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Promotion of Sustainable Products: Can Sustainability Labels Promote User Selection of Environmentally Friendly Products?

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Abstract: Sustainable development is growing in importance in today's climate crisis. With the percentage of sales via digital channels increasing annually and consumers becoming aware of the environmental impact of their choices, a huge opportunity presents itself for promoting sustainable goods online if designers can find an effective way to raise awareness in consumers. Using a simulated e-commerce site (webshop), we investigated whether the presence or absence of sustainability labels displayed next to product images influenced users' product selections. There was a significant association between the presentation of sustainability labels and the number of selected sustainable products. Overall, participants were familiar with sustainability labels and indicated willingness to pay 'extra' for sustainable products, while there was more variation in the way they felt that sustainability labels influenced their product choices. The findings highlight the complexities of factors influencing purchasing decisions and the need for more design-inspired research in this area. Whilst user interface design may be an effective means to influence sustainable product choices, design should also enable consumers to make informed product choices, while still providing a 'fair' e-commerce environment.

Keywords: ecolabeling; e-commerce; consumer decisions

1. Introduction

The rise of e-commerce has transformed the global economy, changing the way we shop and do business. Over the last two decades, e-commerce has transformed from a niche market to a global economic juggernaut, with current and predicted sales steadily increasing [1]. The expansion of e-commerce can be attributed to several factors, such as the widespread access to broadband internet, the rise of smartphones and tablets, and the increased comfort and convenience for consumers shopping from home. The COVID-19 pandemic also contributed to more recent growth [2], as individuals and businesses have been forced to digitalize both essential and non-essential purchases, with the vast majority of local businesses being closed during lockdowns in various countries. The predicted increase of e-commerce in 2024 across Europe will make this sector a key driver of economic growth [3,4], and so research in consumer behavior will become increasingly important.

E-commerce allows users to efficiently search for products and compare prices from home. This reduces the need to travel to shops [5], which in turn may lower carbon emissions, a positive development. Concurrently, while the benefits of e-commerce to shoppers in terms of convenience and time savings are evident, there may still be a negative environmental impact of increased carbon emissions arising from consumer behavior, product delivery, product packaging, and waste [6–8]. Consumer concerns about sustainability in e-commerce are also reflected in research on shopper perspectives. For example, a study involving nine countries revealed that e-commerce is perceived to be a problem for the environment, especially in Europe but less so in the US [9]. The consumption of sustainable products themselves adds another dimension to the notion of sustainable transactions. The

findings from a large-scale study [10] on the purchases of eco-friendly products showed that 72% of online shoppers in Vietnam reported buying sustainable products always or frequently, compared to a 42% worldwide percentage. While sustainability is internationally recognized to be key to our survival [11], especially affecting younger and future generations that need to live with the consequences of a lack of sustainability for the foreseeable future, these data suggest that there is a vast heterogeneity of sustainability considerations across the globe. Within societies, however, it may be unsurprising that it is predominantly the young (Zoomers, or Generation Z) that are considered to be willing to show eco-friendly behavior [12–14].

Against this backdrop, there is a huge opportunity for interface designers and researchers to become involved in advancing eco-friendly consumer attitudes, decisions, and behaviors online, due to the capacity of such e-commerce interfaces to reach a vast audience via green marketing. Green marketing can be described as the advertising of products with a focus on their environmental sustainability. Online consumer decisions are associated with a multitude of factors, such as economic, social, and individual influences, as well as the online environment itself (e.g., [15]). Graphical interfaces are important in directing a consumer's attention [16]. As online transactions largely rely on usable interfaces and the appearance of product presentations to affect consumer decisions, the role of user interface design to guide user choices should not be underestimated as a means to promote the purchase of sustainable products. Specifically, drawing attention to the visual representation of products is key to the current research and resonates with the notion that e-commerce platforms are pivotal in promoting sustainable products, resulting in conscious consumer decisions [2]. Kemppainen et al. [17] also highlight that research on the influence of interface factors, online tools, and apps are important components in overcoming barriers to sustainable product choices, such as product availability, information, and transparency, as well as consumer factors, including habits.

The research in this paper explores whether online product information can influence user decision making, and specifically, whether the presentation of sustainability labels is associated with consumer product selections on a simulated e-commerce site. While existing work has addressed the impact of ecolabels on user decisions using mostly choice or survey studies (for a review, see [18]), few projects have investigated the impact of labels in a semi-real, natural environment using an e-commerce setup. The use of more naturalistic tasks compared with conventional research approaches may be preferable in respect of the ecological validity of findings [19]. In choice or survey studies, participants are typically faced with explicit sustainability choices (i.e., a choice task) or being directly asked about sustainability aspects (e.g., via a survey) as the main component of the study. Further, as others have noted [14], a social desirability bias, whereby participants respond in a way that they think may be expected of them—here, in line with social conventions of sustainability—may interfere with participants' responses, raising questions pertaining to the veracity, bias, or generalizability of findings. The current study aims to address this dearth of studies investigating 'natural' behavior in the context of e-commerce. In order to assess whether users would select sustainable products in a less controlled, more realistic environment, we asked users to select products from a simulated e-commerce platform to increase the likelihood of the findings having some degree of ecological validity. The main hypothesis of interest is thus:

H1. *The presence of ecolabels is associated with sustainable consumer product choices.*

This paper is organized as follows: First, we describe aspects of sustainability to clarify our use of the terminology and specify which aspect of sustainability is addressed in the study. We then review research on the implementation of sustainable product features or labels as a design element to promote sustainability in e-commerce. Subsequently, an overview of theoretical frameworks to derive expectations regarding consumers' online product selections is provided, contextualizing the derived hypothesis. We then describe

the methodology and outcomes of the work and conclude the paper with a discussion and an outlook on promoting sustainability via design.

