

Encouraging Sustainable Packaging Choices: The Impact of Nudging on Online Shoppers' Decision for Reusable Packaging

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Abstract:

This paper analyses how different types of nudges affect online shoppers' choice of reusable packaging. Drawing on data from an online experiment with 1,197 Swiss consumers, the results show that three nudges positively affect the reusable packaging choice: 1) the combination of default with sustainable cart reminder, 2) no additional cost info, and 3) visual process icon. This effect is stronger for individuals with lower sustainability values than for those with higher sustainability values. The study demonstrates that consumer packaging choices in e-commerce can be positively influenced towards more sustainable alternatives through nudging. The results further indicate that visual nudges are more effective than text-based nudges and that combining different nudge categories can be more effective than relying on single nudge categories. Since the effectiveness of nudges depends on their type and the subgroup of consumers, they should be implemented dynamically to be successful.

Keywords: e-commerce packaging, sustainable consumer behaviour, digital nudging

Track: Retailing & Omni-Channel Management

1. Introduction

The past decade has seen significant growth in e-commerce and online retail sales, which is expected to continue (eMarketer, 2022, 2023). This growth also means that the environmental impact of e-commerce is increasing (Frei et al., 2020; Mangiaracina et al., 2015). Packaging accounts for a significant part of e-commerce's environmental impact (Oliver Wyman, 2021; van Loon et al., 2015). However, previous research on using digital nudges to promote sustainable consumer choices in e-commerce has largely neglected packaging options. To address this gap, this paper examines how different types of nudges influence consumers to choose reusable packaging.

2. Literature Review

2.1 Environmental impact of e-commerce and reusable packaging

Worldwide e-commerce sales are predicted to reach 6.3 trillion USD by 2024, a five-fold increase from the 1.3 trillion USD recorded in 2014 (eMarketer, 2022, 2023). By 2026, global e-commerce sales are projected to reach 8.1 trillion USD, continuing the current growth trajectory (eMarketer, 2023). With the growing number of deliveries, the environmental impact of e-commerce is also increasing (Frei et al., 2020; Mangiaracina et al., 2015). Packaging accounts for a considerable part of e-commerce's environmental impact, contributing to 14% of CO₂ emissions from an average non-food online purchase (Oliver Wyman, 2021) and up to 26% of CO₂ emissions in the "last mile" of FMCG products (van Loon et al., 2015).

E-commerce packaging usually consists of three layers: primary packaging, which directly covers the product; secondary packaging, typically made of cardboard and used for transporting the good; and protective packaging, which fills the space between primary and secondary packaging and can take the form of foam, bubble wrap, or padding (Collini et al., 2022). Strategies to reduce e-commerce packaging's environmental impact must target at least one of these layers. This could involve using more sustainable materials for each layer, reducing or eliminating secondary and protective packaging, or implementing reusable packaging (Escursell et al., 2021).

Reusable packaging solutions such as Repack or Kickbag are made of lightweight, recycled materials to replace traditional cardboard-made secondary packaging. The reusable delivery bag can be used up to 20 times or more. Once these bags and their shopping content have been delivered to the consumer, they can be easily folded and returned by mail (Collini

et al., 2022; Escursell et al., 2021). Compared to single-use alternatives, reusable packaging can reduce CO₂ emissions by more than 80% (Hugill et al., 2021).

2.2 Nudging consumer behaviour

Every day, people's decisions are influenced by the way information is presented, not solely by rational thinking. Consequently, the choices we make often rely on how these options are framed (Johnson et al., 2012). Changes in choice architecture, or “nudges”, encompass any element of decision-making that can effectively and predictably alter people’s behaviour without restricting their choices or significantly altering their economic incentives. Nudges typically involve subtle manipulations that people often barely register, such as placing healthier options at eye level in a cafeteria to encourage more nutritious choices (Thaler & Sunstein, 2008).

Different types of nudges have already been employed and proved effective in a variety of contexts (Benartzi et al., 2017; Hummel & Maedche, 2019; Mertens et al., 2022; Milkman et al., 2022). A comprehensive approach to categorising nudges is based on the psychological barriers they address and how they aim to overcome them: by providing *decision information*, modifying *decision structure*, or offering *decision assistance* (Mertens et al., 2022; Münscher et al., 2016).

In contrast to the rational agent model, people often lack complete information when making decisions, relying on immediate, accessible data and ignoring complexity (Kahnemann, 2011). *Decision information*-based choice architecture interventions aim to enhance information accessibility, clarity, and relevance. This can be achieved by translating information, making information more visible, or providing social reference points (Münscher et al., 2016).

