Jan 17th, 12:00 AM

Decreasing Shopping Duration by Altering Choice Environments? An Empirical Investigation of Individual and Hybrid Nudges in the Context of e-Grocery

Phillip Oliver Gottschewski
Hochschule Hannover, Faculty IV - Business and Informatics, Hanover, Germany, Phillip-Oliver.Gottschewski@hs-hannover.de

Marvin Auf der Landwehr
Hochschule Hannover, Faculty IV - Business and Informatics, Hanover, Germany, marvin.auf-der-landwehr@hs-hannover.de

Christoph von Viebahn
Hochschule Hannover, Faculty IV - Business and Informatics, Hanover, Germany, christoph-von.viebahn@hs-hannover.de

Johannes Staritz
Hochschule Hannover, Faculty IV - Business and Informatics, Hanover, Germany, Johannes.Staritz@hs-hannover.de

Decreasing Shopping Duration by Altering Choice Environments? An Empirical Investigation of Individual and Hybrid Nudges in the Context of e-Grocery

Phillip Oliver Gottschewski[1], Marvin Auf der Landwehr[1], Christoph von Viebahn[1], and Johannes Staritz[1]

[1] Hochschule Hannover, Faculty IV - Business and Informatics, Hannover, Germany
{phillip-oliver.gottschewski, marvin.auf-der-landwehr, christoph-von.viebahn, johannes.staritz}@hs-hannover.de

Abstract. Boosted by the Covid-19 pandemic, the utilization of online grocery shopping has gained an increasing relevance over recent years. Increasing customer value by reducing friction can be a key option for online grocers to maintain and increase growth, customer loyalty and satisfaction. Being easy and inexpensive to implement, digital nudges can offer distinct benefits for consumers and online grocers. In this context, we investigated the potentials of digital nudging, using anchoring, social norms and a hybrid nudging concept as rational choice triggers. Our results indicate that anchoring and hybrid nudges have a significant effect on purchase frequency, while none of the investigated concepts is capable of reducing the overall shopping duration. Interestingly, in combination with anchoring nudges, social norms do have a significantly influential effect, although individually proven to be ineffective in low involvement decision contexts such as buying groceries online.

Keywords: *Digital Nudging, E-Grocery, Shopping Behavior, Customer Value*

1 Introduction

The Covid-19 pandemic had a disruptive effect on global economies [1] and challenged businesses and societies for new solutions to secure the supply of foods and goods [2]. Especially online-based sales for fast-moving consumer goods and groceries have increased significantly around the globe over the last 12 months [3–5] and are predicted to gain even more relevance within the upcoming years [6, 7]. Online grocery shopping (e-grocery) offers several advantages compared to stationary grocery shopping, such as a higher level of perceived convenience and efficiency when shopping online [8, 9], or simply a larger range of products available [4, 10]. Furthermore, in times of crisis like the Covid-19 pandemic, remote supplies are more secure as they entail a minimum amount of personal contact, which is a major reason for the significant growth of e-grocery in recent years [5]. A crucial influencing factor for customers to favour online over offline grocery shopping is the percipience of the related transaction costs, namely monetary and non-monetary transaction costs like travel, transportation and in-store

shopping time, as well as physical convenience (e.g., carriage of goods) [4, 11]. Thus, reducing friction and accelerating grocery shopping can increase the perceived level of shopping convenience [12]. This is where digital nudges become a viable option as "*any aspect of the choice architecture that alters people's behavior in a predictable way*" [13] by preserving the customer's freedom of choice [14]. Nudges are based on the exploitation of a wide variety of heuristics. Due to the multitude of possible heuristics and their biases, nudges can follow different conceptual rules and principles (e.g., *default rules* or *anchoring and adjustment*) [15]. One advantage of these user-interface design elements is that they do not only enhance decision quality towards collectively more favorable choices [13], they also serve as a way to reduce the amount of information within a given choice environment (i.e., the vast range of products in an online shop) [15]. Reduced efforts in information processing are likely to promote time savings during the shopping process [16], which serve the customers' needs as they increase life satisfaction by reducing perceived negative impact of time stress, while increasing perceived control over their time [17]. Hence, digital nudges can help to reduce decision complexities and increase customer value [12], which can be defined as aggregate of perceptions of attributes such as convenience that serves the customer's aims when acquiring goods or services [18]. This study seeks to contribute to digital nudging research by empirically testing various digital nudging elements (DNE) in a laboratory experiment and expand the scarce literature on DNEs, especially in e-grocery. Until today, few studies have investigated the concept of digital nudges in e-grocery. Berger et al. proved a positive effect of default nudges in triggering pro-environmental behavior [16], which confirms that default nudges work well in any area of consumption by using presets, for which consumers refrain from actively opting out of [13, 19]. Other studies investigated the effects of numerous types of digital nudges in several general e-commerce areas that cannot directly be transferred to the grocery retail context [10, 20]. Second, we examine the effect of digital nudges on time-saving. Saving time is a crucial reason for consumers to engage in e-grocery [21] and may be reinforced by digital nudging [16]. Third, we investigate the effects of a hybrid digital nudging concept (DNC) combining social norms and anchoring cues. Unlike Ingendahl et al. [22] as well as Jesse & Jannach [23] who investigated a combination of default and social norms cues, this is a novel investigation into the effects of two DNCs that have not yet been jointly investigated. By deliberately assessing two diverse DNCs, namely one that has been proven to be rather effective (i.e., anchoring [24, 25]) and one that is presumed to be less influential (i.e., social norms [16, 26]) in a low-involvement context, we opt to improve the understanding of interaction effects across different DNCs in this domain. Therefore, we aim to answer the following research questions:

RQ1: What are the effects of a hybrid DNE combining social and anchoring cues compared to their individual counterparts?

RQ2: Can the selected DNCs be used for improving customer value in terms of faster decision-making and shorter shopping durations (SD)?