2. Related Work

The European Union (EU) has implemented sustainability goals (United Nations, [20]) into its policies and strategies. The Sustainable Product Policy Framework includes measures to ensure that products placed on the EU market are designed to last longer, and are easier to reuse, repair, and recycle [21]. The Circular Economy Action Plan (CEAP) aims to make the European economy more sustainable by reducing waste and increasing resource efficiency, aiming to make Europe the first climate-neutral continent by 2050 [22]. In 2022, Europe was at the forefront of promoting green marketing, with Denmark, the UK, and Finland leading the Environmental Performance Index [23].

Brundtland's [24] definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [24] (p. 37) underlines the importance of balancing economic, social, and environmental factors in new developments, including e-commerce [25]. Economic, social, and environmental sustainability are often referred to as the "three pillars" of sustainability [26], emphasizing the various facets of sustainable development and stakeholders involved. To the extent that promoting sustainable (eco-friendly) products can be supported via appropriate user interface design features, there is creative leverage for designers (and businesses) to engage with environmental sustainability, and it is this aspect that we focus on in the presented work.

2.1. Sustainable Product Labels

As consumers become more aware of the environmental and social impacts of their consumption, businesses are increasingly focusing on sustainability in their product development and branding strategies. This shift towards sustainability in commercial products is evident in various sectors, from food and clothing to electronics and vehicles. Sustainable products protect the environment from the extraction of raw materials to final disposal [27]. This concept is often referred to as the 'life cycle approach', which considers each stage of a product's life cycle to measure and compare environmental impact [28].

To help consumers identify sustainable products during purchasing transactions, various initiatives have been put forward. The 'Blue Angel', also known as 'Der Blaue Engel' (https://www.blauer-engel.de/en, accessed on 10 April 2024) in German, was the first sustainability label to exist. In order to be certified, the entire life cycle of a product needs to be approved [29]. Currently, it is awarded to more than 20,000 products and services [30]; however, while the label is popular in Germany, its use is not widespread across the European Union.

The more recent EU Ecolabel initiative was launched in 1992 [31]. The EU Ecolabel is a voluntary label awarded to products that meet high environmental standards throughout their life cycle. The label covers a wide range of products, including cleaning products, appliances, clothing, and more. The EU Ecolabel, also known as 'The EU Flower' (https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home/about-eu-ecolabel_en, accessed on 10 April 2024), is widely used across the EU, with currently almost 90,000 products having received the EU Ecolabel certification [32].

The initiative to clearly identify sustainable products via label design is a positive development, but it also presents challenges. Despite proactive attempts by various organizations to familiarize consumers with sustainability labels, their recognizability remains low. Recent research with over 500 respondents showed that only a small number of sustainability labels were recognized [33] in the context of e-commerce, so there is scope for further design work (and initiatives) in this area.

Furthermore, 'greenwashing', where products are marketed as being more environmentally friendly than they are [34], has also crept into label design. While so-called Type I sustainability labels are awarded by third parties, Type II sustainability labels are self-

declared environmental claims made by companies about their own products and services. These do not have to be assessed by third parties and can mislead consumers. To combat this, the EU has implemented regulations to prevent misleading environmental claims. The Unfair Commercial Practices Directive prohibits traders from creating a false impression of the environmental impact of a product [35]. Consumer trust in ecolabels is generally recognized to matter in relation to consumer decision making [36,37], and communicating third party certification increases the trust in an ecolabel [37], which has implications for purchasing decisions.

2.2. Consumer Choices in E-Commerce

Green marketing initiatives are a non-aggressive form of promoting sustainable products and services and provide consumers with honest information on these [38]. The labeling of sustainable products falls into this category to the extent that product labels and descriptions provide a gentle form of marketing via displaying a product's sustainability attributes. Factors impacting on online purchase intentions are multifaceted, including digitization, lifestyle, willingness to pay for sustainable products, and subjective norms, inter alia [39].

Psychological frameworks have a pivotal role in explaining attitudes, decision making, intentions and, ultimately, behavior of consumers. Understanding the drivers behind consumer choices is essential in identifying possible areas of intervention and influencing these choices. Thus, consideration of these frameworks may shed light on how to raise awareness or change attitudes of consumers in relation to sustainable products and services. One framework that has been widely utilized to explore consumer intentions and attitudes is the *theory of planned behavior* put forward by Ajzen [40]. The theory of planned behavior suggests that intention is the immediate precursor of behavior and is determined by three factors: attitude, subjective norm, and perceived behavioral control. Attitude is an individual's positive or negative evaluation of the behavior and is based on the person's beliefs about the consequences of the behavior. For example, consumers might have a positive attitude towards purchasing a green product because they believe it is good for the environment. The subjective norm is an individual's perception or belief about what important others, such as family, friends, and colleagues, think about the behavior. For example, people might have a strong subjective norm to buy sustainable products because they believe their friends and family think it is important to do so. Social norms can be represented by peers, and, in recent decades, by social media, and have a large impact when purchasing sustainable products [41,42]. Within consumer behavior, the notion of the subjective norm may be of particular importance for sustainable online product choices, as this can have a direct impact on purchasing intentions [39]. Related to that is the notion of consumer values in relation to sustainability, as consumers may reflect this value in their purchasing decisions [43,44]. Consumers that have 'green' values are generally more predisposed to responsible purchasing decisions [45].

Perceived behavioral control is an individual's belief about their ability to perform the behavior. It is based on the individual's assessment of their own skills, resources, and opportunities to perform the behavior. For example, individuals might have a high perceived behavioral control to purchase a green product because they believe they have easy access to it. Furthermore, product availability moderates the relationship between green consumption intention and behavior, in that more readily available products, and the perception that their consumption would be positive for the environment, can increase the likelihood of green-minded consumers to actually consume green products [46]. This relationship suggests that making product choices obvious and available via their visual attributes can be a factor in promoting sustainable product choices.

