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Reduce, Reuse, Refuse? The Moderating Influence of Personality
on Social Norm Nudge Effectiveness in the Application of Pro-
Environmental Behavior

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Abstract:

Nudges sind eine beliebte Verhaltensintervention im Bereich des umweltfreundlichen Verhaltens. Für das immer größer werdende Problem der Plastikverschmutzung, versprechen soziale Normen eine kostengünstige und einfach umsetzbare Lösung. Vergangene Untersuchungen deuten darauf hin, dass einzelne Moderatoren, beispielsweise Persönlichkeit, die Wirkung von sozialen Normen positiv beeinflussen können.

Dies weist den Weg zu den Forschungsfragen „Führt ein sozialer Norm-Nudge zu einem umweltfreundlicheren Verhalten als kein Nudge?“ und „Gibt es einen Zusammenhang zwischen der Persönlichkeitsstruktur der Konsumenten und der Wirksamkeit eines Nudges?“.

Um diese Fragen zu beantworten, wurde ein quantitatives Online-Experiment mit Personen aus Deutschland und Österreich durchgeführt. Konkret nutzte das Experiment den Einsatz von wiederverwendbaren Take-Away-Verpackungen und zeigte einer Gruppe eine dynamische Norm, die die Verwendung von Mehrwegverpackungen gegenüber Einwegverpackungen förderte, und der Kontrollgruppe zeigte es das gleiche Bild ohne den Nudge. Die Analyse der durch dieses Experiment generierten Daten zeigte, dass soziale Normen nicht zu einem umweltfreundlicheren Verhalten führten. Dieser überraschende Befund widerspricht der bisherigen Literatur und kann auf Faktoren wie den Boomerang-Effekt, fehlende Nudge-Sichtbarkeit oder frühere schlechte Erfahrungen mit dem im Experiment verwendeten wiederverwendbaren Take-Away-Service zurückzuführen sein. Da es jedoch mit einigen aktuellen Forschungsergebnissen zu sozialen Norm-Nudges übereinstimmt, könnte es auch zur neuen Welle der Anti-Nudge-Forschung beitragen.

Darüber hinaus hatte die Persönlichkeitsstruktur der Teilnehmenden keinen positiven Einfluss auf die Wirksamkeit sozialer Normen. Diese Ergebnisse deuten darauf hin, dass das Soziale-Norm-Nudging möglicherweise nicht das Mittel der Wahl ist, um umweltfreundliches Verhalten in Deutschland und Österreich zu fördern.

Abstract:

Nudges are a popular behavioral intervention for pro-environmental behavior. As the issue of plastic pollution is ever growing, social norm nudges promise a cheap and easily implementable solution to it. To make social norms more effective in this regard, past research suggests individual moderators, such as personality, may moderate their effects positively.

This leads to the research questions ‘Does a social norm nudge lead to a display of more pro-environmental behavior than no nudge?’ and ‘Is there a correlation between consumers’ personality structure and the effectiveness of a nudge?’.

To answer these, a quantitative online experiment was conducted with individuals from Germany and Austria. Concretely, the experiment used the application of reusable takeaway packaging and showed one group a dynamic social norm nudge encouraging the use of reusable over single-use packaging and the control group the exact same image without the nudge. The analysis of the data generated by this experiment showed that social norms did not lead to more pro-environmental behavior. This surprising finding contests previous literature and may be due to factors such as the boomerang effect, lack of nudge visibility or previous bad experiences with the reusable takeaway service used in the experiment. However, as it aligns with some recent research on social norm nudges, it may also add to the new wave of anti-nudge research. Furthermore, participants’ personality structure did not influence social norm effectiveness positively. These findings suggest that social norm nudging may not be the measure of choice in encouraging pro-environmental behavior in Germany and Austria.

Keywords: Nudging, Social Norms, Pro-Environmental Behavior, Big Five Personality, Reusable Packaging, Single-Use Packaging

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1. Introduction

From turtles suffocating from plastic waste to extreme weather occurrences taking homes, livelihoods and ultimately human lives, the state of our planet and its climate is alarming to say the least. UN general secretary Antonio Guterres coined the era we have just entered “global boiling” (Niranjan, 2023), a term that clearly transports its gruesome meaning. Now more than ever, we must take drastic measures to prevent even worse climate effects, as human behavior is a critical contributor to environmental degradation and climate change (Intergovernmental Panel on Climate Change, 2007, p. 36f.).

An especially prominent area of humanities’ behavioral failing is plastic pollution.

Plastic pollution has become a major conservation challenge in recent decades. At a global scale, 29 million metric tons of plastic waste entered aquatic and terrestrial environments in 2016, and the annual rate was estimated to increase 2.8-fold by 2040 in a business-as-usual scenario. (Luo & Zhao, 2023, p. 1)

One especially frivolous – but also easily avoidable – case of plastic pollution is single-use takeaway packaging. Some solutions may come to mind immediately: A ban of single-use packaging by governments around the world, higher taxation of single-use plastic producers or mandatory astronomical surcharges for consumers when getting their food in a single-use container. Even though structural changes would most likely be most effective (Groot et al., 2013, p. 1839), they are often not very accessible, as they are in many cases difficult to get approval for in governing bodies and lengthy to implement.

Furthermore, as in the case of reusable coffee cups, most “(...) traditional approaches to changing behavior—financial incentives, information campaigns, bans and regulations (...)” (Loschelder et al., 2019, p. 2) have not proven to be very effective in changing consumer behavior, even though the classical theory of the *homo oeconomicus* would suggest them to be successful (ibid.).

To overcome the issues of these traditional approaches to changing behavior, a more implicit strategy has been used in past research: Nudging may be a quickly implementable, low-cost approach.

A nudge – a phrase coined by Cass Sunstein and Richard Thaler in their 2008 bestseller, also titled ‘Nudge’ (Sunstein & Thaler, 2008) – is an intervention that changes human behavior without altering financial incentives or fencing off choices in other ways (ibid., p. 5).

This thesis will be focusing on social norm nudging. Social norms can be defined as “beliefs about what are common and accepted behaviors for specific situations (...).” (Groot et al., 2013, p. 1830).

According to the literature, social norm nudges are among the most popular nudging interventions and have been shown to work above average well (Ingendahl et al., 2021, p. 325; Mertens et al., 2022, p. 5). A quantitative review on nudging effectiveness suggests that moderators like personality may influence nudge effectiveness (Hummel & Maedche, 2019, p. 55f.). This has been tested with conflicting results, calling for a retest (Oyibo & Vassileva, 2019; Schär et al., 2019). A further gap here is a test of social norms and personality in the application of pro-environmental behavior, in particular in the uptake of reusable take-away food boxes.

Regarding the potential influence of personality on nudge effectiveness, a useful way to measure personality is the model of the *big five*, which includes the traits *agreeableness*, *extraversion*, *conscientiousness*, *openness* and *neuroticism* (John & Srivastava, 1999, p. 103f; John et al., 2008, p. 1169).

Past studies found connections between social norm adherence and the trait *agreeableness* (Wilmot & Ones, 2022, p. 264), some – though not all - also for *conscientiousness* and *extraversion* (Eck & Gebauer, 2022, p. 559). Their research found the opposite effect for *openness* (ibid.)

Based on this literature, I developed five hypotheses.

The first research question asks whether using a social norm nudge will lead to a display of more pro-environmental behavior than no nudge.

Hypothesis 1, H1: A social norm nudge leads to more pro-environmental behavior in consumers than in the control condition with no nudge.

The second research question asks if there is a correlation between consumers’ personality structure and the effectiveness of a nudge. As mentioned above, based on previous research,

there are three possible positive correlations to nudge effectiveness: *agreeableness*, *conscientiousness* and *extraversion*. Additionally, there is a possible negative correlation between *openness* and social norm nudge effectiveness. This leads to four hypotheses:

Hypothesis 2, H1: The higher a participant scores for *agreeableness*, the higher the effectiveness of the social norm nudge.

Hypothesis 3, H1: The higher a participant scores for *conscientiousness*, the higher the effectiveness of the social norm nudge.

Hypothesis 4, H1: The higher a participant scores for *extraversion*, the higher the effectiveness of the social norm nudge.

Hypothesis 5, H1: The higher a participant scores for *openness*, the lower the effectiveness of the social norm nudge.

I tested these hypotheses in an online experiment on Austrian and German individuals. With this research design I aim to uncover, if, and moderated by which personality attributes, social norm nudges may work in the application of reusable take-away boxes.

However, all five hypotheses had to be rejected, as I found that the nudged group did not act more pro-environmentally than the control group, and personality did not moderate nudge effectiveness. These findings were unexpected and support the recent, growing nudge skepticism in the application of pro-environmental behavior within the scientific community (Murakami, 2022; Marxen et al., 2023; Van der Vliet et al., 2024).

These findings are highly relevant to both the scientific community as well as the world beyond. In the scientific world there has not yet been an exploration of social norm nudging in relation to personality factors in the application of pro-environmental behavior. For Germany in particular, this research is highly relevant, as the government passed a law making it mandatory – since the first of January 2023 – to offer reusable take-away packaging (in addition to single-use options) in any gastronomy business with more than 5 employees (Bundesregierung, 2022). Thus, it is now mandatory to give consumers the choice of reusable packaging, but they are not forced to pick the reusable option. This is where a behavioral intervention can be the difference between choosing the reusable option or not – and as this

thesis' results suggest, money, time and energy may better be spent on interventions that are not nudges. Therefore, these findings may save millions of misguided euros taken from Germanies' taxpayers. Furthermore, this research answers the calls for research from Oyibo and Vassileva, (2019) and Schär et al. (2019), as well as confirms the results of Schär et al. (2019). It contributes that personality attributes may not be an impactful moderator for nudge effectiveness. Instead, as suggested by the additional findings in the results section, individual differences like gender may have a direct effect on pro-environmental behavior – a promising avenue for future research.

In the world at large, as time to halt climate change is rapidly running out, we need to use all available means to make a difference. To uncover whether social norm nudging is the solution we are searching for, the next chapter concerns itself with the theory behind this topic. It is going first into term definitions, models and frameworks as well as an excursion of ethical considerations, and finally a review of past research on the matter. Then it points out the gaps in it and in the end the chapter lists the research hypotheses extrapolated from the research. Subsequently, the methodology is explored in detail: This third chapter describes the research design and process, and in closing explains the analysis of the data generated in the online experiment. Then, the fourth chapter lists the results for all five hypotheses and gives a brief look into further results. Chapter five discusses all these findings, which also includes the limitations of the study and points of departure for future research. Ultimately, the conclusion summarizes the abovementioned content concisely.

With this information given, the next chapter will detail the research.