To answer these questions, we conducted a randomized experiment, using three different types of DNCs: anchoring, social norms and a hybrid DNC containing attributes of both aforementioned DNCs and comparing their decisional influence to a control group without design cues. The remainder of this paper is organized as follows:

First, we provide a short theoretical background about the concept of digital nudging, the role of time-saving in e-grocery and the investigated DNCs. Subsequently, we present our hypotheses and research model and expound the experimental setting. Ultimately, we discuss the results of our study and elaborate on its implications.

2 Theoretical Background

According to prospect theory, decision-making is primarily based on value-perception [27] as well as heuristics and biases, which arise from the interaction of the two cognitive systems (intuitive, automatic and reflective, rational) [28]. Exploiting these heuristics and biases, (digital) nudges act as stimuli and can alter choices, while at the same time preserving the freedom of choice [13]. In this context, the concept of libertarian paternalism describes the way decision-making can be influenced towards individual and collective benefits by being both, paternalistic and libertarian in terms of decision control [14]. Based on libertarian paternalism, nudges work in any type of choice environment, whereby any alternation of the decision frame is considered to influence a person's decision, no matter whether intended by the choice architect or not [13, 15]. Thus, the line between subliminal manipulation and liberal paternalistic influence on choice by nudging is thin [29, 30]. Nudge designs need to be chosen with caution to avoid manipulation, non-transparency of the intervention, restriction of one's freedom of choice and, thus, unethical usage of the nudging concept [29–32].

2.1 Digital Nudges in the Context of E-Grocery

The concept of nudging became popular with the manifesto of Thaler & Sunstein and has its origins in offline contexts such as altering restaurant menus to foster more healthy food choices [13]. As our life is increasingly aimed towards digital environments, the number of decisions made in digital settings is growing [15]. Thus, nudges can be used effectively in online settings, as they are easy and cost-effective to implement [33]. Common digital nudges are default nudges, which have been proven to work well in manifold consumption areas [19], as well as social norms cues, which are often applied by means of product ratings, indicating acceptance and value perception of the peer group [33, 34]. Social norms nudges are effective because of the human need for acceptance and belonging, an emotion that is processed in the impulsive, automatic brain system [35]. Triggering the need to belong, social norms can guide consumers decisions [16]. As descriptive normative information ("*descriptive norms*"), social norms can even accelerate the decision process as they offer "*an information-processing advantage and a decisional shortcut*" [36]. However, in recent studies the effectiveness of social norms nudges is divergent. Berger et al. found social norms to be ineffective in a rather abstract experimental environment [16], whereas other authors found that descriptive norms can indeed affect consumer decisions in more realistic settings [37, 38]. Therefore, it is vital to conduct further research to understand the underlying causes more holistically.

Using anchor heuristics, anchoring nudges have the potential to influence decisions [13], because a *"change of reference point alters the preference order for prospects"* [27]. In the case relevant information is missing, humans try to find reference points to guide them in making a decision. Thus, a conscious choice of a reference value set by the choice architect can provoke different decisions [33], for example via the use of nutri-score labels [24]. Recent studies mainly concentrated on investigating reference labels related to the sustainability of food products. While Auf der Landwehr et. al. [26] found anchoring nudges to be effective in the case of e-grocery, Hallez et al. [25] proved a limited influence of anchoring nudges. To further examine the influence of specific claims on the effectiveness of anchoring nudges in the e-grocery context, we opt to investigate anchoring nudges with a quality related claim in this study. Moreover, current studies mainly focus on the implementation of single DNCs to understand the particular effects one by one. Anyhow, e-commerce websites like Amazon and online grocery shops like REWE have been using hybrid nudges (i.e., combining salience and loss aversion nudges) for a long time already, which, however, require thorough theoretical understanding, investigation, and systemization from a scientific viewpoint.

Ohlhausen & Langen compared decoy effects and descriptive name labels with a combination of the forementioned interventions to nudge consumers towards more sustainable food choices, but found that a combination of both concepts is not influential [39]. Dennis et al. found a combination of numeric and semantic priming nudging elements in an online auction setting to be effective in terms of increasing the willingness to pay for electronic products [10]. Zimmerman & Renaud investigated a range of nudges containing social norms, feedback and informative nudge elements as well as a combination of nudges (i.e., "hybrid nudge") in a cybersecurity context, finding hybrid cues more effective than single cues [40]. Concerning e-grocery in particular, Ingendahl et al. as well as Jesse & Jannach investigated the effects of combining social norms and default cues, proving hybrid nudges to be highly effective compared to single nudges [22, 23]. By investigating a hybrid nudge containing social norms and anchoring cues, we opt to expand the knowledge-base on combinatory digital nudging effects for DNCs that have not yet been jointly investigated.

2.2 Time Pressure and Grocery Shopping

Customer-centric online retailing builds on improving the customer experience by accelerating the shopping process [12]. In online grocery shopping, consumers benefit from an increased level of convenience and significant time-savings compared to stationary shopping activities [4, 12]. E-grocery allows consumers to make *"more time available for activities other than shopping"* [41]. Interestingly, the perception of "losing" time during offline shopping is only present once e-grocery has already been adopted [42], increasing the urge to consider time-savings as major value-driver for future e-grocery strategies and business models [6, 7]. Perceived time stress can be either societal (e.g., 'always on' mentality), organizational (e.g., increased complexity of work) or psychological (undervaluing time as a resource) [43]. With time being a critical resource in today's life [9], (potential) time-savings can serve as an important decision factor for the adoption of e-grocery [8, 9]. Grocery shops mainly offer low-

involvement items [44], which are purchased more frequently when under time pressure [45], because the purchase decision is driven by affect [46]. Affect is processed in one of the two cognitive systems, namely the impulsive system, which drives automatic decisions [35]. Heuristics and biases emerge from the interplay of the forenamed cognitive systems, which are exploitable for choice architects through nudges [13]. Defined as *"perceived limitation of the time available to consider information or make decisions"* [47], time-pressure can be overcome by the use of digital nudges. Hence, digital nudging may help *"consumers [to] profit from time savings due to reduced decision making efforts when shopping for groceries"* [16].