The theory of planned behavior is a useful tool for understanding and predicting consumer behavior in the context of sustainable product purchasing. Using an online survey with 499 respondents and a structural equation modeling approach, Beldad and Hegner [47] found that attitude, subjective norm, and perceived behavioral control were

significant predictors of the intention to purchase fair trade products. This differed for males, for whom behavioral control had no effect, suggesting that interventions to inform consumer choices may need to consider user demographics.

Within the context of decision making, the *default effect* (e.g., [48]) describes the tendency to select preselected (i.e., default) options (including the no-action default option). Dinner et al. [49] propose three channels, i.e., ease, endorsement, and endowment, through which defaults can influence decisions, either in isolation or concurrently. Ease relates to the situation where it appears easier to stay with a preselected option, endorsement refers to the perception of defaults conveying an endorsement by the choice (design) architect, and endowment refers to the extent to which a user may believe the pre-selected option represents the status quo. Jachimowicz et al. [50] showed in their meta-analysis that default effects in consumer domains (related to product/service purchase) are more effective, but weaker in environmental domains, which highlights the need for more targeted research in this area. Furthermore, default effects are more potent when they operate through endorsement or endowment. As Štofejová et al. [39] have noted, green marketing should make consumers perceive sustainable products and services as a 'normal' part of life, which suggests that consumers should be exposed to the existence of such products.

By understanding the factors that influence consumer product choices, interventions can be designed to promote sustainable consumption more effectively, for example, to increase consumers' awareness of the existence or benefits of sustainable product purchasing, or to reduce the perceived barriers to sustainable product purchasing. One such aspect would be to clearly signal to consumers when they have the choice to engage in sustainable behavior by highlighting the existence of sustainable products via labels, in other words, making the choice salient within e-commerce. Two recent studies have found support for this notion. Using a simulated online choice experiment, Neumayr and Moosauer [51] asked participants to select one product at a time from four product choice screens (choice design) and found that consumers were more likely to select ecolabeled food products compared with non-labeled products. In a large-scale online field study with 58,000 consumers, Feuß et al. [52] reported beneficial effects of a specifically designed ecolabel (a bespoke green banner with the words 'sustainable' next to the product) on consumer fashion purchases. Studies of this scale are valuable, but rare, as they present large data sets that can offer a great degree of ecological validity; at the same time, a choice experiment (e.g., [51]) may limit the naturalistic interactions for product selections as participants are directly asked to make a choice from a prescribed selection of products, thereby raising demand characteristics (social desirability) on the part of the participants.

To conclude, the reviewed research suggests that the placement or design of sustainable products on a website can influence consumer purchasing behavior in a number of ways. It can make consumers more aware of the availability of sustainable products by drawing attention to their existence, and thus, make sustainable products more accessible to consumers, as well as hinting at sustainable purchasing as a social norm. In doing so, a webshop may also communicate it is committed to sustainability (default—endorsement). Graphical online interfaces can direct a user's attention to product attributes [16]. Thus, the research question we wanted to explore was commensurate with the idea that the placement of sustainability labels may induce shoppers to select sustainable products. Consistent with Hypothesis 1 (**H1**), we would predict that the presence of sustainability labels next to product images on a webshop may be associated with a higher selection of sustainable products compared to a webshop design on which images do not present with a sustainability label. We compared the effect of existing and actual product relevant ecolabels on product selection to maintain a degree of ecological validity using a webshop scenario. To increase realism compared to a choice task or survey, we implemented a realistic webshop environment that users could browse, placing selected items in a basket. Giving participants greater flexibility when selecting products, as in a real shopping environment, arguably enhances the generalizability of the findings.

3. Materials and Methods

A simulated e-commerce site, a webshop, was created to investigate consumers' product selections, contrasting the effectiveness of adding sustainability labels as a selling point in the product branding compared to not labeling products as sustainable. The webshop page (Figure 1) resembled an online storefront, including a search bar, permitted product filtering and sorting capabilities, and displayed product descriptions. The order of product listings was randomized each time the page was loaded, with all products shown in every case to counteract order effects. All text was presented in English.
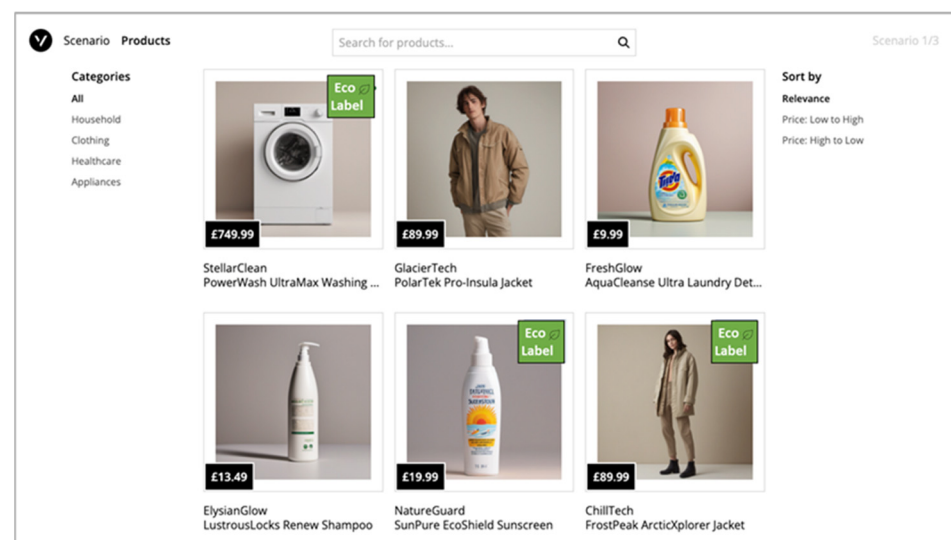

Figure 1. Search page of the webshop with sustainability label placeholders added to some items for illustration. Appropriate, existing product-relevant ecolabels replaced the ones shown in the figure.

