Testing Nudging Strategies within Conversational Agents: Promoting Sustainable Shipping Choices Through Different Types of Nudges

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Abstract.
Conversational agents (CAs) are becoming increasingly important in e-commerce, offering new opportunities to encourage sustainable consumer behavior. Building on nudging literature, this experimental study examines how different types of nudges implemented in chatbots influence decisions about (sustainable) shipping options. Results showed that participants confronted with the social proof nudge reported significantly higher perceived manipulation than those who saw the default nudge. Furthermore, perceived manipulation mediated the effect of the social proof nudge on the likelihood of choosing the more sustainable shipping option. These findings highlight the importance of perceived manipulation as a key mechanism in the effectiveness of nudges. Theoretically, the study provides insights into the differentiated effects of the types of nudges and contributes to our understanding of digital nudging in the context of chatbots.

Key words. Nudging, Conversational Agent, Behavior Change, Sustainability

Introduction

Conversational agents (CAs), such as chatbots and virtual assistants, are becoming standard tools in digital customer interaction. Driven by advances in artificial intelligence and natural language processing, they are now widely used in sectors like retail, healthcare, and education to provide instant, 24/7 communication, reduce costs, and enhance the customer experience (Følstad & Brandtzæg, 2017; Kusal et al., 2022; Panetta, 2017). For businesses, these systems are more than service tools: They are also platforms that can actively shape customer choices.

One increasingly important approach in this context is (digital) nudging. Nudging refers to subtle changes in the so-called choice architecture that deliberately influence behavior without restricting an individual's freedom of choice (Thaler, 2018). As the nudging potential of chatbots has been little studied to date (Weinmann et al., 2016) and the effectiveness of digital green nudges varies greatly (Beermann et al., 2024), this paper aims to shed light on the effect of digital nudges on consumer decisions. The study investigates how young people perceive the nudging strategies "default" and "social proof" in communication with a chatbot and how these nudges influence their shipping choice. Both default and social proof nudge have been found to be cost-efficient, easy to implement in chatbot interactions, and effective in shaping decisions (Caraban et al., 2019; Mertens et al., 2022). By examining the role of perceived manipulation as a mediator, the study provides insights for businesses on how to design chatbot interactions that both drive sustainable consumer behavior and preserve customer trust.

Theoretical background and hypotheses development

CAs are software-based systems with which humans interact through written or spoken natural language, thus mimicking human conversations (Diederich et al., 2022; Feine et al., 2019; Laranjo et al., 2018). While the first well-established chatbot – ELIZA – was already programmed in 1966, the popularity of CAs has increased lately due to a renewed interest in artificial intelligence (Stone et al., 2022; Weizenbaum, 1966). Especially the recent advances in natural language processing aroused the attention of both scientists and practitioners (Diederich et al., 2022). As people are relying more and more on digital technologies in both their personal and professional spheres, the number of decisions made within digital choice environments grows (Weinmann et al., 2016). Nowadays, people use smartphone CAs as a matter of course for everyday tasks (Laranjo et al., 2018). Therefore, CAs are a promising technology in many areas of application, like healthcare, education, and retail (Følstad & Brandtzæg, 2017; Panetta, 2017). CAs possess benefits like 24/7 availability, immediate responses, omnichannel communication, human-like conversation, and cost-saving potential (Kusal et al., 2022).

Several synonyms are used for CAs, for instance, "ECA, chatbot, virtual assistant [or] digital assistant" (Feine et al., 2019, p. 1). CAs can be divided into three categories depending on the mode of communication with the human user: text-based agents (chatbots), voice-based virtual agents, and embodied agents (Allouch et al., 2021). In this paper, we examine text-based chatbots.