3   Hypotheses Development

In the absence of information, people look for reference points in order to make a decision [33]. Using anchor heuristics, behavior patterns can be nudged towards a specific outcome by means of reference points as initial values for choice options in a decision environment [13], as *"different starting points yield different estimates, which are biased toward the initial values"* [28]. Current e-grocery studies indicate a remarkable impact of anchoring nudges on the purchasing behavior. Consumers tend to react positively on anchoring scales like nutri-scores, as found by Dubois et al. [24]. Moreover, Auf der Landwehr et al. proved the use of anchoring nudges to be effective in guiding delivery slot choices [26]. Similarly, Hallez et al. compared eco and nutrition labels in relation to sustainable purchasing behavior when buying foods in a fictive online shop and identified a marginal effect of the concept on more sustainable consumption behaviors [25]. We therefore hypothesize:

H1: The presence of a design element as anchoring option increases the individual purchase frequency of a product compared to the absence of an anchoring option

People adapt to the behavior of their social environment and copy its behavior patterns [13]. Hence, social norms can convey consumers that a product is interesting and socially accepted [34]. They can influence behaviors by either indicating the general acceptance of a peer-group [19] or by adumbrating a high product quality [48], which can be assumed to influence decision-making routines in e-commerce settings [7]. Even though low-involvement products are less prone to social reference and acceptance than high-involvement products [22], there is a discrepancy concerning scientific insights depending on the individual research context. While abstract surveys and experiments suggest a limited influence [16], examinations in more realistic e-grocery environments have found the concept to be significantly effective in altering product choices [37, 38]. Since our experiment builds upon a realistic online-shopping environment based on the online-shop of a major retail chain in Germany, we suspect the influential power of the social norms DNC to be congruent with the insights of Demarque et al. [38] and Goncalves et al. [37] and hypothesize:

H2: The presence of a design element as social norms cue increases the individual purchase frequency of a product compared to the absence of a social norms cue

Few studies have examined the use of *"hybrid nudges"* [40]. Zimmerman & Renaud investigated a hybrid nudge combining social norms, feedback and informative cues in

a cybersecurity context, finding hybrid nudges to be more effective than single DNCs [40]. Also, Ingendahl et al. examined the effectiveness of social norms and default nudges in an e-grocery context, which also showed a strong impact on purchase decisions [22]. In this study, we seek to investigate the impact of a hybrid DNE containing social norms and anchoring properties, which have not yet been jointly investigated in scientific research. Such a combination merges the use of reference points [33] with social acceptance [13] which is likely to oppose a strong influence on the purchase behavior of grocery consumers:

H3: The presence of a hybrid design cue following the concepts of anchoring and social norms increases the individual purchase frequency of a product compared to the absence of a hybrid cue

DNEs can help consumers to choose between options when in doubt or under time pressure [49], since they employ heuristics that trigger our two different cognitive systems (automatic, intuitive and reflective, rational) [13]. The underlying psychological process of social norms nudges addresses the desire to belong and arises from the impulsive system [35], simplifying decisions by *"reducing the amount of information that must be processed to make a decision"* [50], thus increasing the speed of decision making [36]. In contrast, anchoring nudges make use of anchor heuristics to simplify decisions between options [33]. Although simplified, decisions nudged by an anchoring heuristic might not only be processed in the impulsive, but also in the reflective system, as the anchoring heuristic is followed by an (insufficient) adjustment [28]. Hence, the accompanied adjustment heuristic is processed effortfully when comparing all products with an anchoring design cue [13, 28, 51]. In a combination of both design cues, the anchoring effects will lead to a more effortful decision, and thus, to a higher involvement with the product itself as it questions the customers' assessment of the value of a product and the concomitant satisfaction of individual needs, while the social norms cue simplifies and accelerates the decision situation [44]. Therefore, it can be assumed that the individual effects of both DNCs cancel each other out, levelling any potential impacts of the hybrid DNE on the SD. Accordingly, we hypothesize:

H4: The presence of a design element as anchoring option increases the individual SD compared to the absence of an anchoring cue.

H5: The presence of a design element as social norms cue decreases the individual SD compared to the absence of a social norms cue

H6: The presence of a hybrid design cue following the concepts of anchoring and social norms has no effect on the SD compared to the absence of a hybrid cue

Following our previous assumptions, anchoring and hybrid DNCs are likely to have a direct effect on the product purchase frequency (PPF). Moreover, we assume that an increase of the SD is likely when consumers are confronted with an anchoring scale. Due to the anchoring cue, consumers become more intensively involved with the concomitant reference framework and thus, refrain from habitual purchases. The more extensive selection process between product alternatives based on the use and evaluation of the reference framework could lead to an increase in SD [21]. Hence, we suggest that SD is mediated by the PPF in presence of an anchoring cue. Contrarily, social norms design cues are likely to simplify and accelerate the decision-process. Thus, we also assume a mediation effect of the PPF in presence of a social norms cue

on the SD. However, in contrast to the anchoring DNE, the PPF of items with social norms DNE is likely to decrease the overall SD [38]. Concerning the hybrid case, similar to H6, we expect social norms and anchoring effects to mutually balance each other in terms of PPF mediation effects on SD. Therefore, we ultimately hypothesize:

H7: *The effect of anchoring nudge elements on the SD is mediated by the PPF of a product with a respective design cue*

H8: *The effect of social norms nudge elements on the SD is mediated by the PPF of a product with a respective design cue*

H9: *The effect of a hybrid design cue following the concepts of anchoring and social norms on SD is not mediated by the PPF of a product with a respective design cue*