3.1. Participant Selection

The webshop was designed to be responsive, which means that the experiment could be viewed and completed on any device, including mobile phones and laptops. This made it easy for participants to access the experiment from anywhere at any time, and more importantly, from an environment of their choice to make online purchases, resembling a natural shopping experience.

The experiment was clearly advertised as a study and participants were recruited on online platforms like LinkedIn and through word of mouth. In total, 68 volunteers participated in the experiment.

3.2. Design Conditions and Products

Using a between-subjects design, the participants in the study were randomly assigned to two groups: one group was shown a selection of products that were presented with sustainability labels; the other group was shown products without such labels. Apart from the use of the sustainability labels next to product images, the products and purchasing scenarios were identical in each design condition, as well as the product descriptions users could click on for further product details, images, and prices.

The products presented in the webshop were designed to look like real-world products while having no references to existing products to reduce participant expectations or preferences, which may have biased product choices. Three common household product categories that were not considered to be gender-specific, i.e., shampoo, sunscreen, and detergent, with seven images in each category, were created using AI software to generate product images and descriptions (see Figure 2). The GPT3.5 model was used to generate suitable product descriptions, and the Stable Diffusion XL model was used to generate product images. A Python script was written to automate this process. The generated

products were created such that they did not differ substantially in color, shape, or size to minimize the influence of product design features on product selection. In addition to these critical household products, 34 filler products from other product categories (e.g., clothes, appliances, etc.) that were not meant to be selected for purchase were also generated and added to the product site, for a total of 55 images. The presence of filler items was meant to mask or distract from the demand characteristics of the task and create a realistic looking webshop environment, which typically has a greater number of product choices.
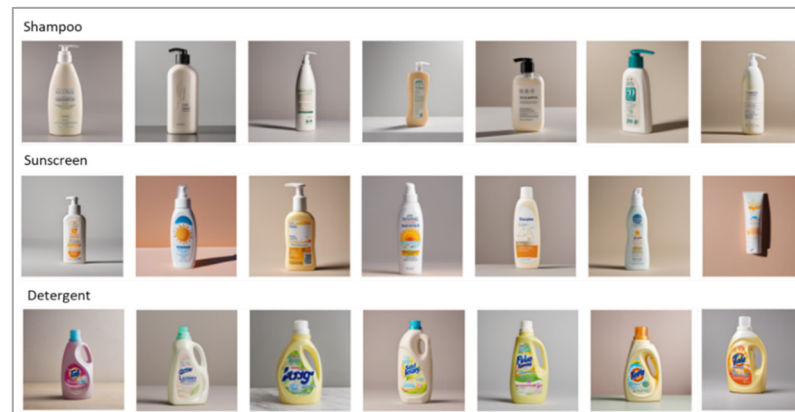

Figure 2. Shown are images of the three product categories (shampoo, sunscreen, detergent) with seven products per category that were used on the webshop. Products were shown with and without existing sustainability labels on the webshop (labels not shown here).

Once a participant clicked on a product, the product description appeared, which could be closed again, just like on a real website. Figure 3 provides an illustration of the same product (laundry detergent) with and without a label in the respective webshop designs. For a non-sustainable product, an example product description was "Discover SunBlock ProShield by SunArmor, your ultimate defense against the sun's harmful rays. This high-performance sunscreen is designed to keep your skin protected, nourished, and glowing all day long". As an example for a sustainable product, the product description was "Discover SunPure EcoShield by NatureGuard, your eco-friendly companion for guilt-free sun protection. This revolutionary sunscreen is thoughtfully crafted to not only shield your skin but also to take care of the environment we cherish".
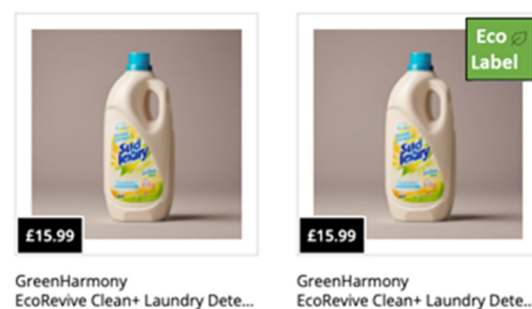

Figure 3. Illustration of the same product without and with sustainability label. An appropriate, existing product-relevant ecolabel replaced the one shown in the figure.

Although price markups for sustainable products can range between 20% and 220% [53] compared to other products, a more conservative markup was chosen in the current study to avoid crossing the price threshold. The average markup between non-sustainable and sustainable products was set at 25%.

As most participants were expected to be based in the EU, the experiment contained regulated EU sustainability labels. For electronics, this is the EU Energy Label [54]. For

all other products, this is the EU Ecolabel [31]. The EU Ecolabel is also one of the most popular ecolabels in the EU [55]. For the experimental condition using sustainability labels, the label was displayed on the product page and absent in the no-label condition.

3.3. Questionnaires

Two questionnaires were used in the study and were presented in the English language. The first, run at the start of the study, was a brief demographic online survey, asking for information on participant age, gender, education, location, and frequency of online shopping to ascertain participant characteristics but also to establish whether, in principle, participants could have been exposed to sustainability labels. The second online survey consisted of three questions and explored participants' views on sustainability labels and purchasing. It was administered after the completed experiment and asked participants about their familiarity with sustainability labels ("How familiar are you with sustainability labels and classifications?", with the options very unfamiliar, unfamiliar, somewhat familiar, familiar, very familiar), their willingness to pay extra for sustainable products ("How much are you willing to pay extra for a sustainable product?", with options not at all willing to pay extra, somewhat willing to pay extra, very willing to pay extra), and how often their purchasing behavior may be influenced by sustainability ("How often do sustainability labels and classifications influence your purchasing behaviour?", with options never, rarely, sometimes, often, always). Participants could also use a text field to provide any comments on the experiment.

