) chose an average of 4 out of 6 GFP. Participants under the age of 50 (I1, I2, I3, I4, I5, I6, I9, I10) chose an average of 4.5 out of 6 GFP, while participants over the age of 50 (I7, I8) chose an average of 5 out of 6 GFP. Interviewees were also questioned regarding their individual identification with sustainable actions in general. Six interviewees reported a strong identification with sustainability, choosing to let their environmental consciousness influence most – or even all – of their decisions (I1, I2, I5, I7, I8, I10). Two interviewees reported a medium level of environmental consciousness, stressing that they are not ready to let sustainability influence all decisions (I3, I6). The remaining two interviewees do not identify with sustainable actions. One interviewee claimed that their own choices only have a very small impact and sees the responsibility with the brands and companies rather than with individuals (I4), while the other simply reported having no interest in the fate of future generations (I9).

Reaction to the Digital Nudges

Whilst examining the product choices, some interviewees already pointed out some of the nudges. In addition, interviewees were asked whether they felt manipulated whilst choosing the products after completing the seven product choices.

With regards to the **default nudge**, half of the participants noticed or mentioned the nudge (I1, I5, I6, I8, I9). Most interviewees reported not feeling influenced at all (I1, I5, I6), with one interviewee describing a small influence on their decision (I8). Finally, one interviewee felt manipulated and decided to rebel against the nudge's recommendation: *"I sometimes have a bit of an 'bite me, I'll do my own thing'-attitude, that's how I would justify it"*. (I9)

However, these sentiments do not correlate with the number of GFP chosen, for example I1, who did not attribute any influence to the nudge, chose all four GFP that exhibited a default nudge, and even the interviewee that reported an adverse effect of the nudge (I9) chose two of these four GFP.

The **social norm nudge** was noticed and mentioned by every interviewee except for one (I7). Two interviewees mentioned the nudge but stressed that they did not consider the recommendation as part of their decision-making process (I1, I3). Despite not feeling influenced, I1 chose all four GFP that exhibited a social norm nudge.

Three participants (I4, I5, I8) mentioned that they considered the recommendation as part of their purchasing decision, however it was never the main reason. Considering the product choices of these three participants, only one chose all GFP that had a social norm nudge (I5), with the other two just choosing some of the options that seemed to be recommended by other customers. A further three participants stated that they were annoyed by the recommendations and failed to see the relevance of such statements (I2, I6, I10). They therefore chose to purposely ignore the statements:

> *46% of the last customers also chose this product. Yes, information like this I find completely unnecessary, I must say. I always ask myself what this is supposed to tell me, is this a product that is somehow hyped or something? But ultimately it doesn't matter to me whether other people have also bought it or not. […] I would still take [the GFP], but not because anyone says that others have also bought it, because I really think that this is irrelevant.* (I6)

Finally, one interviewee pointed out that such recommendations did not influence their own decisions because they simply value their own reasons more than any manipulations, often prompting them to rebel against social norm nudges (I9). Despite that, however, this interviewee chose three out of four GFP that used a social norm nudge.

The **reframing of information** nudging strategy was only noticed and mentioned by four interviewees (I3, I8, I9, I10). Two of these interviewees attributed a small influence of this nudge on their purchase decision (I3, I8), yet did not mention it as a reason when stating their purchase decision during the experiment:

> *I clearly saw that one, one option had significantly less information on where the material is coming from […]. It's actually the case that you look at pictures differently than you look at the description, so I did have the feeling that I was pushed into a certain direction […].* (I8)

As with previous examples, only one of the two interviewees chose all products that had their information reframed (I3). The other two interviewees that mentioned this nudging strategy were annoyed by it, even mentioning an adverse effect (I9, I10). However, even though both participants explicitly stated their dislike of this nudging strategy, they nonetheless chose three (I9) and two (I10) out of four possible GFP that exhibited reframed information.

Influencing Factors for Sustainable E-Commerce Purchase Decisions

To understand the factors influencing the interviewees' purchase decisions, we asked them to evaluate what importance each of the factors identified by Wiederhold and Martinez (2018) yields for them. The first factor, **price**, was relevant to all except one interviewee, who claimed that they do not consider the price as relevant because they tend to always shop for used clothes (I1). Three interviewees claimed the price to be one of the most important factors to consider when deciding for or against a clothing item (I4, I9, I10). Reasons for the price's relevance varied between the three interviewees, however, a limited budget was often quoted as a reason.

> *But overall, the price is the most important when considering comparable products. Because you've only shown products that are the same, at least from the appearance, and they have different prices, then I think I orient myself a bit more on the price.* (I9)

The remaining six interviewees attributed a medium-level influence to the price (I2, I3, I5, I6, I7, I8), with most of them stressing that while they are aware that sustainable clothes need to be more expensive, they would only be ready to spend more up until a certain amount (I3, I5, I6, I7, I8). Many of these interviewees also pointed out that they believe that more sustainable and expensive clothes would also yield a better quality, thus justifying the higher price (I3, I5, I8).

Another interviewee believes that the price is important, but because they only shop for clothes about twice a year, they would be ready to spend a bit more and buy sustainable products with a higher quality and longevity (I2). One interviewee further pointed out that if they had unlimited funds, they would always and exclusively choose sustainable clothes, yet as this was not the case, they had to weigh their options (I6). The second factor, **transparency** regarding materials and manufacturing conditions, was dismissed by one interviewee:

> *Well, I think I'm relatively gullible in that regard. No, if it says that it's made from recyclable or recycled polyester, or if there's some kind of quality seal on it, I usually trust that when the companies state that. I'm not the kind of person who then goes and tracks every single supply chain. […] This time, to look everything up in great detail, I just don't invest that.* (I7)

Four interviewees attributed a medium-level importance to the transparency (I4, I6, I8, I9): One interviewee reported that they are more influenced by a lack of transparency than the actual information provided (I6), with another interviewee explaining that they generally do not trust companies' sustainability claims and are mainly interested in the materials to satisfy their

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own preferences (I4). A third interviewee mentioned that their need for transparency depends on the product in question and is also influenced by the looks and price of the product, as well as how urgently they need it (I8). Finally, the fourth interviewee pointed out that they want companies to justify higher prices with material transparency (I9).