Individuals often lack complete information and tend to avoid complex analyses when making decisions, relying on contextual cues within the decision environment. Choice architecture interventions focused on *decision structure* leverage this context-dependency by adjusting how choices are presented. A well-known approach is "choice default," where one option is preselected if no choice is made. Other decision structure interventions involve altering the effort required to choose an option, changing available options, and changing the consequences associated with options (Mertens et al., 2022; Münscher et al., 2016).

Even with deliberate intentions, limited attention and self-control can hinder behaviour change, creating an intention-behaviour gap. *Decision assistance* interventions, such as

commitment devices, help reinforce self-control, addressing barriers like procrastination and intertemporal discounting. Other decision assistance interventions include reminders, making intended behaviours more noticeable (Mertens et al., 2022; Münscher et al., 2016).

Mertens et al. (2022) provided a comprehensive analysis of choice architecture interventions and analysed the effectiveness of different nudge categories using data from more than 200 studies, encompassing over 440 effect sizes ($n = 2,148,439$). Overall, they found that choice architecture interventions promote behaviour change with a small to medium effect size (Cohen's $d = 0.43$, 95% CI [0.38, 0.48]). Furthermore, they observed significant variations in the effectiveness of interventions based on technique and behavioural domain. Notably, interventions targeting the organisation and structure of choice alternatives (decision structure) consistently outperformed those centred on describing alternatives (decision information) or reinforcing behavioural intentions (decision assistance) across different behavioural domains.

With the rise of e-commerce, more consumer decisions are made online and can be influenced through digital nudging. Digital nudges offer two main advantages over their physical counterparts: first, they are easier, faster, and cheaper to implement; and second, they can be personalised based on the individual user's digital footprint, context, and characteristics (Mirsch et al., 2017). This personalisation can enhance the effectiveness of digital nudges and subtly influence individuals' decisions and behaviour on a large scale (Möhlmann, 2021; Yeung, 2017). The digital nature of online stores makes them ideal for using personalised digital nudges to guide consumers towards more sustainable choices.

2.3 Nudging sustainable consumer choices in e-commerce

Previous studies on nudging consumers towards sustainable options in e-commerce have primarily focussed on three decision areas: first, encouraging the choice of sustainable products (Demarque et al., 2015; Schürmann et al., 2023); second, promoting eco-friendly delivery options (Ignat & Chankov, 2020); and third, minimizing product returns (Pfrang & Spreer, 2022; von Zahn et al., 2022). Although these studies have shown that nudges can encourage sustainable consumer choices across different areas, prior research has largely neglected sustainable packaging options. This is a significant gap since packaging accounts for a considerable share of the environmental impact of e-commerce.

Demarque et al. (2015) found that descriptive norms led to the purchase of more eco-labelled products and an increase in spending compared to a control condition. In contrast, Schürmann et al. (2023) found a negative effect of social norm nudges on sustainable product choice but a positive one of simplification nudges. Ignat and Chankov (2020) found that providing information on a delivery option's economic, environmental, and social impact makes consumers more likely to choose a sustainable alternative. Pfrang and Spreer (2022) conducted a field experiment to reduce product returns of four online retailers. They showed that dynamically implementing different types of nudges could reduce the average return rate by approximately 4%. In another large-scale field experiment, von Zahn et al. (2022) found that selectively implementing a two-component nudge, consisting of an information prompt and a reminder asking for the level of commitment, significantly decreased the value of returned products by 4%.

To the best of our knowledge, only Michels et al. (2022) investigated the impact of nudging on sustainable packaging choices, but only in combination with two other eco-options. Specifically, they considered sustainable packaging as the reuse of packaging material from previous orders alongside longer delivery times and carbon offsetting. Michels et al. (2022) found that default, active choice, and self-nudges significantly increase the number of eco-options consumers select. The effect of different types of nudges on the consumer choice of sustainable packaging on its own thus remains neglected. To fill this gap, we explore how different types of nudges impact consumers' choice of reusable packaging.

3. Methodology

An online experiment was conducted using a between-subjects design to assess the impact of different nudge types on consumers' choice of reusable packaging. The experiment simulated an online shopping experience for fashion products. Tivian was used for creating and running the survey. A market research institute recruited online shoppers aged 18-79 in the German-speaking part of Switzerland. The final sample consisted of 1,197 participants, 50.9% female, with an average age of 46.9 years. We developed eight nudges in three categories (Münscher et al., 2016): decision information (nudges #2-5 and #8), decision assistance (nudge #6), and decision structure (nudge #1). Nudge #7 combines nudges #1 and #6 and their respective categories. Industry practitioners' suggestions and feedback were included in the process to increase face validity. Table 1 shows all nudges. Participants were randomly assigned to nine groups. One group was the control group, while the remaining

eight were subjected to different nudges. The choice situation contained two options: standard packaging or reusable packaging. The dependent variable "How likely is it that you would choose the reusable packaging option?" for each group was measured on a 7-point Likert scale ranging from 1 = very unlikely to 7 = very likely. Additionally, consumers' sustainability-focused value orientation was measured on a 7-point scale, as such values predict responsible consumer behaviour (Buerke et al., 2017). The scale included items such as "I think it is more important to save environmental resources than to be able to consume a lot" ($M = 5.557, SD = 1.453$), "In my opinion, acting socially responsibly should be the foundation for all managerial decisions" ($M = 5.514, SD = 1.423$), and "Personally, I think it is very important that companies act in an ethically correct manner" ($M = 5.756, SD = 1.372$). The Cronbach's α of the 9-item scale was 0.893.