3.4. Procedure and Scenarios

A pilot before the study proper was conducted with four participants to ensure that the instructions, flow, and wording of the experiment were clear. The experiment was run online and gave participants the choice of device. Participants were informed that the study was 'about digital storefronts'. After reading the information and providing informed consent, the study began. First, participants provided demographic information, after which they were shown one of three scenarios, providing them with guidance on which product type to select on the webshop (Figure 4). In addition to browsing, it was possible to use the search bar to find products or view the product list page. Once a product was selected by clicking the 'select product' button (Figure 5), the participant was redirected to the scenario screen with information about the next purchase scenario. Table 1 contains the scenarios for each product. Every webshop condition contained seven possible product choices, two of which were described as sustainable in the product description.
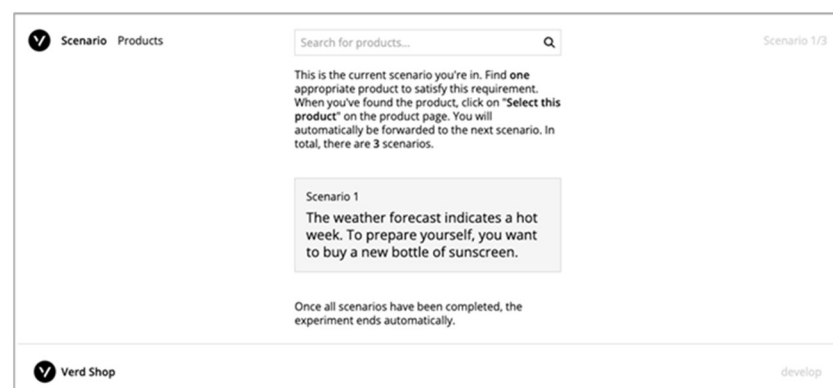

Figure 4. Illustration of how participants were given guidance on which product to shop for on the webshop.
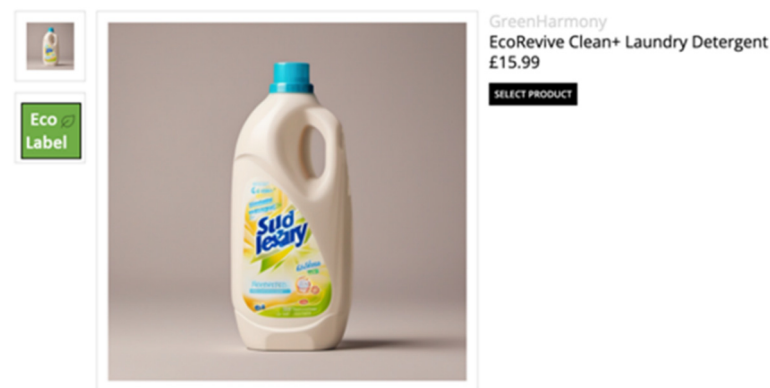
Figure 5. Illustration of completing a scenario by clicking on the 'select product' button. An appropriate, existing product-relevant ecolabel replaced the one shown in the figure.

Table 1. Purchasing scenarios for the three product categories.

Product Type	Scenario Text
Sunscreen	The weather forecast indicates a hot week. To prepare yourself, you want to buy a new bottle of sunscreen.
Laundry detergent	It's almost laundry day, but last time you ran out of laundry detergent. You want to buy a new bottle of laundry detergent before it's too late.
Shampoo	You're almost out of shampoo, and to prevent not being able to wash your hair you decide to buy a new bottle.

Each scenario was shown to the participant in sequence, one at a time, in the same order (sunscreen, laundry detergent, shampoo). The next scenario was shown after the participant completed product selection for a current scenario. When the third product was selected and all scenarios had been completed, the experiment ended with the online survey on user views on sustainability and the participant debrief. In each scenario, the entire product catalogue was available on the site, with initially 55 product images, which was then reduced when participants searched for the relevant item (consistent with a realistic webshop). The variable of interest was the number of sustainable products that participants selected, which could range from zero to three, in the latter case, if sustainable products were bought in all scenarios. Thus, participants in each group were categorized into buying zero, one, two, or three sustainable products.

4. Results

4.1. Participants

Of the 68 participants that took part in the study, five were excluded from further analysis. As participants were free to select any products from the webshop environment, these could also have been products that were not asked for in the scenario. Three participants selected product types that did not align with the scenario and were excluded. Additionally, two participants stated in the optional comment field that they hypothesized the objective of the study was to explore sustainability labels while doing the experiment. To avoid any biases or expectations from influencing the analysis, their data were also excluded. The analysis was conducted with 63 participants, 32 participants in the condition without the presentation of sustainability labels and 31 participants in the condition with the presentation of sustainability labels. Table 2 provides an overview of participant demographics.

Table 2. Participant demographics.