2. Theory

2.1 Theoretical Framework and Conceptual Models

This subchapter deals with definitions of some of this thesis' terms. These are nudging, (social) norms, personality attributes and pro-environmental behavior. Along with these terms, broader insights into the concepts of nudging theory and types of nudges, as well as pro-environmental behavior and theories of personality attributes are discussed.

2.1.1 Nudging

The concept of nudging was developed by Richard Thaler and Cass Sunstein and first presented to a broad audience in their 2008 book 'Nudge: Improving decisions about health, wealth and happiness' (Sunstein & Thaler, 2008).

In their work, the two authors constitute that "(...) there is no such thing as 'neutral' design." (Sunstein & Thaler, 2008, p. 3) – we cannot make choices without our circumstances influencing us. They are not talking about the big differences in people's lives, like social class, culture or religion, but "small and apparently insignificant details" (Sunstein & Thaler, 2008, p. 3), which can impact people's choices and behaviors greatly. This web of small influences in the design around us is called *choice architecture*, while changing the seemingly insignificant details is called a *nudge* (ibid.).

A nudge, as we will use the term, is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting the fruit at eye-level counts as a nudge. Banning junk food does not. (Sunstein & Thaler, 2008, p. 6)

These changes in the choice architecture are therefore supposed to gently nudge people to act a certain way, however, choices are never "(...) fenced off, or significantly burdened." (Sunstein & Thaler, 2008, p. 5). Choice architects (the creators of nudges) have the ability to greatly improve the lives of other people by designing environments that are user-friendly (ibid., p. 11).

When deconstructed, the definition of a nudge seems to imply four main aspects: 1. A change to the choice architecture; 2. The change to a behaviour; 3. An undisturbed choice set; and 4. The absence of monetary incentives. (Santos Silva, 2022, p. 3)

Crucial in this quote are monetary incentives: These are not considered nudges (ibid.). This is due to the so-called *behavioral revolution* in the field of economics revealing that there are inherent limitations of price-based mechanisms regarding behavioral change (Santos Silva, 2022, p. 1). Moreover, according to Frey “Money sometimes has a negative effect on behaviour (...)” (Frey, 1997, p. ix). This is because of mechanisms he details in his work *Not Just for the Money* (1997). According to him, intrinsic motivation is a key driver of economic activity. However, once monetary incentives are introduced, these can crowd-out intrinsic motivations to perform certain actions (Frey, 1997, pp. 7-10; Frey & Reto, 2001).

Another important aspect of nudges is the behavior they are trying to elicit. Nudges try to “(...) influence choices in a way that will make choosers better off, as judged by themselves.” (Sunstein & Thaler, 2008, p. 5). This is referred to as “libertarian paternalism” (ibid., p. 13), as the nudged subjects retain free will while being influenced to act in their own interest. While the authors of *Nudge* see a lot of value in this combined term, among the rest of the scientific community it is not particularly popular (Sunstein & Thaler, 2021, pp. 312f.).

Nudges work based on different biases which are anchored in our automatic and reflective thinking systems, in other words the fast and slow decision-making systems in our brains (Thaler & Sunstein, 2021, pp. 41f.). These biases are *anchoring*, *availability*, *representativeness*, *optimism and overconfidence*, *gains and losses*, *status quo bias* and *framing* (Thaler & Sunstein, 2021, pp. 27-40). Other features of our cognitive system that make nudges effective are the *hot-cold empathy gap* and *identity-based cognition*. The first refers to the difference between one’s intention to act and the way one acts once a given situation arises (Thaler & Sunstein, 2021, p. 52), while the second explains how we subconsciously want to act more like people that we consider similar to us (Thaler & Sunstein, 2021, p. 79).

Regarding climate change, a number of behavioral biases lead to the issue not being taken seriously enough (Thaler & Sunstein, 2021, p. 282). These are *present bias* - taking the now more seriously than the future-, *salience* – the visibility of greenhouse gases to the naked eye is very low, *probabilistic harm* – ascribing specific storms, floods or other natural disasters to climate change is difficult, as the danger of them happening is probabilistic – and finally that there is no specific villain to blame to the plight of a changing climate (Sunstein & Thaler, 2021, pp. 282-284). This combination of factors makes climate change – or rather its counteraction, pro-environmental behavior, which aims to stop or reverse climate change - a great area of application for nudging interventions.

Finally, nudges lose effectiveness once agents feel manipulated by them (Santos Silva, 2022, p. 9). This leads to the issue of manipulation – can one even nudge without being manipulative? Thaler and Sunstein present a clear stance on that question:

The first misconception is that it is possible to avoid influencing people's choices. In countless situations, some organization or agent must make a choice that will affect the behavior of some other people. There is, in those situations, no way of avoiding nudging in some direction, and these nudges will affect what people choose. Choice architecture is inevitable. (Thaler & Sunstein, 2021, p. 14)

While choice architects may have no choice but to influence people's choices, how and to what degree exactly they can and should do that, is an important question to consider.

2.1.1.1 Excuse: Ethical Considerations of Nudging

Throughout the years, both the infringement on personal autonomy through nudging and the concept of liberal paternalism have been subject to widespread criticism (Santos Silva, 2022, pp. 3,7). Is it ethically permissible to influence other persons' decisions through overt or – even more questionable – covert nudging?

When attempting to find an answer to this question, starting with a definition of an *autonomous decision* seems appropriate: “Three criteria are generally accepted as being required for a decision to be considered autonomous: it must be (1) consistent with an individual's conscious, higher-order desires; (2) rational, made with sufficient time and information to allow reflection; and (3) free from covert external influence (...)” (Felsen et al., 2013, p. 203) Overt influences may not go against any of these criteria. As Felsen et al. discussed though, covert nudges paint a different picture: “Covert influences, however, present a challenge. While they plainly violate the third condition and therefore infringe upon autonomy, they may also be seen to enhance autonomy by increasing the likelihood of a decision aligned with the first condition, their higher-order desires.” (Felsen et al., 2013, p. 203)

This leads to several questions: Which criterion is more important? Is it permissible to violate one criterion of autonomous decisions to strengthen another one? How much may individual autonomy be infringed upon for the good of a higher purpose?

Santos Silva proposes a framework that categorizes the degree of impact on an individual's autonomy in three distinct types (Santos Silva, 2022, p. 7). “*First-degree nudges* respect the

decision-making autonomy of the individual and enhance reflective decision-making. Typical first-degree nudges involve the supply of simple information to individuals (...)” (Santos Silva, 2022, p. 7). In contrast, *second-degree nudges* build on “(...) behavioural or volitional limitations to bias a decision in the desired direction.” (Ibid., p. 8) The final, *third-degree nudge*, takes this to the extreme by involving “(...) behavioural manipulation to an extent that other nudges do not (...)” (Santos Silva, 2022, p. 8) This framework can serve as a guide for judging individual nudges’ ethical permissibility based on where they fall on this scale. The nudge used in the empirical part of this thesis may be interpreted as a first-degree nudge, as it gives information, but it could also be seen as a second-degree nudge, as the information given plays into subconscious biases and the desire to act in accordance with social rules. Thus, the impact on the autonomy of the individual is low to medium.

A related issue here is also reversibility: It is important to keep in mind whether the effect of a nudge is truly reversible in practice or just in theory (Santos Silva, 2022, p. 8).

Another helpful tool is the distinction between different concepts of autonomy: A differentiation can be made between ‘thin’ and ‘thick’ autonomy (Santos Silva, 2022, p. 8). In the thin version “(...) freedom of choice is an ingredient of welfare” (ibid.) while in the thick version “(...) freedom of choice is an end in itself and thus should be overridden only for the most compelling reasons.” (ibid.). Which of these one agrees with, veers into political territory this thesis will not breach; however, even if one believes in the thick version of autonomy, pro-environmental behavior to slow or reverse climate change may be seen as a most compelling reason.

The question of who has the right to decide on what is best for other people also ties into another question: How can people know, what might be better for other people? Elements that play into this are the biases decision makers or nudge architects are under when creating nudges, not knowing what the nudged populations’ true preferences are, or if the preferences within a nudged group are heterogenous or inconsistent (Santos Silva, 2022, p. 10).

A final argument that overturns the ethical argument for pro-environmental nudges is that, as they are good for the environment, not primarily the individual, they therefore don’t fall under the definition of libertarian paternalism (Santos Silva, 2022, p. 3).

In conclusion it can be said that, while caution regarding the use of nudging is advisable, pro-environmental nudges in general, and *first-degree* overt nudges in particular may be ethically permissible in the framework established in this thesis.

Now that it has been established that one is always forced to nudge in some direction, the question follows: If one must always nudge, what are the nudges one may choose from?

2.1.1.2 Types of Nudges

An important first distinction between nudges, which diverges from the original definition of Thaler and Sunstein, was created by Marta Santos Silva. According to her, “Paternalistic “nudges” promote individuals’ well-being, while non-paternalistic “nudges” advance social goals, reducing third party externalities in the process. “(Santos Silva, 2022, p. 5) Within this framework, nudging to enforce pro-environmental behavior falls into the non-paternalistic category, as it supports social goals.

Furthermore, a differentiation needs to be made between overt and covert nudges. Overt nudges are “(...) those of which the decision maker is aware and can consciously process (...)” (Felsen et al., 2013, p. 203), while covert nudges possess neither of those qualities. Felsen et al. also found out that in most – though not all – cases, humans find overt nudges more acceptable than covert ones because the latter go against their desire for autonomy (Felsen et al., 2013, p. 203). This means there is “(...) an inevitable tension between the respect for autonomy and the potentially beneficial outcomes for both the individual and society—of improved decisions “(Felsen et al., 2013, p. 203). An entirely different approach to this question has been utilized by Thaler and Sunstein: According to them, the second type – covert - does not actually exist, as nudges have to be visible to work, so it is in fact only their reasoning that is hidden (Thaler & Sunstein, 2021, pp. 323f.).

There are many different, non-consistent types and typologies of nudges (Santos Silva, 2022, p. 6). Nudges may be divided into *System 1* and *System 2* nudges (Jung & Mellers, 2016, p. 63). *System 1* refers to automatic cognitive processing, which includes interventions such as status quo options or defaults (ibid.). An example of this may be the automatic selection of the more sustainable choice on a website. *System 2* on the other hand refers to deliberate cognitive processing and includes informational nudges (ibid.).

A simple typology, originally developed for healthy eating nudges, classifies nudges into three types of interventions (Cadario & Chandon, 2020, p. 2). These are *cognitively oriented intervention*, which “(...) seek to influence what consumers know (...)” (Cadario & Chandon, 2020, p. 2), *affectively oriented interventions* “(...) that seek to influence how consumers feel without necessarily changing what they know (...)” (ibid) and *behaviorally oriented interventions* “(...) that seek to influence what consumers do (i.e., their motor responses) without necessarily changing what they know or how they feel (...)” (ibid.). The interventions used in this study are cognitively oriented; more precisely they fall in the category of *information interventions* (Hollands et al., 2017, p. 3). Similarly, Schubert developed a typology for green nudges, which consists of the three categories: *preserving one’s own positive self-image*, *following social pressure* and *setting defaults* (Schubert, 2017, p. 331). This thesis’ interventions fall in the second category.