Digital nudging is defined as the application of design features within user interfaces (UIs) with the objective of influencing individuals' actions in digital decision-making settings (Weinmann et al., 2016). These settings include UIs like online forms or ERP screens, where users have to make choices or judgments (Weinmann et al., 2016). Digital nudging thus refers to a deliberate manipulation of the choice architecture to achieve a specific result (Caraban et

al., 2019). Typically, the aim is to aid users in making decisions that are more beneficial for themselves and society (Jesse & Jannach, 2021). An essential characteristic of (digital) nudging is to maintain the choice space and the user's freedom of choice (Jesse & Jannach, 2021; Lembcke et al., 2019). Nudging has been effectively implemented across different domains such as online shopping, healthcare, and environmentally friendly behavior (Beermann et al., 2022; Capasso & Umbrello, 2022; Dennis et al., 2020). Within the scope of CAs, digital nudges are applied in multiple areas to guide choices and behaviors. Research indicates, for instance, that embodied CAs can encourage users to adopt healthier habits by delivering explanations that align with their beliefs and objectives (Abdulrahman et al., 2023).

There is a wide range of different digital nudges (Caraban et al., 2019). In this study, we examined the default nudge – in which the more sustainable option of shipping is preselected – and the social proof nudge – which uses other people's behavior as an argument (see Figure 2). The default nudge was chosen as it is frequently applied in practice, considered promising for influencing behavior, and is highly effective (Beermann et al., 2024). The social proof nudge was selected as it utilizes emotional aspects and possesses a high potential to influence behavior (Mertens et al., 2022).

(Digital) nudges deliberately manipulate the choice architecture. In our study, we wanted to investigate whether users do feel manipulated and whether this potential perceived manipulation mediates the relationship between the type of nudge and the target behavior, in our case the choice of a shipping option. Wachner et al. (2020) showed that participants expect the default nudge to violate their autonomy, but not the social proof nudge. This forms our first fundamental hypothesis (H1). Dekker (2024) states that people deeply involved in a topic might be more willing to accept manipulative communication if they think it helps a larger cause. Even further, they might not see the communication as manipulative at all. German university students possess relative strong pro-ecological worldviews (Geiger et al., 2018; Kaiser et al., 2005; Schultz et al., 2005) and are therefore expected to accept manipulative communication regarding sustainable shipping. This leads to our second hypothesis (H2). Jung and Mellers (2016) found that participants' support for nudges aiming at the automatic mind – such as default and social proof – was mediated by the perceived threat to their autonomy. This forms the basis of our third hypothesis (H3).
Thus, our three specific hypotheses are:

H1: The type of nudge (social proof nudge vs. default nudge) has a significant effect on perceived manipulation.

H2: Higher levels of perceived manipulation are associated with a decreased likelihood of choosing the unsustainable shipping choice.

H3: Perceived manipulation mediates the relationship between the type of nudge (social proof nudge vs. default nudge) and the choice of a shipping option.

Figure 1 shows our suggested conceptual research model.

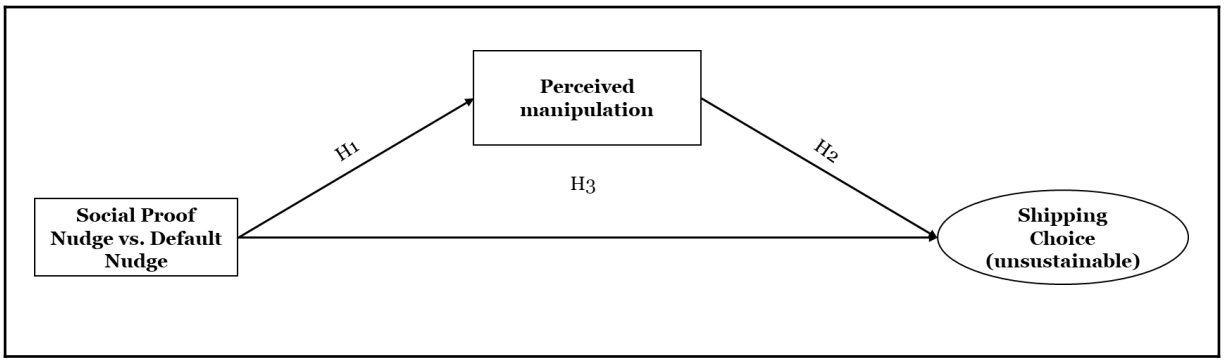

Figure 1: Research model.