Demographics	Count	Demographics	Count
What is your age?		**Where are you located?**	
Prefer not to say	1	Austria	10
Under 18	2	Netherlands	18
18–24	27	Romania	4
25–34	14	United Kingdom	14
35–44	5	United States	4
45–54	6	Other	13
55–64	6		
64+	2		
What gender do you identify as?		**How often do you buy products from a webshop?**	
Prefer not to say	2	Prefer not to say	0
Male	38	Under 1 time a month	24
Female	20	1–2 times a month	18
Other	3	3–5 times a month	14
		6–10 times a month	5
		11+ times a month	2
What is the highest level of education you have completed?		**What is your academic discipline?**	
Prefer not to say	3	Prefer not to say	2
Doctoral degree or above	5	Archaeology	1
Master's degree	11	Architecture and design	1
Bachelor's degree	23	Biology	2
High school diploma	15	Business	5
Other	6	Computer science	25
		Education	3
		Engineering and technology	4
		Law	1
		Mathematics	2
		Medicine and health	4
		Physical performance/recreation	1
		Psychology	2
		Public administration	1
		Other	9

Most of the participants reported to be between 18 and 34 years of age, with the two pooled age groups making up 65% of all participants. Most participants were male (approximately 60%) and 32% of the participants were female. Participants had a wide range of educational backgrounds, with the largest group (37%) having a Bachelor's degree.

Almost half of the participants (40%) had a background in a computing-related area. Regarding location, the majority of participants were located in Europe (73%), and 51% were based in the European Union. Thus, the chosen sustainability labels for the experiment could have been familiar to participants. Most participants indicated that they purchased products online less than once a month (38%), while two participants (3%) indicated that they purchased products more than 11 times per month.

4.2. Product Selections

To ascertain whether the presence of sustainability labels had any effect on product choices, a 2 (sustainability label vs. no sustainability label) × 4 (zero, one, two, three selected sustainable products) chi-square test was conducted. Each cell contained the number of participants that selected zero, one, two, or three sustainable products per design group (with and without sustainability product labels). As more than 20% of cells had an expected count of less than 5, the assumption for this 2 × 4 chi-square test was violated and the likelihood ratio [56] was chosen as the appropriate statistic. There was a

significant association between the presentation of sustainability labels and the number of selected sustainable products $LR = 7.920$ (3, $n = 63$), $p = 0.048$, revealing a medium strength of the association $v = 0.308$. The difference for one and two selected products, respectively, between webshop designs appears negligible. However, it appears that the number of participants that selected zero sustainable products was lower in the design condition where product images were presented with a sustainability label (48.4%, $n = 15$) compared to the design condition where no label was presented (65.6%, $n = 21$) (Figure 6). In the latter condition, no participants selected three sustainable products, in contrast to the design with sustainability labels presented, in which five participants (16.1%) selected three sustainable products across scenarios. Thus, we may infer that the presence of sustainability labels was associated with a higher number of sustainable products being selected.
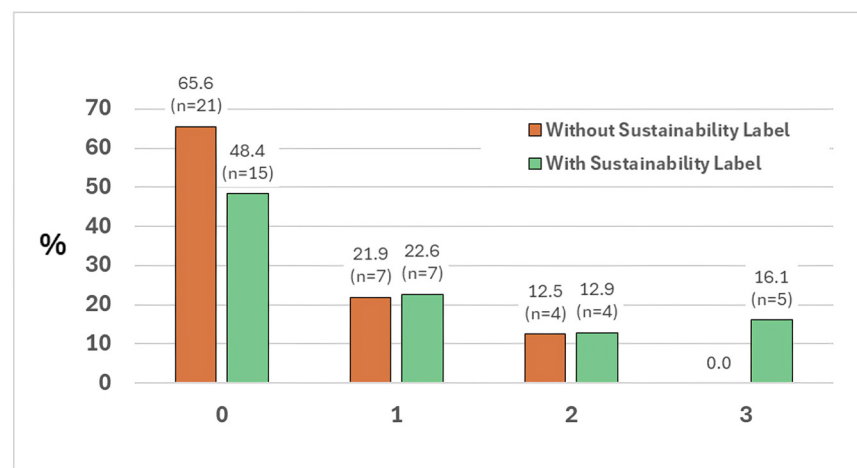

Figure 6. Percentage of participants who selected zero, one, two, or three sustainable products for the different webshop conditions. Numbers in parentheses indicate raw numbers.