In their quantitative review of nudging effect sizes, Hummel and Maedche built a taxonomy of nudges based on 100 studies including 317 different effect sizes of nudges (Hummel & Maedche, 2019, p. 48). The nudge types are *warnings/graphics*, *social reference*, *simplification*, *reminder*, *precommitment*, *feedback*, *elicit implementation intentions*, *disclosure*, *defaults* and *change efforts* (ibid., p. 56).

As Hummel and Maedche pose that digital nudges may work differently from offline nudges and are not included in their literature review (Hummel & Maedche, 2019, p. 47), an additional framework for digital nudges is needed to fully understand nudge types.

Valta and Maier built a taxonomy of digital nudges through a systematic literature review of scientific literature on nudging (Valta & Maier, 2023, pp. 8f). These 10 types correlate in some part with the cognitive biases discussed earlier, and are: *Anchoring*, *decoupling*, *framing*, *hyperbolic discounting*, *loss aversion*, *messenger effects*, *priming*, *simplification*, *social norms* and *status quo bias* (ibid.). Their detailed descriptions can be found in Figure 1 (Valta & Maier, 2023, p. 8).

Form	Explanation	Examples	Articles
Framing	Framing influences users by designing specific choices more appealingly (Mirsch et al., 2017).	Gruene-Yanoff & Hertwig, 2016; Guthrie et al., 2015; Hilton et al., 2014; Wang et al., 2013	54
Status quo bias	The status quo influences users by highlighting the disadvantages of leaving the current state more prominent than the advantages associated with a change (Mirsch et al., 2017).	Avineri, 2012; Forwood et al., 2015; Schirmacher et al., 2019; Stryja et al., 2017	29
Social norms	Social norms influence users by giving information about the behavior of other users, provoking herd behavior (Mirsch et al., 2017).	Chang et al., 2016; Kooreman & Prast, 2010; Laskowski, 2015; Auf der Landwehr et al., 2021	21
Messenger effects	Messenger effects influence users through messages the users receive, e.g., warning symbols or reminder messages (Mirsch et al., 2017).	Altmann & Traxler, 2014; Czap et al., 2015; Tsai et al., 2017; Zhang et al., 2014	18
Priming	Priming influences users by preparing them for the situation where a decision takes place, e.g., by visualizing the consequences of a decision (Mirsch et al., 2017).	Henkel et al., 2019; Knijnenburg & Kobsa, 2014; Momsen & Stoerk, 2014; Wang et al., 2013	17
Loss aversion	Loss aversion influences users using the bias that individuals weigh losses and disadvantages that may result from a decision more heavily than gains and benefits (Mirsch et al., 2017).	Bertsimas & O'Hair, 2013; Bull, 2012; Jones et al., 2015; Oelander & Thøgersen, 2014	14
Hyperbolic discounting	Hyperbolic discounting influences users using the bias that individuals value the present more than the future, even though future effects may be better (Mirsch et al., 2017).	Grand, 2008; Ratner et al., 2008; Wang et al., 2013; Woodend et al., 2015	10
Anchoring	Anchoring influences users using the bias that individuals tend to assess or estimate choices concerning individual starting points, and therefore different starting points lead to different results (Mirsch et al., 2017).	Bergram et al., 2020; Kretzer & Maedche, 2018; Oullier & Sauneron, 2010; Székely et al., 2016	10
Simplification	Simplification influences users by reducing the complexity of choice options (Mirsch et al., 2017).	Boskovic-Pavkovic et al., 2019; Gerber et al., 2017; Rodriguez et al., 2019; Thomas et al., 2013	7
Decoupling	Decoupling influences users by separating the costs of a choice from its consumption (Mirsch et al., 2017).	Avineri, 2012; Czap et al., 2015; Kattelman et al., 2014; Yevseyeva et al., 2014	6

Figure 1: Table of digital nudges according to Valta and Maier

This thesis specifically tests a social norm nudge, as indicated in its title. According to the focus theory of normative conduct social norms may “(...) mobilize decision making processes, especially when they are made salient, or focal, in a specific situation” (Groot et al., 2013, p. 1830). This is because humans consult social norms to figure out the appropriate response in social situations, especially uncertain ones (Cialdini & Goldstein, 2004, p. 597). “People tend to underestimate the extent to which the behaviours of others influence their own actions” (Schwartz, 2019, p. 90) Social norm nudges can be effective in influencing behavior both when people consciously want to follow the herd and when “(...) no conscious thought is associated with it” (Ölander & Thøgersen, 2014, p. 344). In a meta-analysis of nudge effectiveness across different nudges, while the average nudge effectiveness obtained a Cohen’s d of 0.31, social reference nudges reached a Cohen’s d of 0.40, therefore working above average well (Mertens et al., 2022, p. 5). In a different review of nudging interventions, Ingendahl et al. found them

to be among the most popular nudging interventions (Ingendahl et al., 2021, p. 325). They have proven to successfully influence consumer behavior in a plethora of applications, ranging from buying more eco-friendly items online to positive changes in energy consumption and paying for healthier food (ibid.) This is why they have been chosen for this thesis.

To meaningfully discuss social norm nudges though, one needs to understand social norms first. According to Cristina Bicchieri a “‘Norm’ is a term used to refer to a variety of behaviors and accompanying expectations.” (Bicchieri, 2005, p. 2). The earliest works proving the social influence of norms have been published in 1935 (Demarque et al., 2015, p. 167). However, after that, a decade-long controversy around the importance of norms in predicting human behavior followed, resulting in research determining that norms guide behavioral action in a meaningful way (Schultz et al., 2007, p. 1)

Now what constitutes a social norm? Eriksson, Goodin and Southwood propose the “norms as normative attitudes view” here (Eriksson et al., 2013, p. 15), which defines norms as “normative attitudes plus knowledge of those attitudes” (Eriksson et al., 2013, p. 15). Going forward with this non-reductive definition, norms serve the purpose of “(...) making us accountable to one another” (Eriksson et al., 2013, p. 15). Or as Groot et al. put it:

Social norms are customary rules of behavior that guide our interactions with others (...); they are thought to be beliefs about what are common and accepted behaviors for specific situations (...). (Groot et al., 2013, p. 1830)

Often used interchangeably with the word norm, there is a differentiation between formal and informal norms: While legal rules for example belong to the first group, social norms are part of the latter variety (Bicchieri, 2005, p. 8). Due to their informal nature, they “(...) may not be enforced at all” (ibid.). In case they are enforced, sanctions tend to be informal, ranging from gossip to dishonor for the transgressor (ibid.). While they may seem similar to moral rules, they differ in that “(...) conformity to a social norm is conditional on expectations about other people’s behavior and/or beliefs.” (Bicchieri, 2005, p. 8) People also frequently take social norms into account to respond to (uncertain) social situations; therefore they influence behaviors ranging from recycling to tax evasion (Cialdini & Goldstein, 2004, p. 597). An important distinction lies with the difference between injunctive and descriptive norms: The former inform us about what is typically approved/disapproved, while the latter describe what is done (Cialdini & Goldstein, 2004, p. 597). These two types are also called proscriptive – desired behavior that is not necessarily collectively enacted – and prescriptive – observable

behavior in a population – by some researchers (Bicchieri, 2005, p. 8). Injunctive and descriptive norms are two distinct forms of human motivation (Cialdini et al., 1991, p. 203). Descriptive norms influence behavior by looking to other people's behavior for a decisional shortcut to one's own behavior – if a certain behavior works for the people around us, chances are high it will be a safe choice to emulate it (ibid.). Injunctive norms however offer motivation through promising either (informal) sanctions or social rewards for a certain behavior, based on the shared moral norms a group holds (Cialdini et al., 1991, p. 204). The theory that much of human behavior is based on shared injunctive norms is highly contested though: Many conflicting norms may exist at the same time in any given situation, making every behavior ex-post explainable through injunctive norms. Thus, the value of the theory is considered limited by some researchers (ibid.).

Past experiments showed that participants may react negatively to a descriptive norm if the norm described is below the level of their own past conduct. If the desired sustainable behavior is not yet displayed by a large enough share of the population to be convincing, an injunctive norm may be thus advisable. This is as the so-called *boomerang-effect* may occur when displaying an undesirable social norm. It refers to people exhibiting more of the undesired behavior after learning through the nudge, that most people are acting according to the undesired behavior (Groot et al., 2013, p. 1831). An example of this is households starting to use more energy after being informed of the (descriptive) norm, that their neighbors have been using more energy than them (Schultz et al., 2018, p. 250). Therefore, scholars advise using injunctive rather than descriptive norms when most people are not displaying the desired behavior (Groot et al., 2013, p. 1831).

Injunctive norms also consist of two groups: subjective social norms and personal norms. The former refers to what is believed by most people to be the appropriate behavior and is (informally) sanctioned. (Trujillo et al., 2021, p. 3) Personal norms on the other hand are based on internal values and complied with because of them, without external reinforcement of the norm (Thøgersen, 2006, p. 238).

A special form of social norm nudges are dynamic social norm nudges:

Dynamic norms promise to cope with the challenge of fostering sustainable behavior when social norms are not (yet) aligned with the desired outcome. Instead of highlighting the current state of a behavior (i.e., X% of a reference group show the

‘static norm’), dynamic norms emphasize the increasingly changing norm over time to elicit (pre-)conformity to this change. (Loschelder et al., 2019, p. 3).

These are not to be confused with dynamic nudges, which refer to nudges being personalized for the individual they are supposed to influence (Dalecke & Karlsen, 2020, p. 140f). Research on this new form of norms is still sparse (Loschelder et al., 2019, p. 3) but has been called for in past studies on static social norm nudges (Trujillo et al., 2021, p. 18). It showed very promising results in the reduction of meat consumption in the US, with participants even acting counter normatively to be in congruence with the dynamic norm (Sparkman & Walton, 2017, p. 1663). This is particularly true when the adherence to a normative behavior is rapidly increasing, even if the baseline of uptake was very low (Schultz et al., 2018, p. 252). In a replication of the meat consumption study in the UK however, the same dynamic social norm nudge did not show an effect (Aldoh et al., 2021, p. 8315). The authors of the study believe higher norm salience in the UK to be the reason for this lack of effect and call for further research testing dynamic social norm nudges with a wide range of moderators (ibid.). These conflicting results make dynamic social norm nudges an interesting field of study in a different geographical region than past studies.

Finally, a potentially valuable moderator for (dynamic) social norm effectiveness is personality attributes.