Methodology

We recruited 110 students to participate in the survey in June 2025 via private social media and other channels. The mean age was 25 (SD = 4.72) years, and 53% of the sample were female, whereas 47% were male.

This study was conducted as part of an experimental online scenario. Participants were asked to imagine wanting to buy a hoodie for €59.99 on an online shopping platform, where they were guided through a typical ordering process. Once the item was in the shopping cart, a chatbot took over and directed them through the checkout process. Before selecting a payment method, the participants were asked to choose a shipping option.

The test participants were randomly assigned to one of two experimental conditions. Depending on the condition, they were shown a screenshot simulating an interaction with the chatbot during the shipping selection process (see Figure 2). The screenshots varied in the type of nudge used. In one condition, the sustainable shipping option was preselected as the default nudge. In the other condition, a social proof nudge was used, indicating that 76% of the other customers had also opted for the sustainable option.

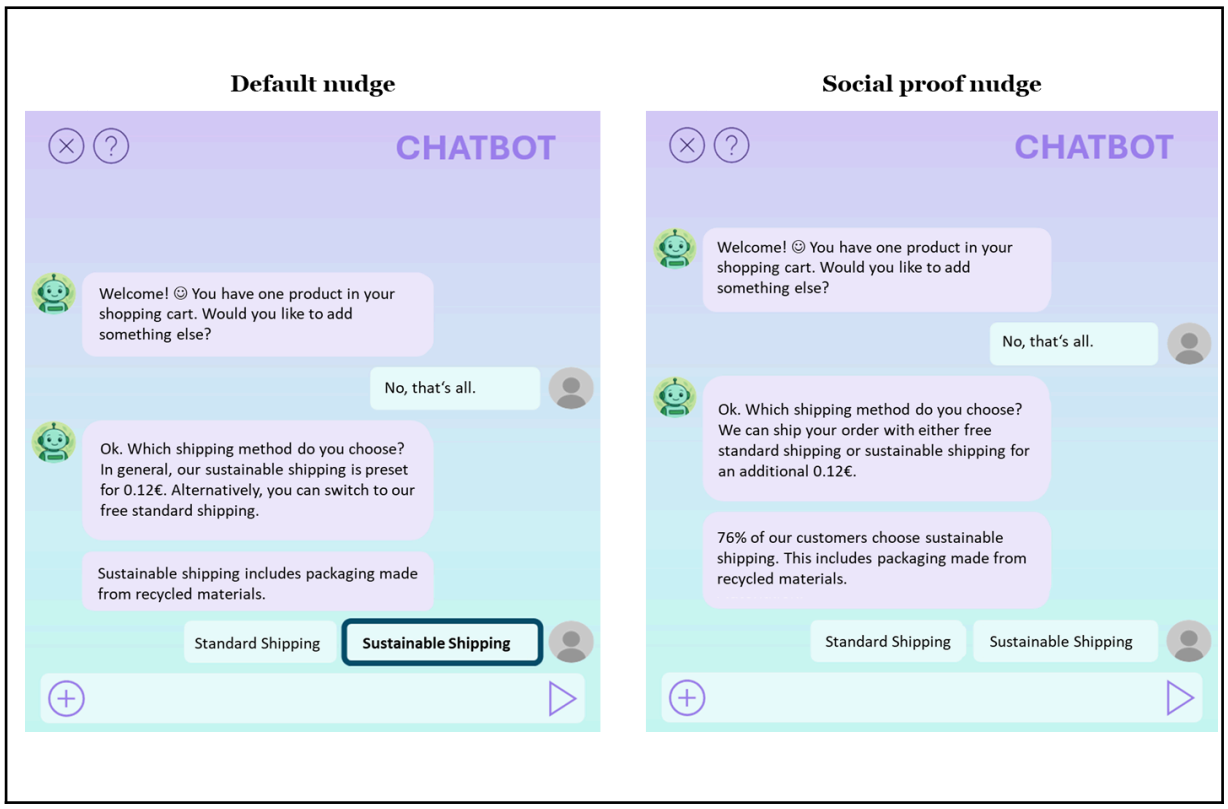

Figure 2: Social proof nudge and default nudge.