We examine the direct effect of each DNC on PPF (H1-3) and SD (H4-6). In addition, H7-H9 investigate the mediating role of PPF on SD, as shown in Figure 1.
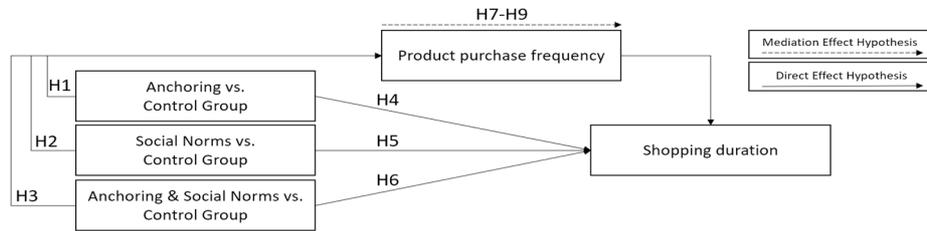

Figure 1. Research Model

4 Experimental Design

To answer our research questions, we conducted a virtual experiment with a one-way between-subjects design. We developed the designs for the three DNCs social norms, anchoring and the hybrid nudge according to the digital nudge design method from Mirsch et al. [52] namely by defining and analyzing the nudging context and creating as well as selecting multiple ideas to implement the nudges in our experimental setting. In this iterative process, we discussed the DNEs until we concluded on a final design, which is in line with our research goals. To implement the anchoring nudge, we used the nutri-score scale as design reference, which is a well-known commercial construct in several countries and has proven to be effective in various studies in the grocery context before [20, 24]. Utilizing a three-colored traffic light like scale (green A suggests high, yellow B indicates medium and red C suggests low quality) we depicted the level of quality by using the claim *"Gut. Günstig. Lecker. (Good. Affordable. Tasty.)"*. Based on several real-life examples (e.g., amazon.com), we chose to use a colored information tag as descriptive norms stating '*Bestseller*' to visualize a product's popularity and thus, indicate social acceptance as proclaimed by the paradigms of social norms [13]. Finally, we aligned both designs to represent a combination of the two nudges. An overview of the shop as well as the design of the used DNCs is depicted in Fig. 2. To conduct the experiment, we designed a fictitious online-shop based on a major grocery retailer with 847 products in several categories, including descriptions, pictures, and prices to ensure a high level of realism. Each DNC was implemented in a

single shop instance and the same products were used for the interventions within each shop. When entering the shop instances, participants were displayed a brief scenario description, outlining a shopping list with a total of eight products that had to be bought during the experiment as well as a fixed budget of € 70 that was not to be exceeded.
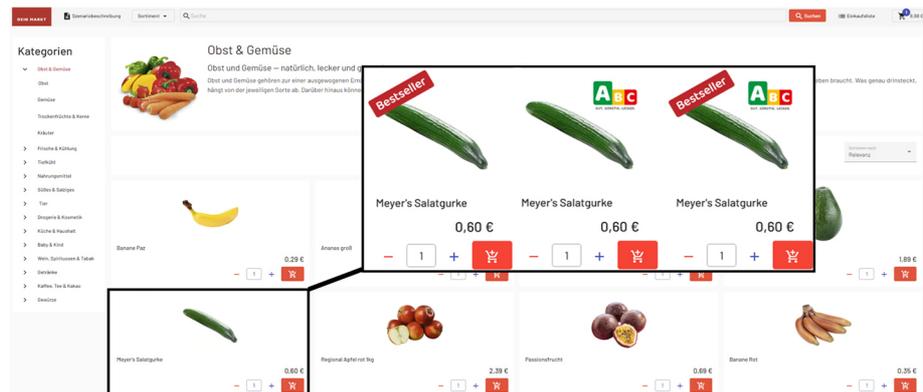

Figure 2. Shop design and nudge instantiations (only one instantiation in each treatment)

This way, we sought to increase the scenario realism and replicate realistic, price-sensitive shopping behaviors. To control for individual product and brand preferences, the shopping list was compiled exclusively of low involvement products (cucumbers, salt, butter, onions, spaghetti, milk, flour and salt sticks) and style and length of all product descriptions were aligned with each other [44]. Within the product categories, we selected one mid-range-priced product as carrier for the DNC cue. For the dependent variable PPF, we compared the PPF of the particular item featuring a DNE with the PPF of that item in the control group. The second dependent variable (SD) was measured from the time on a participant agreed to the scenario description until the manipulation check questions in the checkout were completed. The experiment took place in May 2021. Participants were allocated randomly to one of the four different shop-instances with social norms, anchoring or hybrid cues and a control group without any design intervention by a php-script with fixed seed, ensuring an equal distribution. All participants were recruited by the use of a crowdsourcing service, namely Clickworker. Getting paid by working online, its two million internet affine users are a perfect fit for a study about online purchasing behavior like present in our study. Similar to Amazons Mechanical Turk, Clickworkers are compensated for study participations, which has shown to have high reliability and provide higher-quality data than student or online convenience samples [e.g. 34]. Participants had to finalize the experiment within the checkout process, where we collected additional control variables (age, gender). Moreover, we implemented several manipulation check questions. Scenario realism was assessed (i.e., *"How realistic was the shopping experience?"*) on a 5-point Likert scale, while the conscious perception of digital nudging design cues per individual DNC case was checked by means of dichotomous questions (Anchoring: *"Was there a label on the product options?";* Social norms: *"Was there a bestseller reference for certain products?"*; Hybrid: *"Was there a bestseller reference combined*

with a purchase recommendation for specific products?). The experiment was terminated upon completion of these checks.

5   Analysis and Results

5.1   Descriptive Statistics

In total, we invited 363 individuals to participate in our field study. Due to failed manipulation checks and suspicious data patterns (e.g., insufficient time spent, low degree of perceived realism), we excluded 108 participants from the analysis, finally yielding a data set of 255 participants. Selected descriptive statistics on the study subjects are outlined in Table 1. To check the assignment of participants to the treatment groups, we performed a set of one-way ANOVAs. Since these analyses did not reveal any significant differences across the groups for the control items gender ($F = 0.22$, df = 3, $p > 0.1$) and age ($F = 0.43$, df = 3, $p > 0.1$), we deem the random assignment of the participants to the treatments as successful.