2.1.2 Personality Attributes

Many studies have shown the positive effect of personalized individualized social influence measures - based on participants’s personality structures - on persuasive strategy effectiveness (Halko et al., 2010; Hirsh et al., 2012; Kaptein et al., 2010; Kaptein et al., 2015). Whether these results hold true for social norm nudges as well, has been researched in the following studies and reviews. In a quantitative review of 100 studies on nudging effectiveness, it is suggested that several moderators – like personality – may influence nudge effectiveness (Hummel & Maedche, 2019, pp. 55f.). Jung and Meller showed effects of personality on nudge acceptance when they surveyed two representative samples of the US-American population on their agreement with different types of nudge interventions and their personalities on different scales for individualism or communitarism, reactance, empathy, desire for control and conservatism (Jung & Meller, 2016, pp. 66f.). Individualism had negative effects on nudge acceptance, as did conservatism, while empathy affected nudge acceptance positively. Reactance and desire

for control affected *system 1* nudges negatively and *system 2* nudges positively (ibid., p. 72). These findings suggest that personality attributes affect people's views of nudges.

Ingendahl et al. tested the effect on social norm nudge effectiveness of the personality factors need for uniqueness and need for cognition: The nudge remained robust against variations in these personality factors (ibid., p. 331). These resulted in a call for future research on the effect and effect size of other possible moderators (ibid., p. 333). Likewise, Coventry et al. found in their study on social norms for web cookie acceptance that the personality factors risk-taking behaviour and impulsivity moderate how likely participants were to accept cookies (Coventry et al., 2016, p. 6). The researchers call for more research on the effects of individual differences on social norm nudge effectiveness (ibid., p. 9). Finally, Oyibo and Vassileva, as well as Schär et al. tested the moderating effect of the *big five* personality factors on social norm nudge effectiveness (Oyibo & Vassileva, 2019; Schär et al. 2019). While for Oyibo and Vassileva the results were positive, Schär et al. found conflicting results: None of the personality factors had any effect on nudge effectiveness. Schär and the co-authors were astounded by these results and called for more research on the topic (ibid.). Based on these opposing findings and the call for more research on this, the big five personality factors have been chosen as the personality concept.

The *big five* personality dimensions are an integrative model of personality conceptualization, which – after decades of ever-widening conceptual breadth surrounding the topic of personality – is nearing consensus within the scientific community (John & Srivastava, 1999, p. 103f; John et al., 2008, p. 116).

The *big five* taxonomy is not based on one theoretical perspective but was “derived from analyses of the natural-language terms people use to describe themselves and others” (John et al., 2008, p. 116). This method of deriving a taxonomy from the words and number of words used to describe a concept stems from the assumption that “Those individual differences that are of the most significance in the daily transactions of persons with each other will eventually become encoded into their language.” (Goldberg, 1981, pp. 141f.) An example of this pattern in another sphere can be found in the variety of words used for snow in the peoples of Alaska, as opposed to the limited terminology used in the rest of the United States of America (ibid.).

The original dimensions of the *big five* – a term coined by Lew Goldberg in 1981 - were *surgeency*, *agreeableness*, *conscientiousness*, *emotional stability* and *culture* (Goldberg, 1981,

pp. 157f.). Surgency is now usually called *extraversion* (John & Srivastava, 1999, p. 108). Each of these five dimensions corresponds to six facets and all of them are rated on a scale (ibid., 1999, Appendix A). The exact scale can be found in the appendix (Appendix A).

However, personality traits may also be a potential confounding variable in the mechanism proposed in this thesis, as there may be a connection between personality traits themselves (not in their relation to nudge-effectiveness) and likeliness to hold pro-environmental views (Fraj & Martinez, 2006; Markowitz et al., 2012). This connection has been explored in past studies, which showed that “(...) *openness*, *agreeableness* and *conscientiousness* were strongly linked to environmental engagement across both persons and nations” (Gifford & Nilsson, 2014, p. 143). This may be explained by *openness* and *agreeableness* relating to a person’s “(...) higher order personal value of self-transcendence, reflecting an expanded sense of self and a greater concern for others” ([Hirsh, 2010, p. 247), or because of the link between *agreeableness* and empathy (ibid.). Another reason for *openness* being a factor may be due to its connection to “(...) increased cognitive ability and flexibility in thought (DeYoung et al., 2005), potentially affording a broader perspective on humanity’s place in the larger ecology and a greater aesthetic appreciation of natural beauty.” (ibid.). Finally, *conscientiousness* may be related because of the qualities’ correlation to “(...) higher levels of social investment and prudent rule-adherence in general (...)” (Hirsh, 2010, p. 248) or because these individuals “(...) carefully follow social guidelines and norms for appropriate environmental action (...)” (ibid.). The mitigation tactic for these potential confounders is discussed in the data analysis part of the methodology section.

2.1.3 Pro-environmental Behavior

At this point, *pro-environmental behavior*, another central term in this thesis’ title, needs a definition. It is a “(...) special case of prosocial behavior because it also implies that people benefit others, whereas often, no direct individual benefits are received by engaging in these behaviors.” (De Groot & Steg, 2009, p. 426)

What constitutes prosocial behavior then? “Prosocial behavior is defined as any act that benefits another person or other persons.” (Aronson et al., 2005 as cited in: De Groot & Steg, 2009, p. 425) In a more elaborate definition, Groot et al. describe pro-environmental behaviors as

(...) behaviors which benefit the environment by changing the availability of materials or energy from the environment or altering the structure and dynamics of ecosystems in a positive way [4,5]. Acting pro-environmentally entails that other people or the environment may benefit, whereas often, no direct individual benefits are received by engaging in these behaviors. (Groot et al., 2013, p. 1830)

De Groots definition will be used in this thesis, as it explicitly covers both the personal and environmental effects of pro-environmental behavior.

Closely related to pro-environmental behavior, but specifically around buying goods, is the concept of *sustainable consumption* “(...) behaviours undertaken to promote positive (and/or avert negative) environmental effects” (Schwartz, 2019, p. 87). Regarding the effects on the person displaying the described demeanor, this definition is more wide-reaching than the one for pro-environmental behavior. Rather than just benefiting other people or the environment and not necessarily gaining anything for oneself, sustainable consumption may also cause negative effects for the individual making the choice:

While purchasing environmentally responsible products often implies immediate costs for the individual in terms of financial losses or the costs of behavioral change, sustainable consumption should produce longer term benefits for the community (e.g., resource conservation, reduction of greenhouse gases). This places the individual in a social and temporal dilemma regarding the management of limited communal resources (...) (Demarque et al., 2015, p. 166)

In the context of this thesis, the behavioral change cost as well as the temporal and social dilemma are especially relevant, as they are not part of the other motivations of pro-environmental behavior but key moments in which nudges may influence decision making (ibid.). These two elements may be mitigated by utilizing a nudge to prompt sustainable consumption.

But why would people choose to act this way, especially if it goes against their own best interest?

2.1.3.1 Motivation for Pro-environmental Behavior and Sustainable Consumption

Psychologists have long proposed that certain behaviours are motivated by an inner energy, or intrinsic motivation, that does not require external stimuli to encourage people to engage in it because the behaviour is performed for its own sake (e.g., White, 1959). In contrast, extrinsic motives are activated by reward or punishment, such as money, prizes or avoiding penalties, which are separate from the activity itself. Intrinsic and extrinsic motivations thus differ because in the former, rewards are internal, and in the latter, rewards are external to the individual. (Schwartz, 2019, p. 88)

These same rules apply for pro-environmental behavior and sustainable consumption: It may either be motivated internally or externally, the latter potentially meaning through nudges (Schwartz, 2019, p. 87). There is also evidence that suggests that social norms to help the environment may activate people's individual beliefs about the same matter (Trujillo, 2021, p. 1). This suggests a potential connection between external and internal motivation for sustainable behavior. Some of the previously studied factors that may motivate pro-environmental behavior are weighing benefits and costs, normative and moral concerns, acting out of affective motives or a combination of all three factors (Steg & Vlek, 2009, p. 311). Another important component of individual motivation are contextual factors, for example, whether the pricing structures, access to recycling facilities or the set-up of a public transport system in a city facilitate pro-environmental behavior (ibid., p. 312). Habitual behavior is also considered to play an important role. While in other models of motivation, subjects are presumed to make rational choices, this framework views human actions as largely habitual (ibid.). Finally, other important motivating factors for pro-environmental actions are both self-image and visibility to others (Schwartz, 2019, p. 90). Ulph, Hilton and Panzone further discerned two types of attributes that drive the purchase of sustainable products: The first one is hedonic, meaning the cost and benefits associated with the product, and the second one is moral, the self-image benefits of making the pro-environmental choice (Ulph et al., 2017, pp. 9f.). All of these may influence pro-environmental behavior and thus either support or counteract nudges.

Steg and Lindenberg propose a different view of behavior – these authors view it as the result of multiple goals that may or may not be congruent with each other (Lindenberg & Steg, 2007, p. 118). They establish three possible frames for pro-environmental behavior: gain, normative and hedonic (Lindenberg & Steg, 2007, pp. 118f.).

It used to be argued that morality is the main motivator for pro-environmental behavior, however “Environmental behavior may follow from various nonenvironmental concerns, such as a desire to save money, or a desire for comfort, freedom, or arousal.” (Lindenberg & Steg, 2007, p. 118) These informed the three types of goal frames: “A hedonic goal frame activates one or more subgoals that promise to improve the way one feels in a particular situation” (Lindenberg & Steg, 2007, p. 119) They further define: “A gain goal frame will make people very sensitive to changes in their personal resources. (...) A normative goal frame activates all sorts of subgoals associated with appropriateness (such as behaving the right way, contributing

to a clean environment, showing exemplary behavior). It will make people especially sensitive to what they think one ought to do.” (Lindenberg & Steg, 2007, p. 120) Speaking in these frames, pro-environmental behavior can also be a result of a gain or hedonic framing. A particularly interesting finding of Lindenberg and Steg is that “When people want to act appropriately but do not know how, it is likely that either the gain goal or the hedonic goal displaces the normative goal frame.” (Lindenberg & Steg, 2007, p. 121) This is particularly true for so-called *smart norms*, abstract norms that need to be extrapolated for the concrete situation (ibid., p. 120). Hence, social norm nudges may play a vital role in making norms salient in relevant decision moments. Here it is important to look at nudges in comparison to other interventions.