<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input checked="" type="checkbox"/> Mehrwegverpackung	<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input type="checkbox"/> Mehrwegverpackung Ihre Wahl ermöglicht CO2-Einsparungen von über 50%.	<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input type="checkbox"/> Mehrwegverpackung Für über 70% der Onlinekund:innen die bevorzugte Wahl.	<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input type="checkbox"/> Mehrwegverpackung 
#1: Default	#2: Environmental Impact Info	#3: Social Norm	#4: Visual Process Icon
<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input type="checkbox"/> Mehrwegverpackung Wiederverwendbare Verpackungslösung – einfach über den nächsten Postbriefkasten retournieren.	<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input type="checkbox"/> Mehrwegverpackung Sie haben nachhaltige Produkte in Ihrem Warenkorb. Eine nachhaltige Mehrwegverpackung passt perfekt dazu!	<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input checked="" type="checkbox"/> Mehrwegverpackung Sie haben nachhaltige Produkte in Ihrem Warenkorb. Eine nachhaltige Mehrwegverpackung passt perfekt dazu!	<p>VERPACKUNG</p> <input type="checkbox"/> Standardverpackung <input type="checkbox"/> Mehrwegverpackung Bei beiden Optionen fallen keine Zusatzkosten an.
#5: Return Convenience Info	#6: Sustainable Cart Reminder	#7: Default + Sustainable Cart Reminder	#8: No Additional Cost Info

Table 1. Overview of nudges¹

4. Results

An initial one-way ANOVA found no effect of the tested nudges on consumers' likelihood of choosing reusable packaging ($F(8, 1188) = 1.738, p = .085$). Although all nudges had higher means than the control group (see Table 2), their effects were not sufficiently large to be statistically significant for the overall sample (Cohen's d ranging from 0.08 to 0.33).

As all nudges aimed to steer consumers towards choosing a more sustainable packaging option, we next conducted a two-way ANOVA, adding consumers' sustainability-focused

¹ The English translations of the nudges are "Your choice enables CO2 savings of over 50%" (#2), "The preferred choice for over 70% of online customers" (#3), "Reusable packaging solution – simply return via the nearest post box" (#5), "You have sustainable products in your shopping basket. Sustainable reusable packaging is the perfect match!" (#6 and #7), and "There are no additional costs for either option" (#8).

value orientation as main factor.² There was no main effect of the nudges ($F(8, 1179) = 1.492$, $p = .155$), but a statistically significant main effect of consumers' sustainability values ($F(1, 1179) = 94.358$, $p < .001$) and a statistically significant interaction effect of the nudges and consumers' sustainability values ($F(8, 1179) = 2.892$, $p = .003$). We thus performed post-hoc analyses for the subgroups of consumers with high versus low sustainability values based on the estimated marginal means.

Group / Nudge	Overall sample				High SVAL				Low SVAL			
	n	M	SD	d	n	M	SD	d	n	M	SD	d
#0: Control	122	5.10	2.07		56	6.11	1.37		66	4.24	2.19	
#1: Default	127	5.30	1.86	0.10	63	5.83	1.70	-0.18	64	4.78	1.88	0.26
#2: Environmental Impact Info	133	5.74	1.79	0.33	71	6.34	1.39	0.17	62	5.06	1.96	0.39
#3: Social Norm	138	5.47	1.95	0.19	62	6.32	1.29	0.16	76	4.78	2.13	0.25
#4: Visual Process Icon	144	5.49	1.90	0.20	70	5.81	1.89	-0.17	74	5.18	1.88	0.46
#5: Return Convenience Info	135	5.62	1.83	0.27	67	6.22	1.39	0.08	68	5.03	2.02	0.37
#6: Sustainable Cart Reminder	118	5.27	2.00	0.08	56	5.34	2.21	-0.42	62	5.21	1.80	0.48
#7: Default + Sustainable Cart R.	146	5.71	1.69	0.33	85	5.91	1.60	-0.13	61	5.44	1.78	0.60
#8: No Additional Cost Info	134	5.59	1.73	0.26	61	6.10	1.40	-0.01	73	5.16	1.86	0.46

Table 2. Descriptive statistics and Cohen's d for overall sample and subgroups with high versus low sustainability values (SVAL)

For consumers with *high* sustainability values, multiple group comparisons with Bonferroni correction revealed no statistically significant effects of the tested nudges. In this subgroup, consumers in the control group were highly likely to choose the reusable packaging option ($M = 6.107$, $SE = .239$). In contrast, consumers with *low* sustainability values were less likely to choose the reusable packaging option in the control group ($M = 4.242$, $SE = .220$). In this subgroup, multiple group comparisons with Bonferroni correction revealed a statistically significant effect of the nudge combining default with sustainable cart reminder (#7; $M = 5.443$, $SE = .229$) compared to the control group (mean difference: 1.2, $p = .006$). These results suggest that the nudges' effectiveness varies by their type and the subgroup.