4.3. Sustainable Labels and Purchasing Decisions

In order to put the findings into context, it is important to establish how familiar participants were with sustainability labels and how they viewed sustainable products in relation to purchasing decisions. Figure 7a (top and bottom panels) shows that the most frequent response in relation to sustainability labels and classifications was 'somewhat familiar' for both webshop groups. Most participants in each group were 'somewhat willing' to pay extra (Figure 7b, top and bottom panels) for sustainable products. The responses in relation to how often sustainability labels and classifications influence purchasing behavior were varied, with the most frequent response in the no-label design group being 'sometimes' (Figure 7c, top panel); however, the data were more spread out in the group that saw the sustainability labels (Figure 7c, bottom panel). Roughly the same number of participants in each webshop design group indicated to be at least sometimes influenced by labels and classifications (Figure 7c, top and bottom panels).
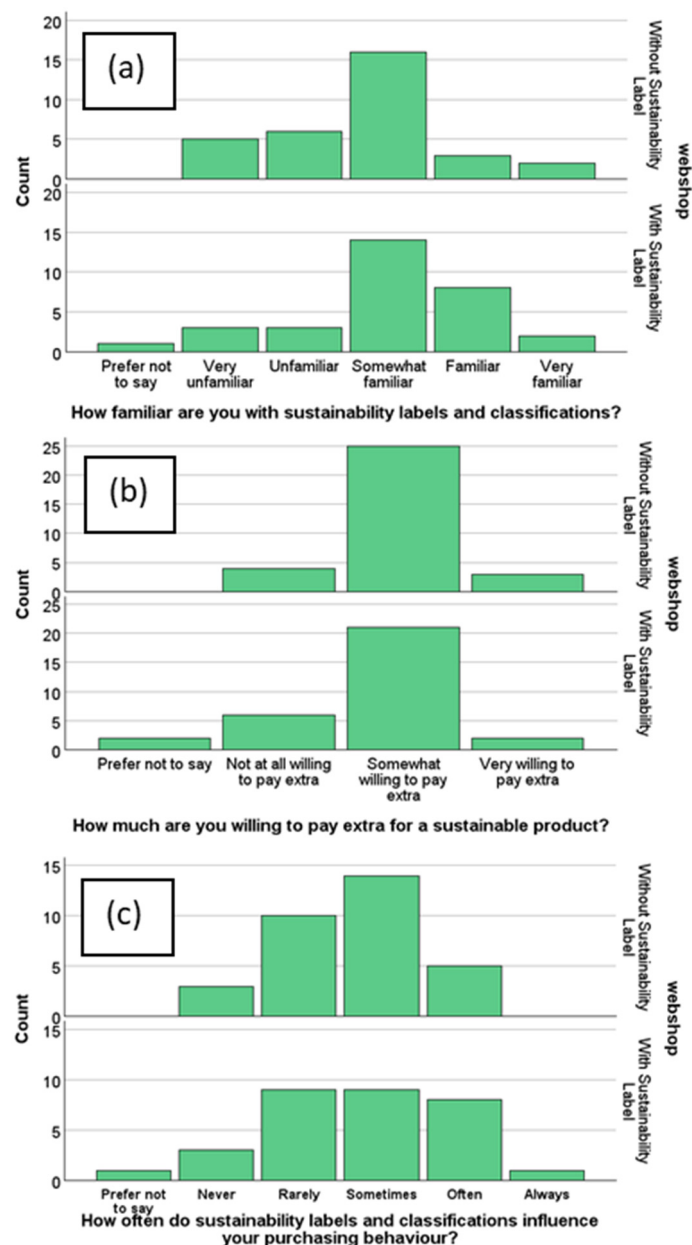
Figure 7. Participants' familiarity with sustainability labels (**a**), their willingness to pay extra for sustainable products (**b**), and reported influence of sustainability labels on their purchasing behavior (**c**) for each webshop condition (without sustainability labels (**top panel**) and with sustainability labels (**bottom panel**)).

5. Discussion

This study was set within the context of the growing importance of sustainability initiatives across the globe, with a focus on one 'pillar' of sustainability, i.e., environmental sustainability [26]. We specifically explored whether the presence or absence of sustainability labels next to product images was associated with product selections on a semi-realistic, simulated webshop. This hypothesis was based on the notions that the visual presence of sustainability labels makes these products salient [16] to the consumer, places green product selection (social norm) under the control of the consumer (theory of planned behavior), and/or reflects the aspect of endorsement of products. The intention of the study was not to contrast these frameworks against each other but to contextualize why ecolabels may be effective in influencing consumer selections in green marketing. It was presumed that the experimental setup resembled a natural shopping experience via the use of responsive

design and the possibility to browse and select products on a webshop similar to a real-life online shopping experience. This setup contrasts with typical studies in this area that employ a more controlled choice design setting or surveys and addresses a dearth of this methodology in the field. The findings showed that there was a significant association between the presence or absence of sustainability labels and the selection of sustainable products, in line with the hypothesized outcome. This association appeared to be due to participants choosing more sustainable products when a sustainability label was added to the product images, compared to the condition in which the label was not presented (Figure 6). This is a promising finding, as the freedom participants had to browse the webshop did not prevent them from making (un-/prompted) sustainable product choices, thus reducing the influence of a potential social desirability bias associated with participants' responses [14] or demand characteristics inferred from the setup. This is reassuring, given that the findings are consistent with those of others, using more controlled, choice design-based studies (e.g., [51,52]) than in the current design. The findings thus contribute to the broader, increasing knowledge base of sustainability research, suggesting the validity of the chosen approach. From a design and development perspective, a more natural test environment can give researchers confidence that the data are an adequate reflection of real-life behavior (for a discussion see [57]), which is informative (and desirable) for companies wanting to promote green products online.

It is important to consider participant demographics and responses to sustainability questions to build a comprehensive picture of the findings. In the study, about half of the participants saw sustainability labels next to products whereas the other half did not. For this label, a Type I ecolabel was used, as these labels are given by third parties after a rigorous life cycle check of the product. The ecolabel used was the EU Ecolabel, as this is one of the most popular ecolabels in the European Union [55], and most participants were expected to be based in this area. This turned out to be the case, with the majority of participants being located in Europe. Although the United Kingdom is not part of the European Union, the EU Ecolabel was used in this area until 2020 [58]. Most participants reported to be at least somewhat familiar with labels and classifications in both webshop conditions (Figure 7a), which contrasts with previous research showing that most ecolabels were not widely recognized [33].

The majority of participants in the current study had a Bachelor's degree. A study by Naz et al. [59] showed that, while university students expressed concern towards environmental protection, this mindset was not reflected in their behavior of purchasing green products. If the price was too high, then there was less motivation to buy green products compared to a cheaper alternative [59]. In the current study, the price increase for sustainable products was only 25%. In real life, the price increase of sustainable products over their non-sustainable counterparts is, on average, 75% to 85% [53] (range 20–220%) and the higher price tag associated with sustainable products is a recognized barrier to sustainable product consumption [17]. Thus, the low markup may have swayed participants to more readily select sustainable products. However, given that the prices were the same in both label-absent and -present conditions, with identical product descriptions (only the absence or presence of the sustainability label next to the product distinguished the two webshop conditions), it could be argued that the presence of the sustainability labels themselves had an effect on product selection, e.g., by making these products salient. The responses of participants towards sustainable product consumption were positive, as most participants indicated to be at least somewhat willing to pay extra for sustainable products (Figure 7b). Given that most participants had a Bachelor's degree or higher it could be argued that price was not so much of an obstacle in selecting sustainable products for the group in the current study, perhaps due to adequate income.