After viewing the scenario, the participants answered a standardized questionnaire. The questionnaire included questions about the presumed choice of delivery option (sustainable versus standard) on a 6-point Likert scale and the extent to which the chatbot interaction was perceived as manipulative: “I felt as if the chatbot had guided my decision” on a 6-point Likert scale.

A pre-test was conducted to determine a realistic price premium for the sustainable shipping option. The goal was to establish credible pricing and test the plausibility of the scenario. The results showed that participants considered the scenario very realistic.

Results

To test the effectiveness of different nudging strategies within a conversational agent, two experimental conditions were compared: One group received the default nudge, and the other received the social proof nudge. The evaluation results show significant differences in decision-making behavior and subjective perception of the chatbot's influence.

Regarding the likelihood of selecting standard shipping, the mean value was higher in the default nudge condition (M = 4.48, SD = 1.645) than in the social proof condition (M = 3.66, SD = 1.685). An independent samples t-test confirmed this difference was significant (t(108) = 2.549, p = .012, two-tailed). These results suggest that the social proof nudge was more effective in persuading users to choose sustainable shipping over standard shipping.

There were also significant differences in perceived manipulation by the chatbot. Participants in the social proof condition reported stronger feelings of being guided by the chatbot in their decision-making process (M = 3.89, SD = 1.418) than participants in the default condition (M = 3.06, SD = 1.625). This difference was also statistically significant (t(105.31) = -2.796, p = .006, two-sided). An overview of the analysis results can be found in Table 1.

		Default nudge (n = 47)	**Social proof nudge**	**t-test (two-sided) (n = 63)**
Shipping choice (unsustainable)	Mean SD	4.48 1.645	3.66 1.685	T = 2.549, p = .012
Perceived manipulation	Mean SD	3.06 1.625	3.89 1.418	T = -2.796, p = .006

Table 1: Descriptive statistics

A mediation analysis was conducted to examine the possible mediating effect of perceived manipulation by the chatbot on the choice of shipping type. The objective was to determine if the perceived manipulation mediates the relationship between the type of nudge used and the choice of the shipping method. The independent variable was the experimental condition, for which a dummy variable was created (0 = default nudge; 1 = social proof nudge). The mediator was perceived manipulation. The dependent variable was the self-reported probability of selecting the standard shipping (unsustainable choice). The analysis was conducted using path modeling in the SmartPLS software program with PROCESS (Model 4) (Hair et al., 2022). The significance of the path coefficients was determined using bootstrapping methods with bias-corrected confidence intervals (5,000 resamples). The results are presented in Table 2.

Relationship	β-value	t-value	p-value (path)
Social proof nudge vs. default nudge perceived manipulation	.830	2.876	.004*
Perceived manipulation shipping choice (unsustainable)	-.233	2.295	.022*
Social proof nudge vs. default nudge shipping choice (unsustainable)	-.623	1.908	.056
Note. * p < 0.05; ** p < 0.01; *** p <0.001.			

Table 2: Results of the mediation analysis.

First, the results reveal a significant effect of the social proof nudge on perceived manipulation (β = .830, p = .004), **supporting H1**. This means that the participants who were confronted with the social proof nudge feel significantly more manipulated than participants who saw the default nudge.