Table 1. Selected descriptive statistics

Controls	Mean	StD	Min	Max	N
Age	39.16	12.27	19	74	255
Gender[1]	1.42	0.49	1	2	255
Dependent Variables					
Shopping duration	11.24	7.58	5	57	255
Purchase frequency	2.05	1.64	0	8	255
Independent Variables – Purchase frequency					
Control group	1.36	1.33	0	5	67
Anchoring	2.85	1.77	0	7	72
Social Norms	1.84	1.38	0	6	61
Hybrid	2.09	1.66	0	8	55
Independent Variables – Shopping duration					
Control group	8.64	5.87	6	34	67
Anchoring	17.19	8.31	7	57	72
Social Norms	9.18	6.08	6	41	61
Hybrid	8.89	5.52	5	33	55

[1] Gender was dummy-coded with 1 = male, 2 = female

5.2   Direct Effect Analysis

To test H1 to H6, we conducted several one-way ANOVAs in IBM SPSS Statistics 26. Since Hotelling's Spur, Pillari's trace, Wilk's lambda and Roy's largest root indicated a significant difference across the treatments (independent variables), we continued to perform planned contrast analyses to compare the direct effects across the groups. Homogeneity of variances was asserted using Levene's Test, which showed that equal variances could be assumed for both, PPF ($p > 0.05$) and SD ($p > 0.05$). The results of our planned contrast analyses are shown in Table 2. Concerning product purchases, the

anchoring DNC seems to be particularly effective in stimulating certain buying decisions, showing a significant difference compared to the control group (p < 0.001) in support of H1 as well as compared to the social norms treatment (p < 0.01). While social norms cues did not individually elicit any significant differences in PPF compared to the control group (p > 0.05), the combination of design cues related to the concepts of social norms and anchoring (hybrid DNC) showed a slightly significant effect in terms of influencing purchase intentions (p < 0.05). Accordingly, we can also accept H3 while we have to reject H2. In terms of SD, the time per shopping instance in minutes seems to increase with the presence of a DNC compared to the absence of design cues as investigated in the control treatment. Due to the fact that the average SD in the anchoring group significantly exceeds the time per run in the control group, we can accept H4. Similarly, design cues related to the individual social norms concept as well as the hybrid DNC result in prolonged decision-making and shopping processes. However, these differences are not statistically significant compared to the control group, which is why we have to reject H5 and can accept H6. Finally, the results of the planned contrast analyses were further confirmed by calculating the non-parametric Tukey-Kramer as well as the Games-Howell-Post hoc test.

Table 2. Planned contrast analyses

Treatment	Product purchase frequency				Shopping duration			
	Mean (SD)	Mean difference (contrast value)			Mean (SD)	Mean difference (contrast value)		
		2	3	4		2	3	4
Control group	1.36 (1.33)	1.49***	0.48	0.73*	8.64 (5.87)	8.55***	0.54	0.25
Anchoring	2.85 (1.77)		-1.01**	-0.76	17.19 (8.31)		-8.01***	-8.30***
Social Norms	1.84 (1.38)			0.25	9.18 (6.08)			-0.29
Hybrid	2.09 (1.66)				8.89 (5.52)			

5.3 Mediation Analysis

To assess the (potential) mediation effect of the effectiveness of a given DNC on SD, as postulated in H7 to H9, we conducted a bootstrap mediation analysis with 10,000 samples and a 95% bias-corrected confidence interval as recommended by Hayes (2018). Thus, we used PPF as potential mediator between treatment groups and SD. To evaluate mediation effects, it is suggested that a significant direct effect must be present between the independent (treatment) and dependent variable (SD). Moreover, the direct and indirect effects need to be checked in the presence of the mediator variable (PPF). While a significant indirect effect always suggests a mediating effect, full mediation is given if the direct effect becomes non-significant when the mediator is present. In contrast, partial mediation can be assumed if the direct effect continues to be significant when the mediator is given [53, 54]. As outlined in Figure 3, our mediation analysis did not unveil statistically significant indirect effects of the DNC treatments anchoring *(indirect effect = 0.29; standard error = 0.45; 95% bias-corrected confidence interval (CI) = [-0.54, 1.29])*, social norms *(indirect effect = 0.09; standard error = 0.17; 95%*

bias-corrected confidence interval (CI) = [-0.18 ,0.51]) and the combination of both (*indirect effect = 0.14; standard error = 0.23; 95% bias-corrected confidence interval (CI) = [-0.28, 0.68]*) through the PPF for selected product alternatives with design cue (i.e., DNC effectiveness) on the SD. Despite the strong, statistically significant effect of the anchoring DNC on both, SD and PPF, our mediation analysis did not reveal any significant correlation between PPF and SD. Thus, neither a partial, nor a full mediation is supported, which is why we have to reject H7 and H8 while we can confirm H9.
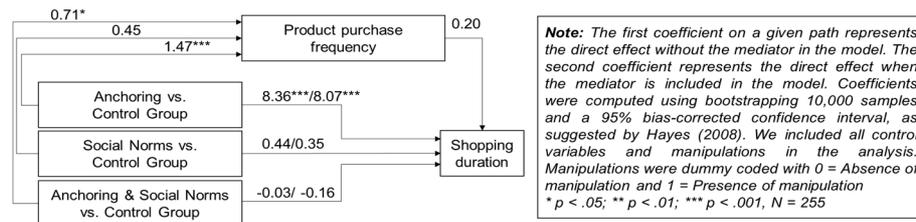