2.1.3.2 Comparison of Interventions for Pro-environmental Behavior

Environmental regulation typically comprises several regulatory techniques that range from command-and-control instruments relying on criminal and administrative enforcement to market-related mechanisms such as environmental taxation, subsidies, tradable allowances and deposit schemes, participatory-based regulation, and self-regulatory schemes (Feldman and Perez 2009). It has long been thought that these methods, sometimes named “anti-nudges” (Sunstein 2009), were the best way to reduce environmental harm (Vankatachalam 2008). However, empirical studies have demonstrated that traditional methods are partially ineffective (Sunstein and Reisch 2014) in pursuing environmental protection. (Santos Silva, 2022, p. 2)

As stated above, there are various interventions that may lead to more pro-environmental behavior, with ‘anti-nudges’ long being thought to be most effective, until empirical studies deemed them partially ineffective (ibid). Nudges may offer an alternative to interventions such as mandates or subsidies, and there is a body of work directly comparing nudging and its alternatives. Early works on nudge effectiveness already showed comparable effects of descriptive social norms as of an 11 to 20% price increase on electricity usage (Allcott, 2011, p. 1082). Abiola et al. (2023) compared the effectiveness of nudges versus monetary interventions on uptake of reusable plastic bags as compared to single-use plastic bags. In this study, the nudge intervention, including the social norm nudge “Help us not to sell plastic bags” (Abiola et al., 2023, p. 5), performed better than monetary interventions. Similarly, in Sudarshan’s (2016) assessment of energy consumption in Indian households, nudge interventions performed better than monetary interventions. Most convincingly, in a meta-analysis of 13 studies on different behavioral interventions to elicit pro-environmental behavior in hotel guests, out of all tested interventions, including charity donations and environmental appeals, only social norms and nudges were statistically significantly successful (Nisa et al.,

2017, p. 354). Hence, nudges have shown to be as effective as or more effective than other interventions in promoting pro-environmental behavior in various studies.

However, a few recent studies also found contradicting results regarding the effectiveness of social norm nudges: They are finding nudges not as effective as other behavioral incentives to encourage pro-environmental behavior, or even not effective at all. These results have recently been found across geographies and types of interventions, some remarkable examples: Starting with Murakami et al.'s 2022 study on energy-saving behaviors of Japanese subjects. While a monetary intervention – a rebate - managed to cut electricity consumption by 4%, the nudge intervention did not decrease consumption at all (Murakami et al., 2022, p. 1779). In 2023, Marxen et al. tested different behavioral interventions to encourage users to allow optimized electrical vehicle charging. Three types of monetary incentives showed to be successful in encouraging optimized EV charging, while all attempted nudge interventions – default-setting, feedback and badges, battery-related tips and environmental framing showed no effect at all (Marxen et al., 2023, p. 10). In 2024, Van der Vliet et al. tested nudges to increase the consumption of plant-based alternative products as opposed to meat and dairy products. In this randomized control online experiment, nudges did not lead to significantly more plant-based purchases than in the control group (Van der Vliet et al., 2024, p. 1). Finally, a meta-analysis of 118 interventions to promote pro-environmental behavior in tourism was conducted by Greene et al. (2024) and found that social norm nudges offered very limited effectiveness.

Hence, this contradicting evidence makes it even more important to (re-)test (social norm) nudge interventions in the application of pro-environmental behavior and see whether they are effective.

Now that the central terms and models of this thesis have found their definitions, an in-depth look at past research on this thesis' topics is in order.

2.2 Review of Previous Research

2.2.1 Research on Social Norm Nudging for Pro-environmental Behavior

Most psychological research on so-called nudges in recent years has examined the role of normative messages and showed that communicating which behaviours are typically performed (descriptive norms) and/or typically approved/disapproved of (injunctive norms) can induce pro-environmental behaviours (Cialdini, 2003). (Schwartz, 2019, p. 90)

Pro-environmental behavior has been nudged many times in a wide range of studies (Münscher et al., 2013, p. 511), often with defaults (Ebeling & Lotz, 2015; Ölander & Thøgersen, 2014, p. 345) or framing (Homar & Cvelbar, 2021), two nudge types discussed in subchapter on nudging. When calculating impact-to-cost ratios, nudges have been found to be more effective than traditional interventions, for example low energy usage rebates (Schwartz, 2019, p. 90). So much so that this application of nudging even received its own term: *Green nudge* has been established as the catch-all phrase for nudges that further pro-environmental behavior or sustainable consumption (Santos Silva, 2022, p. 2). In a meta-analysis by Carrel et al., four factors have been established as related to the effectiveness of green nudges: “(1) the levers, mechanisms and techniques mobilised; (2) the visibility of the behaviour by others; (3) the field of application; and (4) the geographical area.” (Carrel et al., 2023, p. 1)

However, one thing needs to be disclaimed: “As far as sustainable behaviour is concerned, change through nudges is only effective where individuals exhibit limited mental resources (Slovic 1995; Ariely and Loewenstein 2006): they might be ineffective with regard to “bad people”, those who know what they are doing and why.” (Santos Silva, 2022, p. 9) Hence, people who have a strong conviction going against what they are nudged to do will not be nudged.

As pro-environmental behavior is often related to normative considerations (Groot et al., 2013, p. 1830), the focus from here on lies on social norm nudges. This compilation of research will comprise both types of social norms, as according to research, there should be no significant difference in the effect on prosocial behavior between descriptive and injunctive messages. (Groot et al., 2013, p. 1831)

When looking at social norm nudges for pro-environmental behavior, there is a considerable body of work spanning the past 10 - 15 years: From a hotel towel reusal experiment (Goldstein et al., 2008; Wesley et al., 2008; Nisa et al., 2017, pp. 356ff.) to energy and water household consumption (Smith et al., 2012; Nielsen et al., 2017, pp. 29ff.; Jaeger & Schultz, 2017; Buckley, 2020) and climate-saving food choices (Bauer et al., 2022; Boenke et al., 2021; Ensaff, 2021), social norm nudges have been tested in a wide variety of applications.

Since the original towel reusal study from Wesley et al. in 2008, many iterations have been performed. In the meta-analysis by Nisa et al., which was comprised of 13 studies, covering 5859 hotel stays, a comparison between social norm nudging and four other types of

interventions was made (Nisa et al., 2017, p. 354). Social norm nudges showed significant positive effects with an effect size of -0.25 in a 0.95 confidence interval (ibid.).

For energy consumption, the experiment conducted by Nielsen et al. recorded a change in +1% to -10% in energy usage among consumers who received a social norm nudge (Nielsen et al., 2017, pp. 36f.). The +1% in some households may be explained by already eco-conscious people reacting with protest behavior to perceived overly strong environmental regulation (Nielsen et al., 2017, p. 29). Possible avenues to avoid this boomerang effect can be only nudging presumed overconsumers of energy or coupling the normative message with a happy emoticon for below-average consumers (ibid.).

Dynamic norms (a sub-group of descriptive social norms) were investigated in relation to lowering meat consumption (Boenke et al., 2021). This research unveiled that the nudge source - in their example either a company representative, a vegan activist or a researcher – also made a difference in the effectiveness of the nudge (ibid.).

In the book *A Research Agenda for Economic Psychology*, Schwartz et al. (2019) discuss the interplay of nudges, personal motivation, and financial incentives regarding sustainable consumption. Through their analysis of previous scientific papers, they find that nudges, in particular injunctive and descriptive social norm nudges, “(...) can induce pro-environmental behaviours” (Schwartz, 2019, p. 90). In the case of energy conservation, they have been calculated to have the best impact-to-cost ratio out of all nudges, as well as traditional interventions (ibid.).

No studies so far have explored the exact application – reusable takeaway food boxes -proposed in this thesis; however, there were some similar works. A suitable example is the recent study by Luo and Zhao, which compared different nudge and sludge interventions on the use of plastic bags in an online supermarket experiment (Luo & Zhao, 2023). They also related nudge effectiveness to a personal attribute, in their case though it was political orientation (Luo & Zhao, 2023, p. 3). In the experiment, a social norm nudge (in this case called intrinsic nudge) produced a 35.1% reduction in plastic bag uptake among consumers compared to the control condition (ibid., p. 3). This put it in the upper third of most effective interventions, however, it did not reach the first place – extrinsic nudge – which caused a 48,1% reduction (ibid. pp. 3, 5). They corroborate what De Groot et al.’s study in 2013 already showed: In their experiment, an injunctive normative message lowered the uptake of plastic bags from an average of 3.12 in

the control group to only 2.04 in the injunctive normative message group, which worked slightly better than a personal normative message with an uptake of 2.44 bags per shopping session, but not as well as the combined condition of both social norms, which brought their use down to 1.86 bags on average (De Groot et al., 2013, p. 1838). Even though De Groot et al.'s study is a few years old already, their contribution to social norm nudging research is still highly relevant today:

(...) we were able to explore the combined effects of social and personal normative message framing. As expected and in line with studies that have investigated aligned normative injunctive and descriptive normative messages (i.e., [24,47]), a normative message emphasizing both one's injunctive and personal norms resulted in the lowest uptake of free plastic bags (Groot et al., 2013, p. 1840)

In another current piece of research, Wensing et al. explored the effects of four types of nudge interventions on preference and willingness to pay for bio-based plastics among German consumers (Wensing et al., 2020, pp. 1f.). While in the control group 71% of respondents preferred bio-based packaging, all nudge groups yielded higher results, with a norm nudge resulting in 83% of subjects preferring this more ecological type of packaging (ibid., p. 6) The researchers also chose cognitive style as a mediating factor and found out, that the "(...) strongest effects are generated when the nudging strategy matches the characteristic of consumers' cognitive style." (ibid., p. 1) Again, this paper finds a correlation between individual differences in characteristics of participants and the effectiveness of nudges.

The most similar work to this thesis is the experiment and field study done by Loschelder et al. on bringing down disposable to-go cup use (Loschelder et al., 2019). In their two interventions, the scientists have found a 17.1% increase in the use of sustainable alternatives using dynamic social norms (ibid., p. 1).

These findings suggest that a social norm nudge may lead to more pro-environmental behavior in individuals.

2.2.2 Big Five Personality Traits and Social Norms (-Nudging)

There seems to be no previous research on the *big five* personality attributes and their effects on social norm nudge effectiveness in the application of pro-environmental behavior. However, there are works on the *big five* personality attributes and their effects on social norm nudge effectiveness in other contexts – and with conflicting results. While Oyibo and Vassileva found

positive results, Schär et al. could not replicate these findings in their work (Oyibo & Vassileva, 2019; Schär et al., 2019). The authors of both studies encourage more research on the big fives effect on social norm nudges (ibid.). Oyibo and Vassileva encourage experimental research on a concrete application, as they tested only the perceived susceptibility to social norms instead of finding out participants' reactions in an (online) experiment.

Schär et al. suggest that a different introduction of the norm and a different type of norm – they used an injunctive norm – may bring different results. They also call for a re-test of the effect of the big five personality factors on social norm nudges in a different application. This thesis will go beyond these limitations of the two works.

To find possible effect mechanisms for the correlation between personality traits and norm effectiveness, it is worthwhile to look into studies that may give valuable hints at possible mechanisms.