The remaining five interviewees considered transparency as a highly important factor (I1, I2, I3, I5, I10). All of them agree that, to justify a higher price, companies need to be transparent about the clothes' materials and origins. One interviewee emphasised the need for transparency regarding material composition (I2), while another highlighted the need to know where and how the clothing item was manufactured to avoid child labour (I3). The remainder of interviewees did not highlight one over the other and generally valued transparency. A relevant factor in this context is the acknowledgement of one interviewee that they must trust labels and certificates as they cannot verify them (I2, I7, I8).

The **looks** of clothing item is the only factor that all interviewees agreed on having a very high influence on the purchasing decision. Five interviewees reported the looks of clothes to be the most important factor and influences the decision more than any other aspect of the item (I2, I4, I7, I9, I10). *"Well, I have to be honest, this is a big influence for me because I like beautiful things and aesthetic things and so, if I didn't like a sustainable product, then I wouldn't buy it just because it's sustainable"*. (I7)

Two interviewees mentioned that they would buy an item they think looks good, regardless of its environmental friendliness (I4, I9). Many interviewees, however, explained that their preferred clothes should both look good and be environmentally friendly at the same time, mentioning that they would rather not buy anything than either buying something that does not look good or settling for a non-sustainable option (I1, I5, I6, I7).

The evaluation of the **availability** of sustainable options yielded mixed results: Four interviewees replied that the availability – or lack thereof – does not impact their purchase decision (I5, I7, I9, I10). The reasons for this are plentiful: Some generally prefer a smaller selection of options to not feel overwhelmed (I5), while others believe that a lower availability is a marketing trick (I9) or simply does not affect their shopping behavior (I10). Another diminishing factor is that interviewees might just try and find a store that had sustainable options if they valued that (I7).

Contrary to that, three interviewees felt that a limited availability of environmentally friendly clothes has a large impact on their purchase decision (I2, I3, I6). This is largely owed to the fact that the imbalance of fast fashion and environmentally friendly options makes identifying more sustainable options more difficult (I2), as well as creating an impression of hypocrisy or even greenwashing (I3). Beyond that, availability is crucial when a new clothing item is needed urgently: If there are no sustainable clothing items, yet a new item is needed rather quickly, a non-sustainable piece of clothing would instead be purchased (I6).

Lastly for three interviewees, the availability only plays a medium role (I1, I4, I8). One interviewee explained that a lower availability usually indicates a more popular product to them, which in turn would make them consider this product differently (I4). Another interviewee again mentions the factor of urgency: If they urgently need a product which does not have many sustainable options, they would also buy the less sustainable option, but if they have more time to look for a suitable product, they would prefer the sustainable option (I8). Finally, the third interviewee presents an own way of coping with a lower availability:

> *That's definitely annoying me. But, because it also reflects this problem, how slowly everything evolves towards slow fashion and sustainable fashion […] My strategy is, as I said, to always look for used clothes, which I find to be very good, too. Then, you still have the whole selection, and of course there are products which aren't*

> *environmentally friendly, but for me second hand is still okay, […] it's just as good as buying a sustainable product.* (I1)

While all female participants claimed that availability had at least a medium effect on their purchase decision, only two male participants agreed (I4, I6), with the rest stating that it had no effect on their purchase decision.

The influence of a **feeling of powerlessness** in the face of climate change has been confirmed by four interviewees (I2, I3, I5, I8). The other interviewees might also have experienced a feeling of powerlessness before but have not been influenced by it as they believe that change can only come when individuals initiate such change (I1, I3, I6, I7, I10). *"I think every decision you make helps to, let's say, reduce climate change a little bit. I can't save the world, but I can at least make sure that I have a clear conscience"*. (I10)

One interviewee also stated that they simply do not care enough about climate change to be affected by this feeling, citing a lack of altruism as the reason (I9). For the interviewees that do feel affected by this feeling, one of them explained that they use that feeling to justify also purchasing less environmentally friendly clothes sometimes. This interviewee also reported a very high influence of this feeling (I5).

The three other interviewees who mentioned this feeling reported that they do sometimes get affected by this feeling but try to push it aside and still follow their ideals, yet that does not always work (I2, I3, I8). This leads to these participants sometimes 'caving in' and purchasing a non-sustainable piece of clothing instead. While four female participants stated that the feeling of powerlessness influenced their decision to some degree (I2, I3, I6, I8), none of the male participants reported an effect on their purchase decision.

Four interviewees reported being affected by their **brand loyalty** when deciding for or against the purchase of certain clothes (I1, I2, I4, I9). The other interviewees usually rather shop in online stores that have many different brands (I3), care more about looks, price, and fit (I5, I6, I10) and would be ready to try out new, more environmentally friendly brands that they have not yet heard of (I7, I8).

In contrast, three interviewees relate to a strong brand loyalty (I1, I4, I9). These interviewees highlight that they prefer how their preferred brands look and fit them (I1, I4), only being ready to buy clothing from an unknown brand if it is cheaper than their preferred brand (I4, I9). One interviewee explained that, to combine their brand loyalty with their environmental consciousness, they only buy these brand clothes on the used market (I1). Another interviewee added that they would not be ready to spend more money on a brand that they have not yet built trust in (I9). Finally, one interviewee only feels mildly affected by the brand loyalty, stressing that they would give up that loyalty considering poor environmental friendliness (I2).

The final factor identified by Wiederhold and Martinez (2018), the individuals' **level of knowledge** regarding sustainable materials, affects all interviewees except for one, who already has a good level of knowledge through a work project dealing with sustainable fashion (I1). However, this interviewee also acknowledges that material complexity is a relevant issue in the context of sustainable fashion.

Three interviewees reported a medium impact of their level of knowledge (I3, I5, I9), with many having a certain level of knowledge regarding the quality, longevity, and sustainability of materials.

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> *I might be imagining, I probably don't have a real knowledge on how sustainable polyester and polyurethane are, but you pick up on things. And […] I also took a seminar on greenwashing, which had many case studies in it, especially regarding fast fashion. But I am not a professional at this and you can quickly be influenced by the environment, by all these technical terms.* (I9)

The six interviewees who reported being highly impacted by their level of knowledge all mentioned that they have no tangible knowledge on the environmental friendliness of the materials that clothes often are made of (I2, I4, I6, I7, I8, I10). One reason for this is that looking up the environmental impact of every material would take too much time (I4). Another reason is that even if the interviewees have heard of a material before, often they are unable to compare the environmental impact of these materials against each other (I2, I6, I8) and therefore must rely on the brands' declarations (I10). In this context, the interviewees explicitly wished for more readily available and easy to understand information on why certain materials are environmentally friendly (I2, I7).