Figure 3: Mediation results

6 Discussion and Conclusion

The results of our study show that anchoring DNCs perform particularly well in influencing product purchase decisions. Similarly, the hybrid DNC showed an influential effect, which, however, was less eminent than the effects of the individual anchoring DNC. Contrary to that, and against our hypotheses, social norms cues seem to not cause any significant differences in PPF compared to the control group. Furthermore, the SD was not decreased by any of the DNEs and even increased significantly in presence of the anchoring DNE. Unexpectedly, social norms DNC had no influence on the purchasing behavior. This finding is contrary to other studies in realistic settings (i.e., [37, 38]), and confirms the insights of Berger et al. [16]. Hence, we assume the descriptive normative information linked to sustainability or personal health improvement of the nudges used in other studies [37, 38] to be pivotal for its effectiveness, whereby our study as well as the one of Berger et al. [16] were not linking the descriptive norm with a higher involvement goal (i.e. personal health or behaving pro-environmentally). In contrast, anchoring provides a reference framework that was not avoidable by the customers (since every product was assigned with a score-label). Accordingly, decision-making processes were effectively influenced by the anchoring DNC. However, since the corresponding reference framework had to be evaluated effortfully (for multiple options), the SD increased significantly. Furthermore, the presence of the social norms cue within the hybrid nudge intervention seems to simplify the cognitive processing, hence, reducing the more effortful decision. The theoretical implication is three-fold. First, we expand the scarce literature on digital nudges, especially in e-grocery contexts. Our results show the effectiveness of anchoring nudges and the ineffectiveness of social norms DNCs regarding the PPF in the e-grocery context. Our results are in line with other studies [16, 24–26] and confirm these results in a different setting and realistic choice environment. Also, our results suggest

that not only the context of the choice environment is a decisive factor for the success of social norms DNCs in e-grocery settings, but also the concurrent message (i.e., claim) provided to the decision maker along with the indication of social acceptance, which needs to be confirmed in future research. Second, we examined the effect of digital nudges on time-saving, showing a relationship between anchoring DNCs and an increased SD, which is contrary to current assumptions that digital nudges could decrease the SD [16]. We assume the interplay of the two cognitive systems to be relevant in this regard, as the anchoring nudge is using the intuitive and reflective systems to set a reference point and adjust decision-making [51]. Third, we investigated the effects of a novel, hybrid DNC and observed that there might be an interference between the effects of the single DNCs. In our study, an effect of the anchoring DNC on both, PPF and SD was given, however, this effect was extenuated for the hybrid DNE. Thus, we conclude that the individual effects of DNCs directly influence each other when merged to a single design cue. These results outline the importance for choice architects to design and compose DNEs carefully based on their individual psychological triggers and behavioral influences. Practitioners can benefit from our research as it aids to employ DNCs in a purposeful and effective manner to reduce friction and foster the adoption and use of e-grocery. Despite the individual contributions of our study, our research also features several limitations. Using Clickworker as a basis of the field of participants, our study subjects are rather internet-affine in terms of consumption behavior. Thus, we seek to conduct additional studies with other participants in the near future to increase the generalizability of our results. As we used a 5-point Likert scale for the manipulation check questions, the participants comprehension of the scale intervals might not be consistent. Moreover, DNCs can be applied in various forms and with different characteristics, as "*there is no neutral way to present choices*" [15]. Therefore, our study is limited to the individual design peculiarities of our digital nudging cues. Also, we cannot rule out that salience effects did influence the individual effectiveness of the DNEs [23]. Furthermore, we chose to exclusively investigate low-involvement grocery products in this study to decrease the effects of branding affinity. Nevertheless, DNCs such as social norms might work differently for high-involvement grocery products (e.g., coffee) or, as our results suggest, in combination with a specific high-involvement claim or nudge. Therefore, future studies should investigate and compare the role of different DNCs for high- and low-involvement groceries. Also, using nudges in any business context might run afoul with the ethical usage of nudging. Since corporate interests are likely to differ from the welfare of the society, further evaluation of how to use nudges ethically from a business viewpoint is required. As this is one of only a few existing studies investigating a combination of DNEs in one intervention, further research on the effectiveness of other combinations of different DNEs is needed. Moreover, since default nudges are known to be highly effective in influencing consumption decisions, it should be investigated in future research, whether this DNC is also capable to decreasing the average SD for consumers. In this study, we were able to prove that anchoring nudges seem to work effectively in e-grocery setups, while a combination with social norms was found to be less effective. Further research should therefore concentrate on evaluating the perfect match(es) for hybrid nudges within different application areas.