The above results were further tested with a two-way ANCOVA that controlled for sex, age, income, and education. The analysis revealed no main effect of the nudges ($F(8, 959^3) = 1.471$, $p = .164$), a main effect of consumers' sustainability values ($F(1, 959) = 78.750$, $p < .001$), and a statistically significant interaction effect of the two main factors ($F(8, 959) = 2.650$, $p = .007$). Next, post-hoc analyses were repeated for the subgroups of consumers with

² For including consumers' sustainability-focused value orientation as a categorical factor, the mean index of the 9-item scale was dichotomised using median splitting.

³ Survey participants not specifying sex, education, or income were excluded in the two-way ANCOVA resulting in $n = 981$ cases.

high versus low sustainability values based on the estimated marginal means. Multiple group comparisons with Bonferroni correction again revealed no statistically significant effects of the tested nudges in the subgroup with high sustainability values, but statistically significant effects for visual process icon (#4), combination of default with sustainable cart reminder (#7), and no additional cost info nudges (#8) in the subgroup with low sustainability values. Nudges #4 ($M = 5.336$, $SE = .232$, mean difference: 1.198, $p = .014$), #7 ($M = 5.419$, $SE = .249$, mean difference: 1.251, $p = .013$), and #8 ($M = 5.322$, $SE = .232$, mean difference: 1.154, $p = .024$) led to a higher probability of choosing reusable packaging compared to the control group ($M = 4.168$, $SE = .246$).

Table 2 shows that the nudges in the low-SVAL subgroup have consistently larger effect sizes (ranging from 0.25 to 0.60) compared to the high-SVAL subgroup and the overall sample. This supports the finding that nudge effectiveness is stronger for consumers with low sustainability values. A further inspection of Cohen's d values reveals that the sustainable cart reminder nudge (#6) has a comparable effect size to nudges #4 and #8 in the low-SVAL subgroup. However, it may also have a back-fire effect in the high-SVAL subgroup, despite not being statistically significant in any of the ANOVA and ANCOVA post-hoc analyses.

5. Discussion

Consumer packaging choices in e-commerce can be positively influenced towards more sustainable alternatives through nudging. Specifically for the consumer choice of reusable packaging, the results indicate that the effectiveness of nudges depends on the type of nudge and consumers' sustainability values. Consumers with low sustainability values are less likely to choose reusable packaging but can effectively be nudged towards choosing this sustainable packaging option over a standard one. However, the type of nudge plays a vital role in determining the effectiveness of nudging for this group. The default (#1) and sustainable cart reminder nudges (#6) were not statistically significant individually, but when combined in nudge #7. Thus, combining decision structure with decision assistance interventions might be a powerful strategy to increase nudge effectiveness. The weaker impact of the default nudge (#1) contrasts with Mertens et al.'s (2022) finding that decision structure interventions outperform other intervention categories. However, Ingendahl et al. (2021) observed a similar effect when combining the default with social norms, where the combination outperformed individual nudges. Further, two nudges addressed the convenience and ease of use of reusable packaging, one visual (#4) and one text-based (#5). Since only the visual process icon nudge

(#5) was significant, the results indicate that visual nudges might be more effective than text-based nudges. Within the text-based nudges, information on no additional cost (#8) was significant, but neither was information on the environmental impact (#2) nor social reference points (#3). This may be explained by the low sustainability values of the focal subgroup, which make financial costs more relevant than environmental consequences or the social norm of acting sustainably.

These results give important directions for future research and the practical implementation of nudging in e-commerce. Field experiments need to verify our results using actual behavioural data from online stores. Such experiments can utilise clickstream behaviour as predictors to determine whom to nudge and how to nudge. Our survey-based results indicate that both subgroup and type of nudge determine the nudge effectiveness, ranging from a Cohen's d of 0.01 to 0.60. Thus, practical implementations need to dynamically evaluate which online shoppers to target and what type of nudge to use in order to be successful. Dynamic machine-learning approaches can ensure that only fruitful subgroups or segments of users are presented with effective nudges. This way, AI can enable personalised digital nudging to reduce the environmental impact of e-commerce.

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