Beyond these factors, interviewees have pointed out more deciding aspects which they consider when making a purchase decision for a fashion item: All interviewees except for I7 mentioned clear preferences for or against certain materials:

> *Okay, okay. 1% spandex versus 8%. Spandex makes pants more comfortable. I'm aware that the pants contain plastic then, but I have 100% cotton jeans and I just can't kneel or sit down comfortably in them. Therefore, I'm always at around 3% spandex.* (I5)

Another common deciding factor – which has already been touched upon in the context of the price – is the assumption that more expensive clothes have a higher quality and longevity (I1, I2, I3, I5, I8): *"I probably also still have this image in my head – which of course isn't always true, I realize – that a higher price speaks for a better manufacturing and, yes, a better product that lasts longer"*. (I3)

Other than that, all reasons stated by the interviewees throughout the experimental part of the interviews were represented by the factors introduced by Wiederhold and Martinez (2018).

Discussion

The objective of this study was to analyze how well various nudging strategies could be applied in a fashion e-commerce scenario to encourage consumers to purchase more GFP. By inserting the results of the explorative analyzes, the original research model needs to be adjusted by adding individual environmental awareness as a factor modifying the effectiveness of the nudging strategies. Furthermore, the results from the interviews need to be considered, too: The purchasing decision is not only influenced by a moderating effect of environmental consciousness on the effectiveness of nudging strategies, but – independently from the nudges – is also influenced by various individual factors, many of which have been introduced by Wiederhold and Martinez (2018). Beyond that, the interviews revealed a possible negative effect of the individual disposition on the nudges' effects, as well as a moderation effect of individual factors on the nudge effectivity. The revised research model is displayed in Figure 7.

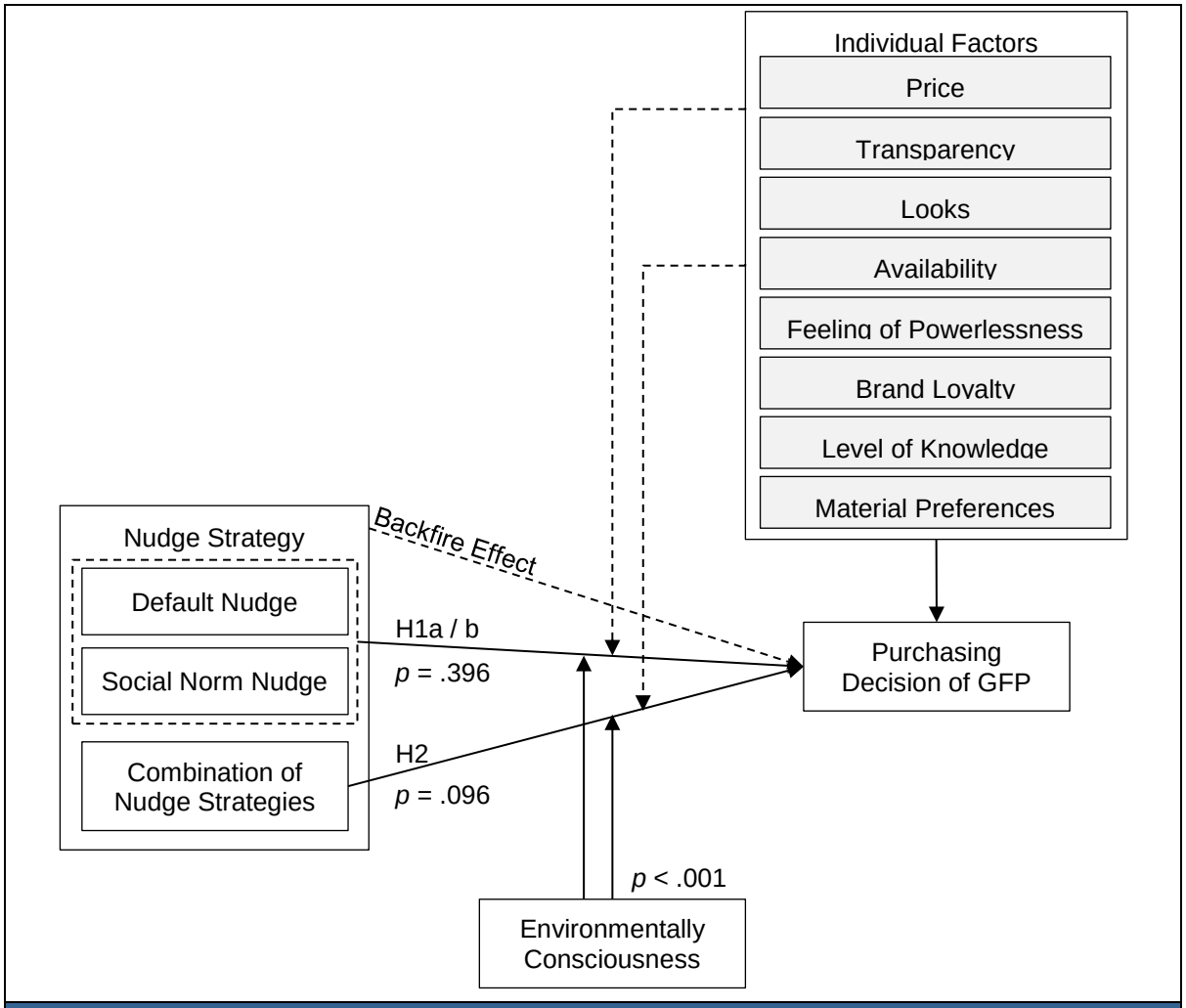

Figure 7 – Adjusted Research Model Including Test Results

The Role of Digital Nudging for Sustainable E-Commerce Purchasing Behavior

First, the online experiment analyzed whether applying various digital nudges to an e-commerce environment could reliably boost the number of purchased GFP. While testing the research hypotheses, any differences observed were of no statistical significance, implying that, statistically, all participants exhibited highly comparable behavior. This contravenes with much of the literature, which has successfully demonstrated that both nudging strategies are capable of reliably increasing the motivation to purchase ecologically sustainable products (Aldrovandi et al., 2015; Charlier et al., 2021; Demarque et al., 2015; Ingendahl et al., 2020; Roozen et al., 2021). Furthermore, previous studies have shown that stacking various nudges yields the highest effectivity (Amarasinghe Arachchige et al., 2022; Charlier et al., 2021; Ingendahl et al., 2020). This contradiction might motivate future research to examine whether digital nudging simply does not produce significant effects when applied to high-involvement purchase decisions or if new nudging strategies should be developed to specifically target these high-involvement products. It is, however, imperative to not only consider the results of the online experiment (which did not yield statistically significant results), but rather to interpret the data in conjunction with the interview data: The combination of both methods paints a clearer picture, revealing that the purchase decision for clothes is influenced by a variety of individual factors, including price, looks, and material preferences.