References

1. Carracedo, P., Puertas, R., Marti, L.: Research lines on the impact of the COVID-19 pandemic on business. A text mining analysis. Journal of Business Research, vol. 132, 586–593 (2021). doi: 10.1016/j.jbusres.2020.11.043
2. Sharma, A., Adhikary, A., Borah, S.B.: Covid-19's impact on supply chain decisions: Strategic insights from NASDAQ 100 firms using Twitter data. Journal of Business Research, vol. 117, 443–449 (2020). doi: 10.1016/j.jbusres.2020.05.035
3. Roggeveen, A.L., Sethuraman, R.: How the COVID-19 Pandemic May Change the World of Retailing. Journal of Retailing, vol. 96, 169–171 (2020). doi: 10.1016/j.jretai.2020.04.002
4. Campo, K., Lamey, L., Breugelmans, E., Melis, K.: Going Online for Groceries: Drivers of Category-Level Share of Wallet Expansion. Journal of Retailing, vol. 97, 154-172 (2021). doi: 10.1016/j.jretai.2020.05.003
5. Grashuis, J., Skevas, T., Segovia, M.S.: Grocery Shopping Preferences during the COVID-19 Pandemic. Sustainability, vol. 12 (2020). doi: 10.3390/su12135369
6. He, B., Mirchandani, P., Wang, Y.: Removing barriers for grocery stores: O2O platform and self-scheduling delivery capacity. Transportation Research Part E: Logistics and Transportation Review, vol. 141 (2020). doi: 10.1016/j.tre.2020.102036
7. Kühn, F., Lichters, M., Krey, N.: The touchy issue of produce: Need for touch in online grocery retailing. Journal of Business Research, vol. 117, 244–255 (2020). doi: 10.1016/j.jbusres.2020.05.017
8. Hult, G.T.M., Sharma, P.N., Morgeson, F.V., Zhang, Y.: Antecedents and Consequences of Customer Satisfaction: Do They Differ Across Online and Offline Purchases? Journal of Retailing, vol. 95, 10–23 (2019). doi: 10.1016/j.jretai.2018.10.003
9. Heim, G.R., Sinha, K.K.: Service Product Configurations in Electronic Business-to-Consumer Operations. Journal of Service Research, vol. 7, 360–376 (2005). doi: 10.1177/1094670504273969
10. Dennis, A.R., Yuan, L., Feng, X., Webb, E., Hsieh, C.J.: Digital Nudging: Numeric and Semantic Priming in E-Commerce. Journal of Management Information Systems, vol. 37, 39–65 (2020). doi: 10.1080/07421222.2019.1705505
11. Chintagunta, P.K., Chu, J., Cebollada, J.: Quantifying Transaction Costs in Online/Off-line Grocery Channel Choice. Marketing Science, vol. 31, 96–114 (2012). doi: 10.1287/mksc.1110.0678
12. Gauri, D.K., Jindal, R.P., Ratchford, B., Fox, E., Bhatnagar, A., Pandey, A., Navallo, J.R., Fogarty, J., Carr, S., Howerton, E.: Evolution of retail formats: Past, present, and future. Journal of Retailing, vol. 97, 42–61 (2021). doi: 10.1016/j.jretai.2020.11.002
13. Thaler, R.H., Sunstein, C.R.: Nudge. Improving decisions about health, wealth and happiness. Penguin Books, London (2009)

14. Thaler, R.H., Sunstein, C.R.: Libertarian Paternalism. American Economic Review, vol. 93, 175–179 (2003). doi: 10.1257/000282803321947001
15. Weinmann, M., Schneider, C., vom Brocke, J.: Digital Nudging. Bus Inf Syst Eng, vol. 58, 433–436 (2016). doi: 10.1007/s12599-016-0453-1
16. Berger, M., Müller, C., Nüske, N.: Digital Nudging in Online Grocery Stores. Towards Ecologically Sustainable Nutrition. In: 41st International Conference on Information Systems (ICIS), vol. 11 (2020)
17. Whillans, A.V., Dunn, E.W., Smeets, P., Bekkers, R., Norton, M.I.: Buying time promotes happiness. Proceedings of the National Academy of Sciences of the United States of America, vol. 114, 8523–8527 (2017). doi: 10.1073/pnas.1706541114
18. Woodruff, R.B.: Customer value: The next source for competitive advantage. J. of the Acad. Mark. Sci., vol. 25, 139–153 (1997). doi: 10.1007/BF02894350
19. Lehner, M., Mont, O., Heiskanen, E.: Nudging – A promising tool for sustainable consumption behaviour? Journal of Cleaner Production, vol. 134, 166–177 (2016). doi: 10.1016/j.jclepro.2015.11.086
20. Hankammer, S., Kleer, R., Piller, F.T.: Sustainability nudges in the context of customer co-design for consumer electronics. J Bus Econ, vol. , 897–933 (2020). doi: 10.1007/s11573-020-01020-x
21. Elizabeth Lloyd, A., Y.K. Chan, R., S.C. Yip, L., Chan, A.: Time buying and time saving: effects on service convenience and the shopping experience at the mall. Journal of Services Marketing, vol. 28, 36–49 (2014). doi: 10.1108/JSM-03-2012-0065
22. Ingendahl, M., Hummel, D., Maedche, A., Vogel, T.: Who can be nudged? Examining nudging effectiveness in the context of need for cognition and need for uniqueness. J Consumer Behav, vol. 20, 324–336 (2021). doi: 10.1002/cb.1861
23. Jesse, M., Jannach, D.: Explorations in Digital Nudging for Online Food Choices. In: Twenty-fifth Pacific Asia Conference on Information Systems. Dubai, UAE (2021)
24. Dubois, P., Albuquerque, P., Allais, O., Bonnet, C., Bertail, P., Combris, P., Lahlou, S., Rigal, N., Ruffieux, B., Chandon, P.: Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. J. of the Acad. Mark. Sci., vol. 49, 119–138 (2021). doi: 10.1007/s11747-020-00723-5
25. Hallez, L., Qutteina, Y., Boen, F., Smits, T.: The ABC's of Ecological and Nutrition Labels. The Impact of Label Theme and Complexity on the Environmental Footprint of Online Grocery Choices. Sustainability, vol. 13 (2021). doi: 10.3390/su13052474
26. Auf der Landwehr, M., Trott, M., von Viebahn, C.: Consumers Choice? Fostering Sustainability in Grocery Deliveries Through Digital Nudging. In: 29th European Conference on Information Systems (ECIS), vol. 26 (2021)
27. Kahneman, D., Tversky, A.: Prospect Theory: An Analysis of Decision under Risk. Econometrica, vol. 47, 263–292 (1979). doi: 10.2307/1914185

28. Tversky, A., Kahneman, D.: Judgment under Uncertainty: Heuristics and Biases. Science, vol. 185, 1124–1131 (1974). doi: 10.1126/science.185.4157.1124

29. Bovens, L.: The Ethics of Nudge. In: Grüne-Yanoff, T. (ed.) Preference change. Approaches from philosophy, economics and psychology. Theory and decision library Series A, Philosophy and methodology of the social sciences, pp. 207–220. Springer, Dordrecht (2009)

30. Hansen, P.G., Jespersen, A.M.: Nudge and the Manipulation of Choice. Eur. j. risk regul., vol. 4, 3–28 (2013). doi: 10.1017/S1867299X00002762