Regarding how often participants indicated their purchasing behavior was influenced by sustainability labels and classifications, both webshop groups had similar responses, which were varied across the response alternatives. More than 50% of participants in each webshop group indicated being at least sometimes influenced by sustainability labels and

classifications (Figure 7c, pooled across 'sometimes', 'often', 'always' response categories). Again, given that the sample was biased towards younger age groups, this finding may resonate with research that reports young people considering sustainability an important subject in our society [14,60]. It is noteworthy that an effect of sustainability labels on product selection was found, given that both groups (with and without label) seemed to indicate similar views on the perceived influence of sustainability labels and classifications.

While the findings of this study are promising, contributing to the wider knowledge of sustainable product promotion in e-commerce, there are of course limitations associated with the chosen research approach. With realistic experimental setups comes a lack of control, such as participants not complying with instructions, or randomly selecting products, or having preconceived notions regarding the purpose of the study, which may dilute the data. However, data from participants that did not comply with instructions or that explicitly noted the purpose of the study were excluded to avoid pre-set biases participants may have had regarding product selections. We can thus have confidence that the findings have a degree of ecological validity. Nevertheless, as neither this current study, nor other more controlled studies, required participants to actually buy a product, we cannot conclude with certainty that labels are indeed effective in promoting sustainable product purchases. A more conclusive approach to explore this aspect may be data analytics, although such an approach may suffer from a lack of causal inference as many variables in addition to the ones of interest are typically present when consumer behavior is analyzed based on available, real-life data. The intention–behavior gap is a widely demonstrated inconsistency between intention and behavior [61], and especially in green consumption [46]. However, research has also shown that this gap may be bridged via the moderating factor of greater availability of green products [46].

While the majority of participants came from younger age groups, it would have been useful to have explored older age groups' choices in relation to sustainable products in the current study, as research has shown that older people also value sustainability [62]. Younger and middle-aged users represent the largest proportion of online shoppers, which is perhaps reflected in our participant pool, but the proportion of older users using online services is growing [63,64]. However, a global study [65] highlighted that sustainability considerations may affect purchase decisions differently across generations, with 33% of millennials choosing a sustainable alternative, when available, compared to between 24–29% of older generations making such a choice. All age groups were represented in the current study but very unevenly, with a large proportion of participants under the age of 35 years. While the association between the label condition and selecting sustainable products had a medium strength given the sample size, it would still have been worthwhile to have a more varied participant pool to increase the generalizability of interpretations to various age groups.

Related to the lack of diversity of age groups may be the existence of preconceived notions that younger consumers may hold in relation to greenwashing. The webshop provided no information about the sustainability labels themselves when they were presented next to the product. Research has shown that younger individuals are more skeptical about sustainable product labels in fear of greenwashing compared to older adults [66]. Thus, it cannot be excluded that this effect may have influenced the findings. In hindsight, it may have been useful to have provided users with information about acceptable ecolabels, but this may have raised explicit expectations on the part of the participants in relation to the purpose of the study and we sought to avoid such expectations.

Nevertheless, going forward, future studies on promoting green products via e-commerce should perhaps provide education in the form of extra information on product pages regarding certification of products. Advertising campaigns about certifications and how to detect greenwashing may be beneficial to inform consumer decision making. Effective education about sustainability labels may also encourage more companies to apply for sustainability labels [67], thereby creating a positive feedback loop. Regarding consumers, knowledge of sustainability itself is an important factor to promote sustainable

product consumption; for instance, Zoomers perceive sustainability mostly focusing on the environmental 'pillar', while knowledge of all facets of sustainability and intention to purchase green items were associated [14]. Thus, more education of consumers in relation to sustainability may also be an avenue to promote sustainable purchases.

The default effect [48] reflects our tendency to choose what has been pre-selected (as a default) when making decisions. Making sustainable, online products more salient or attention-catching, or indeed pre-selecting these products, is a provocative approach that is not without challenges regarding fair e-commerce. The implementation of such a design itself ventures into manipulative or deceptive (dark) pattern territory [68], which, apart from ethical issues, also has been flagged up by the European Commission [35] as unfair commercial practice regarding choice architecture design. At the same time, drawing attention to the concept of sustainability via design may induce consumers to at least consider the selection of sustainable products, especially if the authenticity of a sustainability label can be recognized. From a consumer perspective, if sustainability is seen as important by a large proportion of the population, purchasing sustainable products may increase an individual's perceived social worth [69], especially for consumer groups that are not already convinced of the importance of sustainable product consumption. According to the theory of planned behavior [40], the influence of the subjective norm could then also contribute to converting sustainable product purchase intentions to actual sustainable purchases, especially if it is under a consumer's control to make this choice. Research has also considered the role of social media—and associated recognized norms—in promoting sustainable product choices [42], which suggests that the role of social influence may need to be considered by businesses. Consistent with this, it has also been suggested [70] that companies have to change their practices, including marketing, if sustainability is to be achieved. Retailers may adopt green marketing strategies to increase sales and credibility, while still incorporating transparency and honest communication of product information [71,72]. As has been noted [2], e-commerce can play a major role in facilitating the consumption of sustainable and ethically sourced products.

In conclusion, the proliferation of online shopping presents an effective format to reach a vast audience in the endeavor to promote the purchase of sustainable or 'green' products that will benefit the environment in the long run. While anthropogenic climate change is a worldwide threat it would be naïve to presume that product design alone can combat the challenges we face as people across the globe. However, the use of design to promote sustainable initiatives, combined with the vast reach that online commerce represents, should seed a consumer mindset that, albeit gradually, may become ever more cognizant of the opportunities and control we have as consumers to engage in sustainable and ethical life choices.

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