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A possible inference that could be derived from the descriptive results – and which has been confirmed in the interviews – is that the stacking of nudges yielded the lowest number of selected GFP out of all treatment groups experiencing nudges. This might indicate that the nudge stacking resulted in a *backfire effect*, as originally coined by Osman et al. (2020): Through the failure of one or multiple nudging strategies, a change in customers' behavior can be observed. However, this behavior is changed in the opposite direction of what the system designers originally intended, leading to adverse effects of the nudges. This might even lead to even fewer customers choosing a product towards which they were nudged than if they had not been nudged at all (Hummel & Maedche, 2019; Mols et al., 2015; Osman et al., 2020). An explanation for this effect might be a perceived constraint imposed on customers' freedom of choice, which is created by a superfluous application of one or multiple nudges (Osman et al., 2020; Sunstein, 2017).

However, the online experiment did not identify any treatment group that perceived their autonomy as lower than the others, suggesting that the chosen digital nudges provided the participants with an unrestricted decision-making process (Halpern, 2015; Thaler & Sunstein, 2003). This might be an indication that the backfire effect does not only occur in cases in which consumers perceive their autonomy as being impaired. This aspect is underscored by the interview results: Some of the interviewees who did notice the nudges reported being annoyed by the recommendations of the social norm nudge, as well as the default nudge and reframing of information. Most of these interviewees stressed that, because of these recommendations, they would shy away from purchasing a GFP, rather than feeling inclined to buy that product. Importantly, these interviewees did not feel their autonomy being impaired – as also proven by the results of the probit regression analysis – which further shows that the backfire effect reported by Osman et al. (2020) does not only happen when the consumers' autonomy is crippled. This effect, however, has not been reported by all interviewees, with some also reporting that the nudges had no effect whatsoever, even though the interviewees had noticed the nudge as a manipulation attempt. Finally, some few interviewees considered the nudging strategies as part of their decision-making process, attributing a small effect to the nudges. Overall, the nudges had only a small part in this process, as interviewees stressed that they valued their own reasons higher than the recommendation of the nudges. It therefore seems reasonable to assume that, in the context of high-involvement products, the backfire effect is not necessarily tied to the perceived level of autonomy of a decision, but rather correlates with individual factors.

Furthermore, one aspect that might reduce the effectiveness of digital nudging are individual preferences that already existed prior to being exposed to a nudge (Sunstein, 2017). This is underscored by our interview results: Interviewees cited a wide range of individual factors, many of which had previously been introduced by Wiederhold and Martinez (2018). Specifically, the previously identified factors – price of the GFP, transparency regarding materials and manufacturing process, looks, availability of GFP, a feeling of powerlessness in the face of climate change, brand loyalty and an insufficient level of knowledge – were all either confirmed when mentioned or independently reported by the interviewees. In addition to that, individual material preferences regarding certain clothing items was mentioned as a hitherto not considered factor for or against the purchase of a fashion item. The interviews thereby reaffirm the findings of Wiederhold and Martinez (2018) and Sunstein (2017), that these individual factors seem to be having a stronger impact on purchase decisions than nudges.

Sunstein (2017) further explained that in some cases, where various nudges are applied to a system, that system's users *"might show reactance […], rejecting an official effort to steer because it is an official effort"* (p. 21). This phenomenon can be observed especially in the context of social norm nudges, where people might have individual motives for defying or ignoring social norms. This appears to be in line with the interviews' results: Interviewees reported that, especially considering social norm nudges, they feel overly steered and

annoyed by the recommendations. Specifically, interviewees reported that they were confused about what exactly such social norm recommendations contributed to their purchase decision. Some interviewees even stated that they would feel inclined to purposely choose the product that is not recommended by a social norm nudge, with the sole purpose to defy the nudge's recommendation.

Another relevant factor to consider are the influences that the consumers' individual demographical background might have on GFP selection: With our statistical analyzes confirming that gender does not seem to have a significant effect on GFP selection, we did find influences of the participants' income on the selection of GFP: The results imply that participants with a higher income choose GFP more often than those with a lower income. This conclusion is supported by many interview participants suggesting that their limited budget prohibits them from always choosing the (more expensive) sustainable alternative.

In summary, it would seem that – contrary to much of extant literature – digital nudging alone cannot and does not influence consumers' purchase decisions in the context of sustainable fashion products. Consumers' decision processes are significantly more influenced by cognitive factors, such as the clothing item's price, material, and looks. Different consumers have different preferences and value each of these preferences with a different weight. Additionally, these preferences may vary between clothing items. Despite that, consumers might follow the recommendation of a nudge if none of their individual preferences clearly elevate one clothing item over the other and therefore choose a GFP in accordance with a nudge's recommendation.

The Moderation Effect of Environmental Consciousness

Considering the outcome of the explorative analyzes, a personal identification with environmental consciousness was found to have a significant impact on the effectiveness of digital nudging strategies and – as a result – the number of chosen GFP. For certain products, this is true for both the digital nudge and social norm nudge, as evidenced by the probit regression analyzes: The digital norm nudge was found to have a significant effect on GFP purchase for one product, namely a black t-shirt. From the interviews, we can deduce several reasons for this: Participants who were not swayed by a preference for a certain material or the increased price explained that they had no option to differentiate between the two t-shirts and therefore decided for the GFP. This decision was often taken in accordance with a certain degree of environmental consciousness and the fact that the price difference was not deemed too large. H1a might therefore be partially supported when moderated by a medium to high identification with environmental consciousness if looks, price (difference), and material preferences do not influence the decision otherwise.

A similar case can be made for the social norm nudge, which under moderation had a significant effect on one product: This product – a warm winter jacket – was highlighted in the interviews as interviewees remarked on how they were unable to make out a look-based difference between the GFP and less sustainable jacket, and that they would be ready to spend more money on a winter jacket. This led to many participants (seven out of ten) choosing the GFP over the less sustainable and cheaper option, at times also quoting the social norm nudge as an explicit influence. It would therefore seem that, assuming consumers exhibit a certain level of environmental consciousness and are ready to pay a higher price for a certain fashion item, the social norm nudge can influence consumers' purchase decisions if it is applied in the correct context. The specific characteristics of such a context might be examined further in future studies. Therefore, even though there is no direct effect of the social norm nudge on the GFP selection, H1b might at least partially be supported if moderated by environmental consciousness and if looks, price (difference), and material preferences do not influence the decision otherwise.