Second, higher levels of perceived manipulation decrease the likelihood of choosing standard shipping (β = -.233, p = .022), **supporting H2**. However, the direct effect of the social proof nudge on shipping choice was not significant (β = -.623, p = .056).

In consequence, these results suggest a significant indirect effect: the social proof nudge leads to a lower probability of choosing standard shipping due to a stronger feeling of manipulation. Therefore, the study **supports H3,** our suspected mediation effect of perceived manipulation between the type of nudge and shipping choice.

Figure 3 shows an overview of the effects from our study.

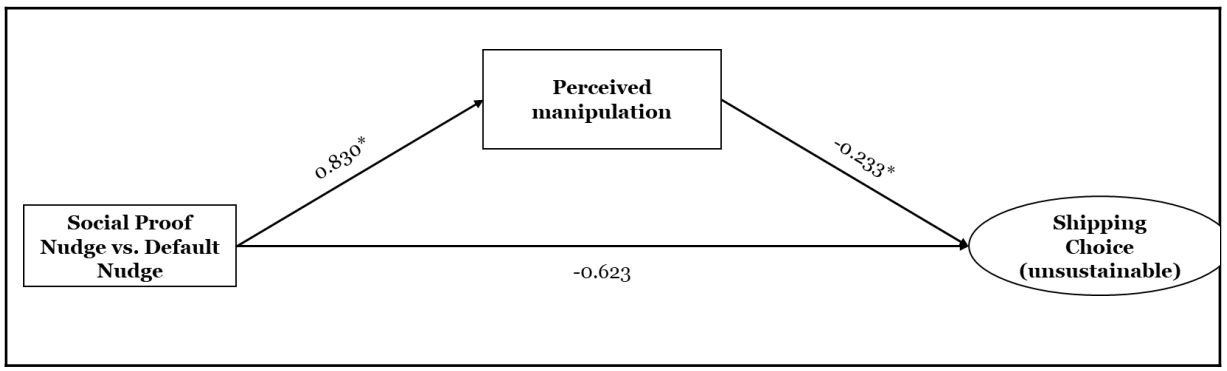

Figure 3: Process model (p < 0.05).*

Implications, Limitations, and Future Research Directions

The findings of our study contribute to research on CAs, digital nudging, and sustainable consumer behavior in several important ways. First, the results highlight that the type of nudge has a significant influence on how successfully it steers customers' decision-making behavior toward sustainable options. In our study, the social norm nudge was, in contrast to the default nudge, more successful in leading a young target group towards the more sustainable shipping option. Based on our findings, we therefore recommend implementing the social proof nudge in CA-based conversations about shipping selection. Second, it becomes clear that it is not only the effectiveness of the nudge itself that is relevant, but also the subjective perception of the measure. In particular, perceived manipulation proves to be a critical variable that mediates the relationship between nudging strategies and sustainable behavior. This illustrates that although a nudge can be effective in influencing behavior, it is also perceived critically—an area of tension that should be systematically considered before practical implementation. In practice, this means that nudges must be carefully formulated, as they influence the perceived manipulation of the conversation.

At the same time, the study draws attention to specific needs for further research. For instance, a more detailed examination of the social proof nudge is necessary, especially concerning the extent to which it is associated with an increased perception of manipulation and how this, in turn, affects acceptance of the nudge. Furthermore, while our results shed light on the mediating role of perceived manipulation, the study did not consider other psychological mechanisms, such as reactance, trust, or perceived transparency, that may also influence how users respond to digital nudges. To increase effectiveness, it might also be crucial to understand the reasons for rejecting sustainable options, even when nudging strategies are implemented. For example, could the perception of the nudge, such as resentment or distrust of the measure, hinder its intended positive effect? In the long term, this can provide a more nuanced picture of the factors that promote or hinder choosing sustainable options. Our study sample consisted of young students. Since this population differs from other groups in terms of their attitudes toward sustainability and technology, future studies should also be conducted with other target groups. Doing so will clarify whether the examined nudges do have the same effect on these individuals.

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