31. Lembcke, T.-B., Engelbrecht, N., Brendel, A.B., Kolbe, L.: To nudge or not to nudge: ethical considerations of digital nudging based on its behavioral economics roots. In: 27th European Conference on Information Systems (ECIS) (2019)

32. Sunstein, C.R.: Nudging and Choice Architecture. Ethical Considerations. Yale Journal on Regulation, Forthcoming, vol. 01/2015 (2015)

33. Mirsch, T., Lehrer, C., Jung, R.: Digital Nudging: Altering User Behavior in Digital Environments. In: 13th International Conference on Wirtschaftsinformatik (WI), pp. 634–648 (2017)

34. Schneider, D., Klumpe, J., Adam, M., Benlian, A.: Nudging users into digital service solutions. Electron Markets, vol. 30, 863–881 (2020). doi: 10.1007/s12525-019-00373-8

35. Vlaev, I., King, D., Dolan, P., Darzi, A.: The Theory and Practice of "Nudging": Changing Health Behaviors. Public Admin Rev, vol. 76, 550–561 (2016). doi: 10.1111/puar.12564

36. Cialdini, R.B., Kallgren, C.A., Reno, R.R.: A Focus Theory of Normative Conduct: A Theoretical Refinement and Reevaluation of the Role of Norms in Human Behavior Advances in Experimental Social Psychology. Advances in Experimental Social Psychology, vol. 24, pp. 201–234. Elsevier (1991). doi: 10.1016/S0065-2601(08)60330-5

37. Gonçalves, D., Coelho, P., Martinez, L.F., Monteiro, P.: Nudging Consumers toward Healthier Food Choices: A Field Study on the Effect of Social Norms. Sustainability, vol. 13 (2021). doi: 10.3390/su13041660

38. Demarque, C., Charalambides, L., Hilton, D.J., Waroquier, L.: Nudging sustainable consumption: The use of descriptive norms to promote a minority behavior in a realistic online shopping environment. Journal of Environmental Psychology, vol. 43, 166–174 (2015). doi: 10.1016/j.jenvp.2015.06.008

39. Ohlhausen, P., Langen, N.: When a Combination of Nudges Decreases Sustainable Food Choices Out-Of-Home-The Example of Food Decoys and Descriptive Name Labels. Foods, vol. 9 (2020). doi: 10.3390/foods9050557

40. Zimmermann, V., Renaud, K.: The Nudge Puzzle. ACM Trans. Comput.-Hum. Interact., vol. 28, 1–45 (2021). doi: 10.1145/3429888

41. Farag, S., Schwanen, T., Dijst, M., Faber, J.: Shopping online and/or in-store? A structural equation model of the relationships between e-shopping and in-store shopping. Transportation Research Part A: Policy and Practice, vol. 41, 125–141 (2007). doi: 10.1016/j.tra.2006.02.003

42. Kang, C., Moon, J., Kim, T., Choe, Y.: Why Consumers Go to Online Grocery: Comparing Vegetables with Grains. In: 49th Hawaii International Conference on System Sciences (HICSS), pp. 3604–3613 (2016). doi: 10.1109/HICSS.2016.450

43. Giurge, L.M., Whillans, A.V., West, C.: Why time poverty matters for individuals, organisations and nations. Nature Human Behaviour, vol. 4, 993–1003 (2020). doi: 10.1038/s41562-020-0920-z

44. Kuenzel, J., Musters, P.: Social interaction and low involvement products. Journal of Business Research, vol. 60, 876–883 (2007). doi: 10.1016/j.jbusres.2007.02.008

45. Peng, L., Zhang, W., Wang, X., Liang, S.: Moderating effects of time pressure on the relationship between perceived value and purchase intention in social E-commerce sales promotion: Considering the impact of product involvement. Information & Management, vol. 56, 317–328 (2019). doi: 10.1016/j.im.2018.11.007

46. Winter, F.L., Rossiter, J.R.: Pattern-matching purchase behavior and stochastic brand choice: A low involvement model. Journal of Economic Psychology, vol. 10, 559–585 (1989). doi: 10.1016/0167-4870(89)90043-3

47. Suri, R., Monroe, K.B.: The Effects of Time Constraints on Consumers' Judgments of Prices and Products. J Consum Res, vol. 30, 92–104 (2003). doi: 10.1086/374696

48. Amblee, N., Bui, T.: Harnessing the Influence of Social Proof in Online Shopping: The Effect of Electronic Word of Mouth on Sales of Digital Microproducts. International Journal of Electronic Commerce, vol. 16, 91–114 (2011). doi: 10.2753/JEC1086-4415160205

49. Campbell-Arvai, V., Arvai, J., Kalof, L.: Motivating Sustainable Food Choices. Environment and Behavior, vol. 46, 453–475 (2014). doi: 10.1177/0013916512469099

50. Duhan, D.F., Johnson, S.D., Wilcox, J.B., Harrell, G.D.: Influences on Consumer Use of Word-of-Mouth Recommendation Sources. J. of the Acad. Mark. Sci., vol. 25, 283–295 (1997). doi: 10.1177/0092070397254001

51. Kahneman, D.: Thinking, fast and slow. Farrar Straus and Giroux, New York (2011)

52. Mirsch, T., Lehrer, C., Jung, R.: Making Digital Nudging Applicable. In: 39th International Conference on Information Systems (ICIS) (2018)

53. Hayes, A.F., Little, T.D.: Introduction to mediation, moderation, and conditional process analysis. A regression-based approach. The Guilford Press, New York, London (2018)

54. Preacher, K.J., Rucker, D.D., Hayes, A.F.: Addressing Moderated Mediation Hypotheses: Theory, Methods, and Prescriptions. Multivariate Behavioral Research, vol. 42, 185–227 (2007). doi: 10.1080/00273170701341316