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The combination of nudging strategies also significantly impacts the GFP selection when moderated by environmental consciousness for half of the products shown, specifically for the backpack, the sneaker and warm winter jacket. As highlighted before, when interviewees were unable to tell the two options apart with regards to looks and material preference, and the price difference was not deemed too large, the GFP was chosen, corresponding with participants' self-reported environmental consciousness. As with the individual nudges, H2 might be partially supported if moderated by environmental consciousness and if looks, price (difference), and material preferences do not influence the decision otherwise.

Furthermore, the results indicate that - given that the personal identification is comparable - some nudging strategies encourage consumers more than others. This insight aligns with the research of Sunstein (2017), who suggested that certain nudges yield a higher effectiveness than others, depending on the specific application context. More specifically, referring to the three major nudging strategies (Lehner et al., 2016; Roozen et al., 2021), the simplification or reframing of information does seem to have a significant impact on purchase decisions in the context of GFP (Roozen et al., 2021). The interviewees echo this sentiment, as both the social norm nudge and reframing of information were pointed out as having an influence in several interviews while the default nudge did not have an influence on the interviewees.

The online experiment found that the two most prevalent strategies - default policies and social norms - do not have a direct significant effect on the purchase decision. This could mean that these two strategies, while proven to be effective for low-involvement products, do not significantly impact high-involvement products. Therefore, other strategies should be used when nudging users towards buying high-involvement products like GFP. A second interpretation of this may suggest that the implementation of the two strategies in the present study was ineffective rather than the strategies themselves being ineffective. Therefore, future research might attempt to identify the possible differences between different implementations of the default policy and social norm nudges.

A further investigation of the linear regression analysis' output reveals that individuals who exhibit a high identification with environmental issues chose fewer GFP when they had been exposed to a stacking of nudges, here as opposed to those participants who experienced only one nudging strategy or no nudges. This implies that the failure of the nudging stack is severe enough to prompt the observed backfire effect. Therefore, the results support the findings of Mols et al. (2015), who postulated that, to reliably predict the effectiveness of various nudging strategies in certain scenarios, it is imperative to also consider the psychological and social influences contributing to the decision-making process. One example of such psychological influences is the studies that have been able to prove that consumers who exhibited low environmental awareness chose significantly less sustainable products (Bly et al., 2015; Park & Lin, 2020). In addition, it has been established that a lack of knowledge regarding a certain topic can further reduce the effectiveness of nudges (Venema et al., 2020; Wiederhold & Martinez, 2018). Beyond that, Wiederhold and Martinez (2018) have identified seven individual factors in the context of GFP that impact the purchase decision, which have been confirmed to have various degrees of impact to each of the interviewees of our study. An eight, hitherto unconsidered, factor is the preference for certain materials. This study thereby confirms and extends the findings of Wiederhold and Martinez (2018).

The present research article also contributes to extending the research of Osman et al. (2020), who examined the different types of possible nudging failures and sorted them into eight categories: 'No treatment effect', 'backfiring', 'treatment offset by negative side effect', 'no treatment effect with positive side effect', 'only proxy changes (not actual criterion)', 'treatment offset by later behavior', 'environment does not support change' and 'intervention triggers counteracting forces' (pp. 9-13). Our research suggests that there might be a ninth type of nudging failure. Indeed, our results showed a counteracting backfire effect that negatively impacted our main criterion. However, for participants with generally low identification with

environmental consciousness, GFP selection was significantly higher when exposed to a combination of nudging strategies, that is, digital nudge stacking. In line with the work of Osman et al. (2020), this type of nudging failure could be categorised as 'backfiring with positive side effect'. This is also supported by the interview findings: In a few cases, interviewees who claimed to have a rather low identification with environmental consciousness chose the more sustainable (and more expensive) option, pointing out the combination of nudging strategies as an influencing factor. When vocalizing their purchase decision, they also mentioned that by choosing the more sustainable option they were doing something good for the environment, despite not having a strong identification with environmental consciousness.

Theoretical Implications

Our work contributes to knowledge in four aspects: First, the present study has revealed a new and previously overlooked type of nudging failure, that is, 'backfiring with a positive side effect', in which the combination of nudges does not only lead to a contrary effect, but also has a positive side effect.

Second, the findings of our qualitative interviews support the notion that individual and psychological factors have a larger impact on purchasing decisions than nudges (Sunstein, 2017). Specifically, the items' price, material composition and looks are more important to consumers in their purchase decision than recommendations conveyed through digital nudges.

Third, our interview data supports the findings of Wiederhold and Martinez (2018) whilst also extending their proposed individual factors with a new factor impacting the purchase decision in the context of clothes, called 'material preference'.

Fourth and finally, our mixed-methods approach helps to gain a deeper understanding of the complex decision process consumers go through when purchasing more sustainable clothes in e-commerce environments: Their individual preferences are weighted to various degrees for or against a GFP. Only when the individual preferences do not result in one piece of clothing being more desirable than the other can digital nudges - moderated by the consumers existing environmental consciousness - influence the purchase decision regarding GFP.

In summary, the present work extends the literature on digital nudging. It also confirms the suspicion that the effectiveness of digital nudging is subordinate to individual factors in the context of high-involvement products.

Practical Implications

The current study also contributes to practice in multiple ways: First, by revealing possible opposite effects when applying digital nudges to high-involvement products, this study suggests that the designers of e-commerce environments should take a more cautious approach when implementing nudges in their systems. Second, system designers can also use the current study as an example of how not to implement a stacking of digital default and social norm nudges because doing so might trigger an adverse effect on what the designers intended to achieve. Third, the results can be seen as an indication that sellers of GFP should also develop and implement strategies to advertise a higher identification with ecologically friendly behavior, which, in turn, seems to motivate GFP purchase behavior in a more significant way than nudges. Alternatively, they should try and inquire about prospective consumers' material, price, and look preferences to ensure their GFP fulfill these individual preferences, which are valued higher than recommendations through nudges.