For example, a connection to pro-social behavior was found for the trait *agreeableness* (Habashi et al., 2016, p. 1177), echoing older findings that deemed people scoring higher on *agreeableness* more helpful and cooperative (Graziano & Eisenberg, 1997). Hence, following a social norm may be more likely for people scoring higher on *agreeableness*. This assumption is corroborated by the quantitative analysis of 142 meta-analyses about the trait *agreeableness*: One of the characteristic themes of the trait is “Social norm orientation: Greater sensitivity to, respect for, and behavioral compliance with social norms and rules, as well as avoidance of rule-breaking and wrongdoing” (Wilmot & Ones, 2022, p. 264) Therefore, a correlation between higher *agreeableness* and a tendency to follow a social norm is to be assumed.

A large-scale study on personality traits and behavioral interventions (through persuasive games and gamified systems) found “(...) people's personality traits play a significant role in the perceived persuasiveness of different strategies.” (Orji et al., 2017). Their detailed findings suggested that “Conscientious people tend to be motivated by goal setting, simulation, self-monitoring and feedback; people who are more open to experience are more likely to be demotivated by rewards, competition, comparison, and cooperation.” (ibid.) This points towards *openness* being a personality trait that makes social norm nudges less effective, as they offer a comparison point with other people – which could also lead to a perceived competitive situation - or what is perceived to be the norm among people.

In another set of experimental studies, Jennifer Eck and Jochen Gebauer tested which personality traits made individuals in the United States of America more likely to choose what was being suggested to them as the social norm in online experiments. They found out that high scorers in *agreeableness*, *conscientiousness* and *extraversion* predicted choosing the socially normative option in the experiment (Eck & Gebauer, 2022, p. 559). In their research, scoring higher on *openness* made individuals less likely to choose the socially normative option (ibid.)

All of these findings make it clear that there should be a positive correlation between higher scores for *agreeableness* and social norm nudge effectiveness. Past research suggests that higher *openness* may lead to a negative reaction to social norms. However, for the other personality traits, past research does not paint a clear picture. *Conscientiousness* and *extraversion* also showed correlations in some past research but did not in others. Due to these conflicting findings, this research may hopefully bring clarity on these two factors.

2.3 Research Gap and Research Hypothesis

In the literature on the topics of pro-environmental behavior and (social norm) nudging, multiple research gaps become apparent.

Firstly, due to some conflicting results of different studies as to whether social norm nudges work to increase pro-environmental behavior, it is necessary to re-test them (Marxen et al., 2023, p. 10; Murakami et al., 2022, p. 1779; Greene et al., 2024).

Furthermore, though research on social norm nudging for pro-environmental behavior has been tested on some very similar domains, such as reusable coffee cups or bio-based packaging (Loschelder, 2019; Wensing, 2020), reusable food containers in a take-back system have not been explored at the time of writing. Though they are very similar domains, a take-back system for delivery food may yield different results, as they are employed in a different context and consumers have less experience with them due to their novelty. The context is that these systems are chosen at home without social control, and the lack of experience with these systems may lead consumers to believe they are exceedingly complicated and therefore opt out of them.

Thus, the first research question emerges, asking whether social norm nudges lead to more pro-environmental behavior than no nudge. This leads to research hypothesis 1:

H1: A social norm nudge leads to more pro-environmental behavior in consumers than in the control condition with no nudge.

H0: A social norm nudge does not lead to more pro-environmental behavior than no nudge.

As mentioned above, limited research has been done on the correlation between the *big five* personality traits and social norm nudge effectiveness in the application of pro-environmental behavior.

This thesis answers the call for more research on the moderating effect of the *big five* personality factors on social norm nudging effectiveness from Oyibo and Vassileva as well as Schär et al. The studies by these two sets of researchers called for this after finding conflicting results regarding the effect of the big five on nudge effectiveness (Oyibo & Vassileva, 2019; Schär et al., 2019).

Therefore, the second research question asks whether there is a moderating effect of consumers' personality structure on the effectiveness of a nudge. As mentioned earlier, based on previous research, there are three possible positive correlations to nudge effectiveness: *agreeableness*, *conscientiousness* and *extraversion*. This leads to three hypotheses:

Hypothesis 2:

H1: The higher a participant scores for *agreeableness*, the higher the effectiveness of the social norm nudge.

H0: There is no correlation between *agreeableness* and the effectiveness of the social norm nudge.

Hypothesis 3:

H1: The higher a participant scores for *conscientiousness*, the higher the effectiveness of the social norm nudge.

H0: There is no correlation between *conscientiousness* and the effectiveness of the social norm nudge.

Hypothesis 4:

H1: The higher a participant scores for *extraversion*, the higher the effectiveness of the social norm nudge.

H0: There is no correlation between *extraversion* and the effectiveness of the social norm nudge.

Finally, the personality trait *openness* has been found to possibly be linked to less likelihood to follow social norms or to even reject them. Hence, the final hypothesis proposes a negative correlation between a personality trait and social norm effectiveness.

Hypothesis 5:

H1: The higher a participant scores for *openness*, the lower the effectiveness of the social norm nudge.

H0: There is no correlation between *openness* and the effectiveness of the social norm nudge.

Empirical research is necessary to accept or reject these hypotheses. The following chapter discusses its setup.

3. Methodology

To understand the methodology of this research in depth, this chapter illuminates the research design and procedure, touching on the research instrument, variables and models as well as the data collection, structure of the sample and research phases. The chapter concludes with a detailed description of the data analysis.

3.1 Research Design

This work employs a quantitative research design to statistically investigate the hypotheses formed regarding social norm nudges in correlation to personality structure. The research design consists of multiple experimental studies: a pretest, two pilot studies and a main round of research. In each round of research there are two groups: one exposed to a social norm nudge and a second, which is not exposed to a nudge.

The pretest was done to identify problems with the questions and the length of the research instrument. After the pretest, the first pilot tested whether the questionnaire worked under survey conditions using an injunctive norm. Since the nudge group performed worse than the control group, a second pretest was created to test a dynamic nudge under survey conditions. This worked and was thus used in the main round of research.

3.2 Measurement Instruments and Variables

In this subchapter, the research instrument – a questionnaire – is detailed, followed by a brief excursion on the reusable takeaway company chosen for this research, *vital*, a look at the variable operationalizations and finally an explanation of the assumed models in the research.

3.2.1 Research Instrument

The research instrument for this study is a questionnaire, comprised of a set of structured questions and scenarios designed to assess the impact of the social norm nudge on consumer behavior. For each round of research, there was a different version of the questionnaire. The final version can be found in the appendix (Appendix B). As mentioned above, the instrument was pretested to ensure its reliability and validity. The responses obtained from the pretest

phase were used to refine the survey questions for the main study. The final questionnaire consisted – in order of appearance – of: informed consent, randomizer between nudge and control condition, for both of those an image and three questions (two of which are there to obscure the aim of this study and are not analyzed statistically), the manipulation check, then the *big five* personality assessment, after that three demographic questions (age, gender, highest completed level of education) and finally a question asking for the purpose of the study. The *big five* personality traits are measured using the *big five inventory* (BFI), which includes 44 items (John et al., 1991, p. 157; Appendix X). The scores for *extraversion* (8 items), *agreeableness* (9 items), *conscientiousness* (9 items), *neuroticism* (8 items) and *openness* (9 items) are calculated as advised by John et al. (ibid., 1991, p. 158; Appendix Y). Additional data – the country of residence – is recorded by the survey platform (Prolific/Qualtrics).

3.2.2 Excuse: Vytal

The service used to exemplify pro-environmental behavior in this thesis is offered by a company called *vytal*. They are a startup that has been founded in 2019 and offers reusable take-away packaging (bowls and cups) for food delivery and take-out (vytal, 2023). In their model, users must download an app in which they find their personal *vytal* number, which they need to present on delivery sites such as *Lieferando* or *Wolt* when they are ordering their meal in reusable packaging (ibid.). If they fail to return the bowl or cup after 14 days to one of the many partners that offer the service, they are charged 10 euros for a bowl or 4 euros for a cup (ibid.).

The example of *vytal* was chosen, as – at the time of writing - *Lieferando* Austria is offering *vytal* bowls as the only reusable packaging option (Lieferando, 2023). In Germany, there are also *rebowl* and *relevo*, two other companies offering reusable take-away packaging. (Recup, 2023; Relevo, 2023) However, as these have not entered the Austrian market at the time of writing, *vytal* was the only option applicable for both Austria and Germany.

3.2.3 Variables

This subchapter outlines the steps taken to operationalize the concepts in this thesis, namely social norm nudge, pro-environmental behavior and personality attributes.

The concept of a social norm nudge is operationalized through a sentence shown in Q0, the initial information and image the participants of the study are shown. On the right-hand side of the image of the check-out screen, between the price information and the information about *vital* as a service, it says ‘Did you know? More and more consumers in your area are willing to choose reusable packaging over single-use’. (Figure 1)

The wording of this dynamic social norm nudge was taken from Loschelder’s work on dynamic nudging for use of reusable coffee cups (Loschelder et al., 2019, p. 1021). They translate their German nudge to ‘more and more customers are switching from to-go-cups to a sustainable alternative’ (ibid.).

The screenshot displays a checkout interface for VITAL. On the left, the 'Personal details' section includes input fields for 'First and last name', 'E-mail', 'Phone number', 'Address', and 'Address line 2'. Below these is a note about order confirmation and tracking. The 'Delivery time' section shows an estimated arrival of 30-55 minutes. The 'Pay with' section prompts the user to select a payment method. At the bottom left is an 'Order and pay (??,?)' button.

On the right, the 'Basket' section lists items: '1 Health Bowl' and '1 Chocolate cake', each with a price of '??,?'. It also shows 'Subtotal', 'Delivery costs', and 'Total', all marked as '??,?'. Below the basket is a green box titled 'DID YOU KNOW?' containing the text: 'More and more consumers in your area are willing to choose reusable packaging over single-use.' Below this is another green box for 'Vital Reusable Packaging' with the text: 'Time for more sustainability! Now you can order your favourite food in environmentally friendly reusable packaging.' It lists instructions: '- Click 'CHOOSE vortal reusable packaging' with your order' and '- Bring the packaging back to any of our many return locations within 2-4 weeks'. The price for this service is '0,00 €'. An image of three stacked white reusable bowls with black lids is shown on the right.

Between the personal details and the packaging options, there are two radio button options for packaging: 'CHOOSE Vortal Reusable Packaging' (0,00 €) and 'CHOOSE single-use plastic packaging' (0,00 €).

Figure 2: Nudge Condition

To control for consumer behavior without a social norm nudge, participants of the study were randomly assigned to one of two groups: the nudge condition or the control condition. While the nudge condition looks as described above, the control condition only shows the price information and directly below it the information about *vital* as a service, without any nudge (Figure 2).