These practical implications are especially relevant to the Asia-Pacific region, as a large majority of the fashion industry is located within the region. Since the regions' inhabitants seem to be more hesitant to purchase GFP, our research acts as a glimpse into the various factors

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that influence consumers' purchase decisions when deciding for or against GFP. These cognitive factors - such as the products' price, looks and brand's transparency regarding their sustainability claims - can be used by clothing manufacturers to strengthen the appeal of their GFP to consumers from the Asia-Pacific region. Additionally, a more targeted advertisement of GFP might moderate the environmental consciousness of consumers in the Asia-Pacific region. With the region's significant influence on the clothing market, it might act as an example for more sustainable fashion e-commerce.

Recommendations for Further Research

When considering the results of the present work, a variety of topics that might be investigated in future research can be identified. The possible reasons that lead to the failure of nudges should be identified (and classified) to help explain why the nudges used in the present study did not have a significant effect on the participants. In the context of the possible opposite effects created by digital nudging, researchers should examine which nudging strategies - or a combination thereof, along with their respective various implementations - are more at risk of resulting in reactance or backfire effect. Moreover, when testing the various contexts for digital nudging applications, it is also important to consider the differences between low- and high-involvement products. Finally, the individual factors should be further examined by conducting a quantitative study to reveal which of these factors have the highest impact on both the purchase decision and nudges' effectiveness.

To assist researchers in conducting follow-up studies, we pose the following question that might guide future studies: '*Do high-involvement products require the use of different nudging strategies compared with low-involvement products?'*. Examining and answering this question will contribute to limiting much of the adverse environmental impact of fashion e-commerce with IS, as well as to understanding the impact that the relationship between digital nudging and individual factors can have on sustainable purchase decisions.

Limitations

We must consider several limitations when assessing the findings of this research. First, the participant distribution to the treatment groups was not entirely equal because the control group included fewer participants than the other treatment groups, which featured nudges. Second, the participants were identified as predominantly female, leading to an unbalanced representation of genders. Third, because the mean differences regarding the number of chosen GFP between the treatment groups proved statistically insignificant, no reliable conclusions can be drawn from the quantitative online experiment. The qualitative interviews underscored that any influence of the nudging strategies is dependent on cognitive factors, such as material preferences, price, looks, or the individual identification with environmental consciousness. All in all, we would like to stress that the online experiment's results should not be interpreted on its own, but instead in conjunction with the results of the qualitative interviews. The experiment merely shows that the nudges did not work as anticipated, while the interviews enrich this finding with insights on why the nudges failed to steer consumers' purchase decisions. The qualitative interviews also do not come without limitations. First, the group of interviewees contained more individuals with a high environmental consciousness than individuals who do not identify with sustainability issues at all. Second, the interview guide did not directly discern between single and stacked nudges, however the interviewees did not mention any differences in the way they evaluated single or stacked nudges.

Conclusion

The present research article analyzed how different nudging strategies could be employed to encourage consumers to purchase GFP instead of regular fashion items, uncovering the previously overlooked impact of individual identification with environmental consciousness. While the online experiment failed to measure a significant effect of the type of nudging strategy on the number of chosen GFP, the interviews delivered more detailed information on the reasons for the failure of the nudges. One of these reasons is the occurrence of a backfire effect, along with a prominent importance of consumers' individual factors to consumers, such as price, looks, or material preferences. This results in a reduction of the effect nudges have on the decision-making process.