The screenshot displays a restaurant ordering interface. On the left, the 'Personal details' section includes input fields for 'First and last name', 'E-mail', 'Phone number', 'Address', and 'Address line 2'. Below these is a note about order confirmation and a green box for 'CHOOSE Vytal Reusable Packaging' with a price of 0,00 €. Further down, there's a section for 'CHOOSE single-use plastic packaging' (0,00 €), 'Delivery time' (30-55 min), and 'Pay with' (Select your payment method). At the bottom is an 'Order and pay (??,?)' button. On the right, the 'Basket' section lists '1 Health Bowl' and '1 Chocolate cake', each with minus and plus icons. It also shows 'Subtotal', 'Delivery costs', and 'Total' prices, all marked as '??,?'. Below the basket, a green box promotes 'Vytal Reusable Packaging' with an image of three stacked bowls and text explaining the sustainability benefit and return policy.

Figure 3: Control Condition

The variable ‘pro-environmental behavior’ is operationalized through the question ‘How likely are you to get the meal in reusable packaging?’ and its answer scale ranging from 1= very unlikely to 5= very likely. In the dataset, this can be found as the combined variable Q3, consisting of the variables Q3a and Q3b from the questionnaire. Q3a represents the answers to this question by the control group, Q3b the answers by the treatment group.

Hence, the independent variables are the two versions of the message, and the dependent variable is how likely participants are to choose reusable packaging.

Thirdly, ‘personality attributes’ are operationalized with the standardized *Big Five personality inventory* (John & Srivastava, 1999). It consists of 44 questions that each finish the question ‘I see myself as someone who...’ with different attributes and are to be answered on a five-point scale, with 1 being ‘Disagree Strongly’ and 5 being ‘Agree strongly’ (John et al., 2008, Appendix 4.1). To generate a scale score for each of the five personality dimensions (*extraversion, agreeableness, conscientiousness, neuroticism, openness*), the standardized BFI scale scores are employed in this thesis. The following five dimensions are calculated by computing the mean of each of the five lines while reverse-coding all items labelled ‘R’ :

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36
 Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42
 Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R
 Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39
 Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44' (John et al. 2008, Appendix 4.2).

3.2.4 Models

Based on the hypotheses formed in the last chapter and the variable operationalizations described in the section above, certain effect models are to be expected for the hypotheses.

For Hypothesis 1, *A social norm nudge leads to more pro-environmental behavior in consumers than in the control condition with no nudge*, it is expected that the social norm nudge, the independent variable in this model, affects the amount of pro-environmental behavior the study subjects display – the dependent variable (Figure 4).



Figure 4: Model Hypothesis 1

In the cases of Hypotheses 2 to 5, the H1 for each of them reads:

Hypothesis 2: The higher a participant scores for *agreeableness*, the higher the effectiveness of the social norm nudge.

Hypothesis 3: The higher a participant scores for *conscientiousness*, the higher the effectiveness of the social norm nudge.

Hypothesis 4: The higher a participant scores for *openness*, the higher the effectiveness of the social norm nudge.

Hypothesis 5: The higher a participant scores for *openness*, the lower the effectiveness of the social norm nudge.

For these hypotheses, the model is slightly more complex, as it includes an intercept or moderator, pro-environmental behavior (Figure 5).

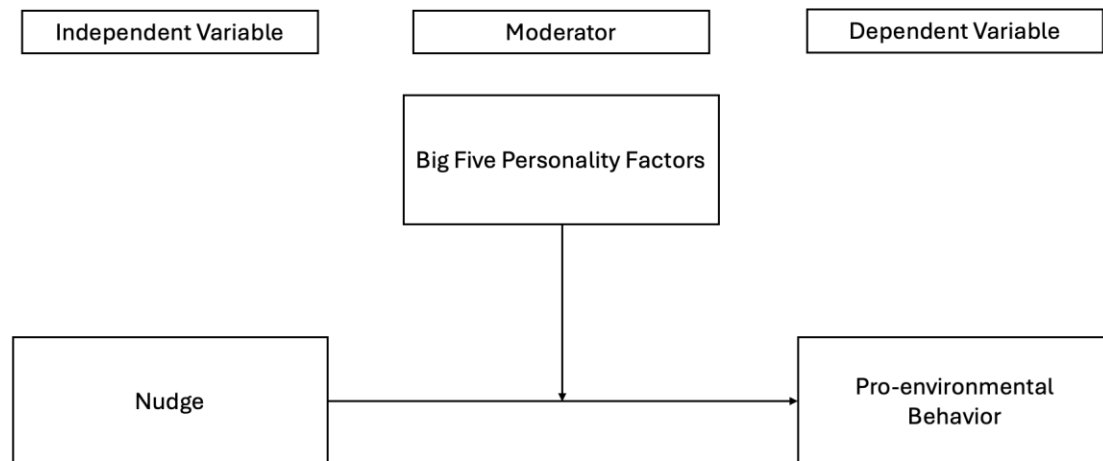


Figure 5: Model Hypothesis 2 – 5

With these three operationalizations and the models for each of the hypotheses in mind, now this study's data collection and sampling methods will be detailed.

3.3 Data Collection and Sampling Methods

3.3.1 Data Collection

Data was collected through an online survey – hosted on *Qualtrics* – administered on *Prolific*, a dedicated survey platform. Participants accessed the survey using their laptops or tablets, ensuring a convenient and consistent data collection process.

3.3.2 Timeframe

The pretest was running for two weeks in October 2023, the pilot studies and the main study round were running for two days each in November 2023.

3.3.3 Respondents

The sample for the pretest, the two pilot studies and the main round of research consisted of randomly selected prolific users residing in Austria and Germany that spoke English. This geographic region was selected due to their similarities in the food delivery ecosystem, as well as cultural and linguistic similarities. The penetration rate for meal delivery services in the German market in 2024 has been prognosed to reach 36,3%, while the rate in Austria for the same time frame is supposed to reach 47,1%, with the revenue per user prognosed to reach 343,50€ and 365,60€ respectively (Statista, 2023B; Statista, 2023C).

In each round of research, 50% of participants were randomly assigned to the treatment condition, while the other 50% answered the control version of the questionnaire.

Both the pilots and the main research were a standard sample, as the aforementioned literature as well as the research questions didn't call for a (gender-) balanced sample or a representative sample.

The pretested included five participants. Two of them were female, one non-binary and two more were male. Two people held a high school diploma, one held a bachelor's degree and two held a master's degree.

The first pilot study had an n of 50 and a gender distribution of 61% male, 37% female and the rest preferring not to say. In Pretest 1 most participants held a bachelor's degree (- 41%), followed by a high school diploma (-30%) and a master's degree (-19%). The youngest participant was 18, and the oldest 55, with a median of 25 and a mean of 28.

The second pilot, also with a sample size of 50, skewed very similarly in terms of education levels with 40%, 36% and 18% respectively. It had a gender split of 62% of the respondents being male and 38% female. In this study, the ages of respondents ranged from 18 to 46, the median was 28 and the mean was 29.

The main research round consisted of 304 respondents. The n=304 for the main research represented just under 10% of the 3,468 available participants – meeting the requirements discussed at the beginning of the subchapter – on the site. Of the respondents, 68% identified as male, 29% as female, 2% as non-binary and 1% preferred not to say.

The highest completed level of education for most participants (38%) in the main research was a high school diploma, closely followed by a bachelor's degree (36%). 21% of respondents held a master's degree, followed by 2% each having completed the mandatory basic education or holding a PhD or higher. 1% preferred not to disclose their level of education.

The average age of respondents in the main research was 28 years, with the youngest person being 18 and the oldest 71. The median age was 27 years.

After relaying these details about the data collection and the collected sample, the next step is to describe the research procedure.

3.3.4 Procedure

The research questionnaire was created based on the existing literature. The scenario (both in the treatment and the control group) was based on the layout of the Austrian *Lieferando* website at the time (Lieferando, 2023), with certain changes – such as color and the exact positioning of boxes. The initial version of the social norm nudge was an injunctive nudge based on the findings of Groot et al. that “(...) making an injunctive norm salient in a setting where a descriptive norm favors the undesired behavior, may be an effective way to promote a variety of environmental behaviors.” (Groot et al., 2013, p. 1839).

After the nudge and two questions placed at this point of the questionnaire to distract the participants from the actual purpose of the study, the question to test the reaction to the nudge was ‘How likely would you be to order the food in reusable packaging instead of single-use?’ (Appendix B) , with a 5-point scale ranging from 1 = extremely unlikely to 5 = extremely likely. The five-point scale instead of the 7-point scale, as used in the literature (Loschelder et al. 2019, 9), was chosen to create internal conformity with the *big five* personality scale, which took up a large part of the survey and also consisted of a five-point scale. The questions and possible answers for the *big five* personality questions were taken in both content and format from the guide provided by John and Srivastava (John & Srivastava, 1999, pp. 103f.). The first version of the questionnaire was pretested with 10 participants, which caused certain formulations to be changed and some additional questions to be dropped. Then the first pilot study was started.

3.3.4.1 Pilot One

I conducted the pilot phase of the study to validate the research instrument and ensure the effectiveness of the social norm nudge. The participants were randomly assigned to one of two groups: the nudge group and the control group. The Nudge Group (Treatment Group) exposed participants to a social norm nudge associated with the target behavior. Participants in the control group did not receive any nudges.

This first version of the questionnaire included questions about environmental concern, which were taken from Gifford and Nilsson (Gifford & Nilsson, 2014, p. 143). These were included, as past nudge research in the field also had participants rate their climate concerns and how likely they were to act climate conscious in general (Luo & Zhao, 2023, p. 3).

The first pretest included 50 participants and tested a social norm nudge versus a control group. There was no statistically relevant difference between the treatment group and the control group. The average rate of sustainable consumption was 3.6 out of 5 for the treatment group and 3.8 out of 5 for the control group. Hence, the control group was more likely to choose the reusable packaging option than the treatment group. Furthermore, many participants did not pass the manipulation check – 58% of the treatment group selected either ‘no’ or ‘I don’t know’ when asked about the presence of the nudge.

Regarding the effectiveness of the nudge, this result was at odds with the literature and caused changes to be made to the survey.

3.3.4.2 Pilot Two

For the second pilot study, the font and its background area on the nudge image were enlarged, the manipulation check question was moved to earlier in the questionnaire and most importantly the nudge was changed from a static to a dynamic nudge.

The new version of the nudge was created in accordance with the literature, in particular Loschelder et al.’s work on dynamic nudges for take-away coffee cups (Loschelder et al., 2019).