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Appendix A

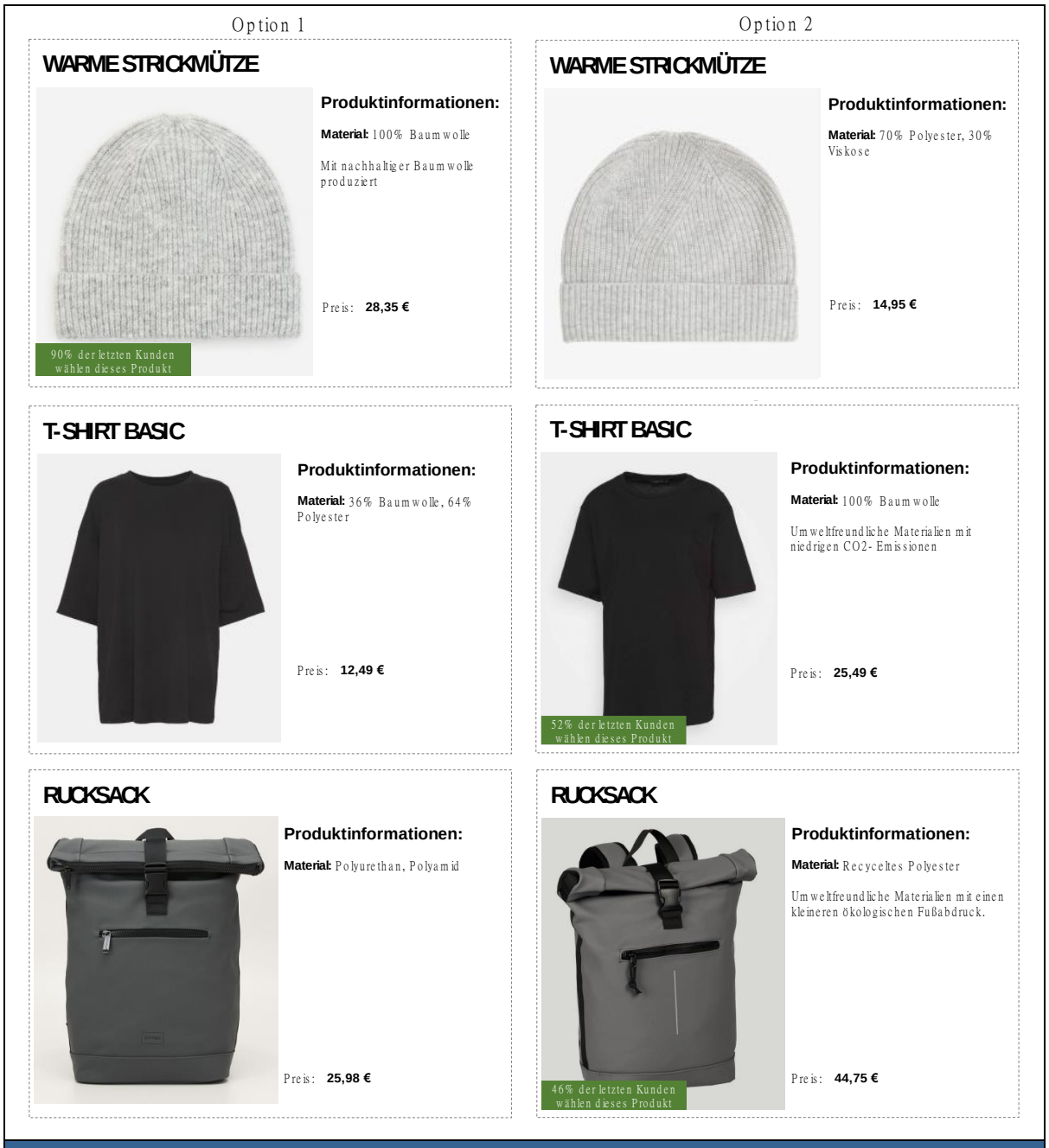

Figure A.1 – First Choice of Products Used in the Experiment

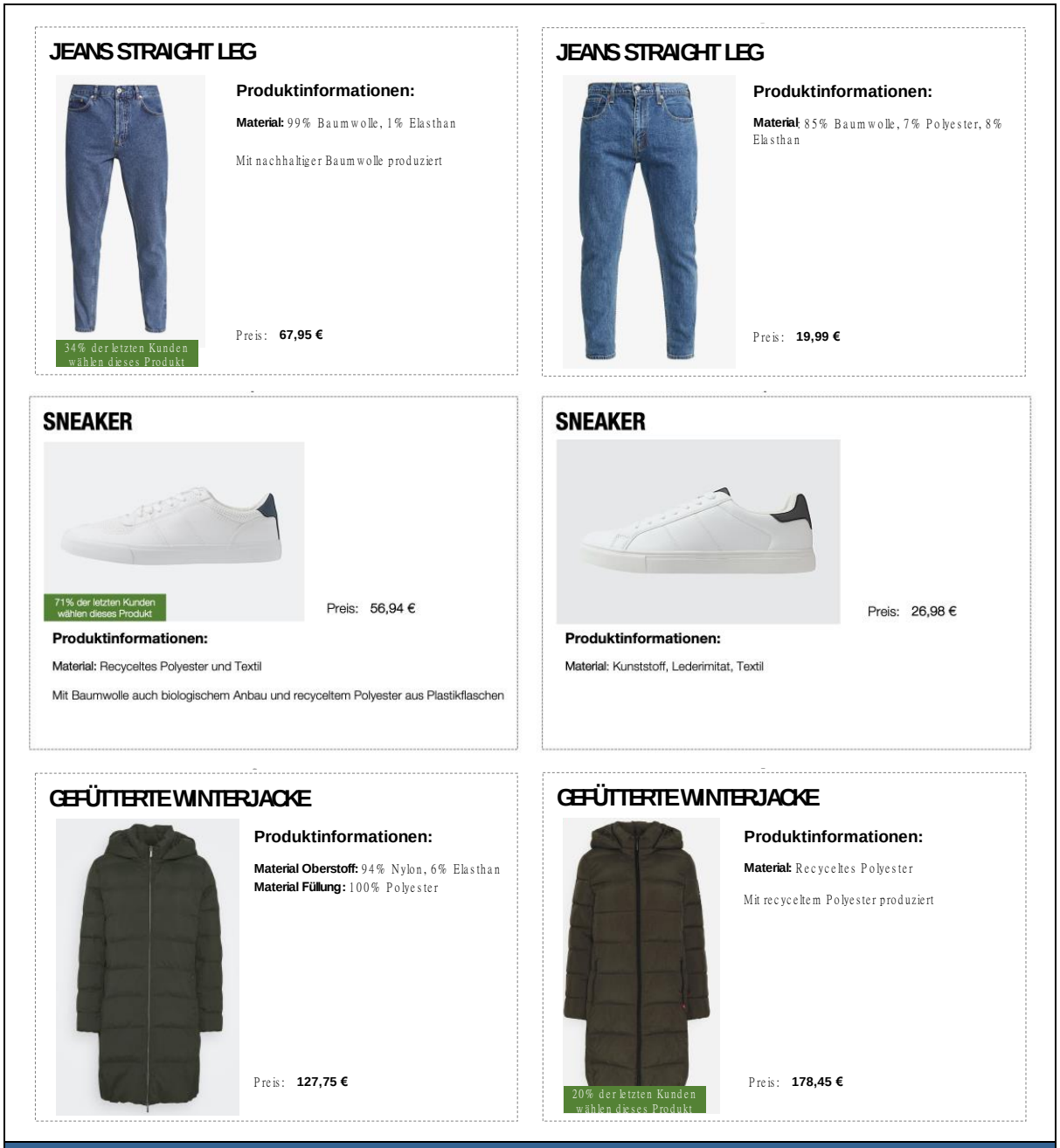

Figure A.2 – Second Choice of Products Used in the Experiment

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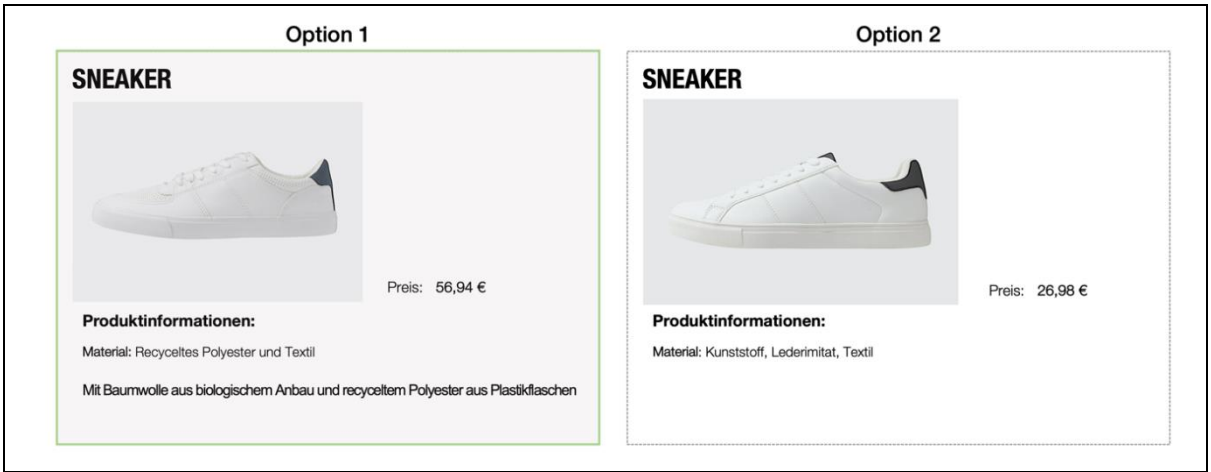

Figure A.3 – Product 1 of the Interview Stimulus Material (Default Nudge)

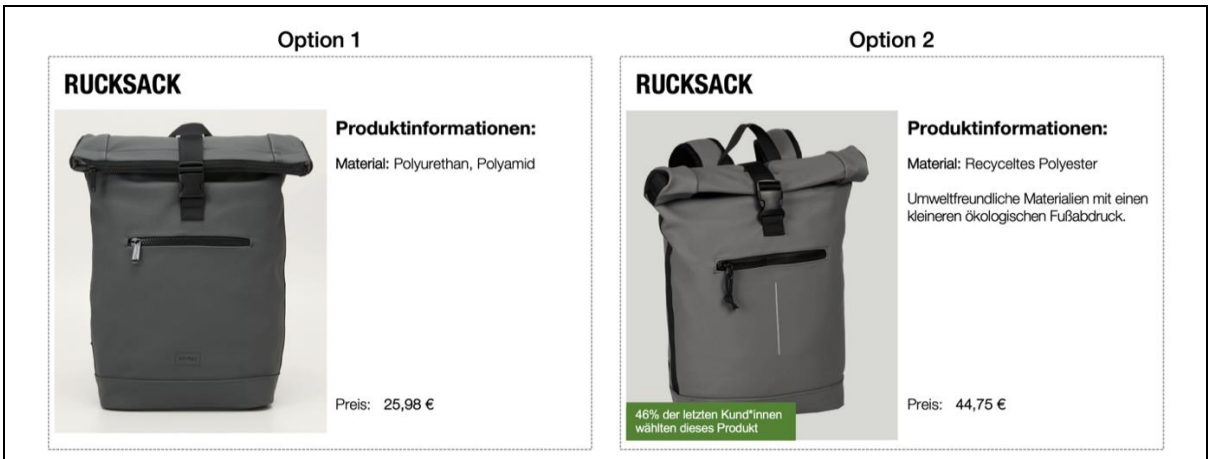

Figure A.4 – Product 2 of the Interview Stimulus Material (Social Norm Nudge)

Figure A.5 – Product 3 of the Interview Stimulus Material (Reframing of Information)

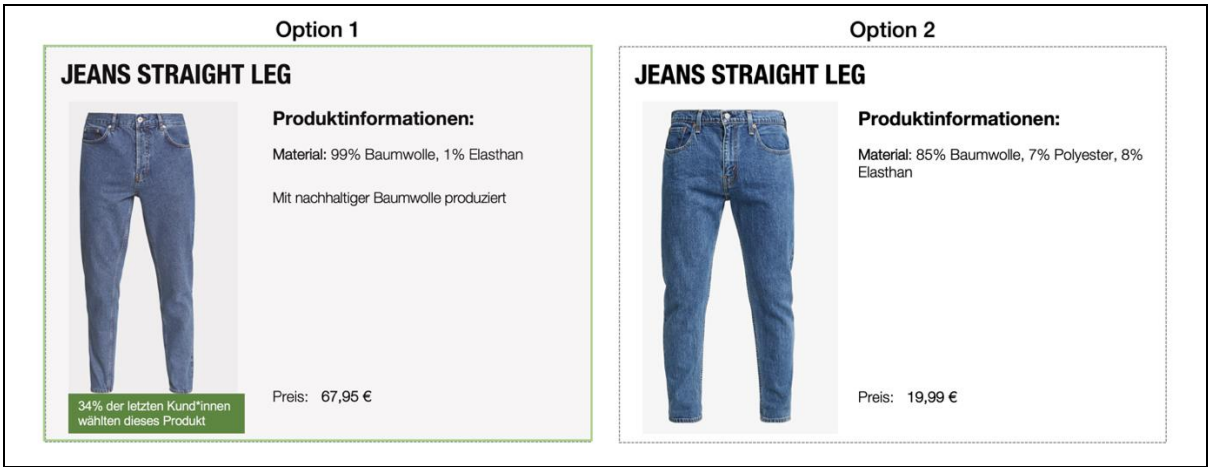

Figure A.6 – Product 4 of the Interview Stimulus Material (Combination of Default and Social Norm Nudge)

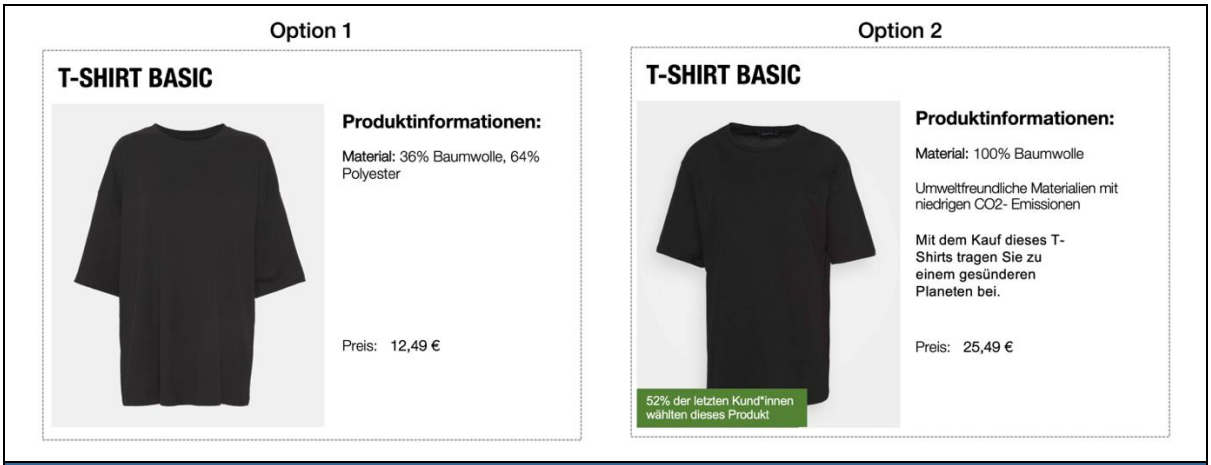

Figure A.7 – Product 5 of the Interview Stimulus Material (Combination of Default and Social Norm Nudge)

Figure A.8 – Product 6 of the Interview Stimulus Material (Combination of Default Nudge and Reframing of Information)

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Figure A.9 – Product 7 of the Interview Stimulus Material (Combination of All Three Digital Nudges)

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