Loschelder et al.’s dynamic nudge was: “Our guests are changing their behavior: More and more are switching from the to-go-cup to a sustainable alternative.” (Loschelder et al., 2019, p. 8), in this questionnaire the dynamic nudge read “Did you know? More and more consumers in your area are willing to choose reusable packaging over single-use”. (Appendix B)

Loschelder et al. tested the choice of reusable packaging over single-use with the question “Which cup are you more likely to choose?” on a 7-point scale ranging from 1 = to-go-cup, to 4 = unsure, to 7 = reusable mug’ (Loschelder et al., 2019, p. 9). In this thesis’ questionnaire, the question was adapted to “How likely would you be to order the food in reusable packaging instead of single-use?” (Appendix B) , with a 5-point scale ranging from 1 = extremely unlikely to 5 = extremely likely.

Additionally, a question asking about the individuals’ identification with Austria as a country was taken out of the questionnaire, as it turned out that the potential group of Austrian respondents on Prolific was not large enough for the research to be conducted and thus the very similar German market was added.

Furthermore, questions regarding pro-environmental behavior before the participation in the study were taken out of the research at this point, due to them making the questionnaire too lengthy. Finally, the question asking for country of residence was taken out of the survey, as this information was already provided through the filter for study participants on Prolific (and the question also made the questionnaire unnecessarily lengthy).

In the second pretest, 50 participants from Germany and Austria were involved. They answered the changed questionnaire and this time there was a statistically significant difference between the control and treatment groups: In the treatment group, the average sustainable consumption score was 3.6, while in the control group it was 2.7.

Due to these findings, the main research uses a dynamic social norm nudge.

3.3.4.3 Main Research Phase

The main research went on for two days in November 2023 and used the same modalities as described earlier: It was online for two days and utilized *Qualtrics* and *Prolific* to host the survey and recruit the participants respectively. The research instrument used looked as described in subchapter 3.2.1 *Research Instrument* and the sample structure was as described in 3.3.3 *Respondents*. It can be seen in its entirety in Appendix B. The analysis methods used on the collected data will be discussed in the following subchapter.

3.4 Data Analysis

I conducted quantitative data analysis to test the hypotheses presented in the hypothesis section of this thesis. Descriptive statistics, correlation analysis and t-tests were employed to evaluate the differences between the nudge group and the control group and the correlation of the effectiveness of the nudge for pro-environmental behavior and the different personality attributes. In the following, detailed descriptions of the analyses will be given.

The data analysis for this thesis has been done in *Qualtrics* and *Excel* for descriptive and basic inferential statistics, whereas for advanced statistical analysis, *SPSS* was used. For the upcoming analysis section, the syntax used for more complex computations has been added to the appendix for transparency and reproducibility reasons.

The *big five* variables were calculated exactly as detailed in section 3.2.3 of this thesis. Missing values in the *big five* variables have been handled by using median imputation, based on the median of the respective variable. As there were only very few missing values, it is presumed that these were missed at random, possibly because respondents did not see the questions.

To answer hypothesis 1, descriptive statistics as well as *t-tests* were employed. In more detail: Firstly, bar charts for the nudge and the control group and a boxplot for Qq3a_1 and q3b_1 were created. Finally, a more detailed bar chart for the nudge and control groups across the five values on the scale for pro-environmental behavior is shown.

As for the statistical analysis, an *independent sample summary t-test* was used.

As for hypotheses 2 to 5, the correlation between the social norm nudge and sustainable behavior, moderated by the *big five* personality factors, two ordinal regressions for the nudge and control group were employed. “Ordinal regression models are used to describe the relationship between an ordered categorical response variable and one or more explanatory variables.” (Fagerland & Hosmer, 2017, p. 668) Ordinal regressions were thus chosen, as the dependent variable – pro-environmental behavior, which is scaled in a ranked way from 1 (not at all) to 5 (very much) - is ordinally scaled. The independent and explanatory variable – the *big five* personality factors – can have any scale level.

Because of the ordinal structure of the dependent variable, other regressions could not have been chosen. The first ordinal regression calculates the relationship between the endogenous variable q3a_1 (control group) and the exogenous variable, the mediating factors of the *big five* personality factors. The second regression employs the same calculation for q3b_1, the nudge group. Hence, the effect of personality factors on nudge effectiveness can be compared with the effect of personality factors on pro-environmental behavior without a nudge. This comparison thus also allows to separate the potentially confounding effect of personality structure and the likeliness to behave pro-environmentally from the effect of personality traits on nudge effectiveness.

The standardized goodness-of-fit measure of the ordinal regression also shows whether the model is a good fit for the data at hand.

Furthermore, tests for other possible correlations in the data were performed based on age, gender and education level. These were performed as Spearman's rank correlations for both the nudge and control groups.

All tests were performed on the basis of a 95% confidence interval. After these descriptions of the performed tests, the next chapter will show their results.

4. Results

The following chapter discusses the results of the various analyses discussed in the last chapter, starting with descriptive statistics, then going into inferential statistics regarding first the effectiveness of the nudge overall and after that the influence of the *big five* personality traits on nudge effectiveness. Finally, the results are briefly summarized.

4.1 Testing Hypothesis 1: The Difference between Nudge and Control Group regarding Pro-environmental Behavior

H1: A social norm nudge leads to more pro-environmental behavior in consumers than in the control condition with no nudge.

The aim of this analysis was to investigate the effectiveness of a nudge intervention in promoting the use of reusable packaging over single-use packaging.

Participants were randomly assigned to either the nudge group or the control group, and their likelihood of choosing reusable packaging was measured on a scale from 1 (= extremely unlikely) to 5 (=extremely likely).

This subchapter first shows their visual analysis and then the statistical analysis in the form of a *t-test*.

4.1.1 Visual Analysis Results

To visualize the group differences, graph data sets for *categorical field information* as well as an *independent-samples median test* were performed (Figure 6, Figure 7). These show that out of the total of 304 responses, 152 each were randomly assigned to the nudge and control groups. The boxplots in the *independent-samples median test* show that while the median for both the nudge and the control group were 4, the first quartile for the nudge group stood at 2,5, while for the control group it occurred at 3. The minimum value for both groups was 1, while the maximum was 5. The third quartile for both groups was 5, making the interquartile range for the nudge group larger than for the control group. Due to this fact, the nudge group skews slightly left, while the control group does not.

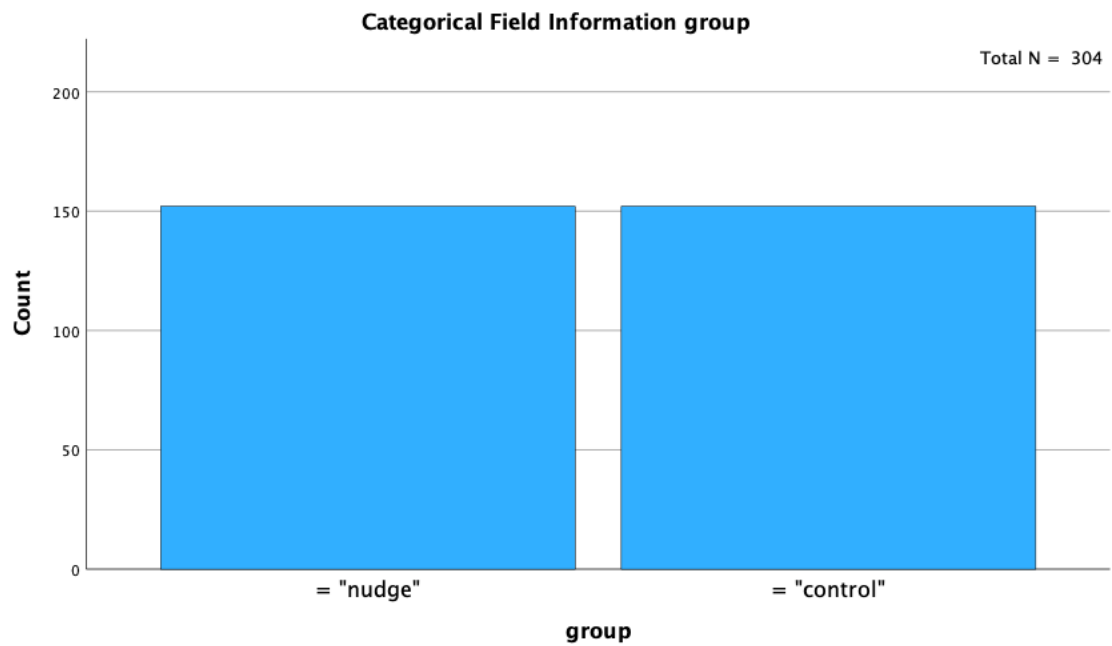


Figure 6: Categorical Field Information per Group

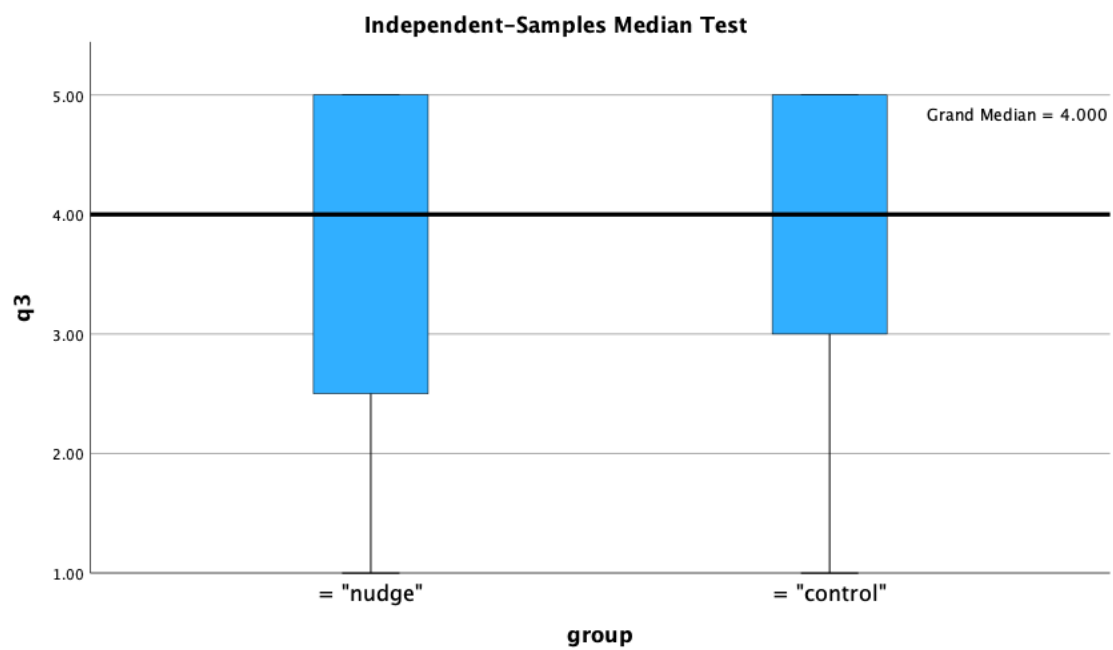


Figure 7: Boxplots

Finally, I created a *bar chart* to visualize the differences between the two groups across the five parameter values (Figure 8).

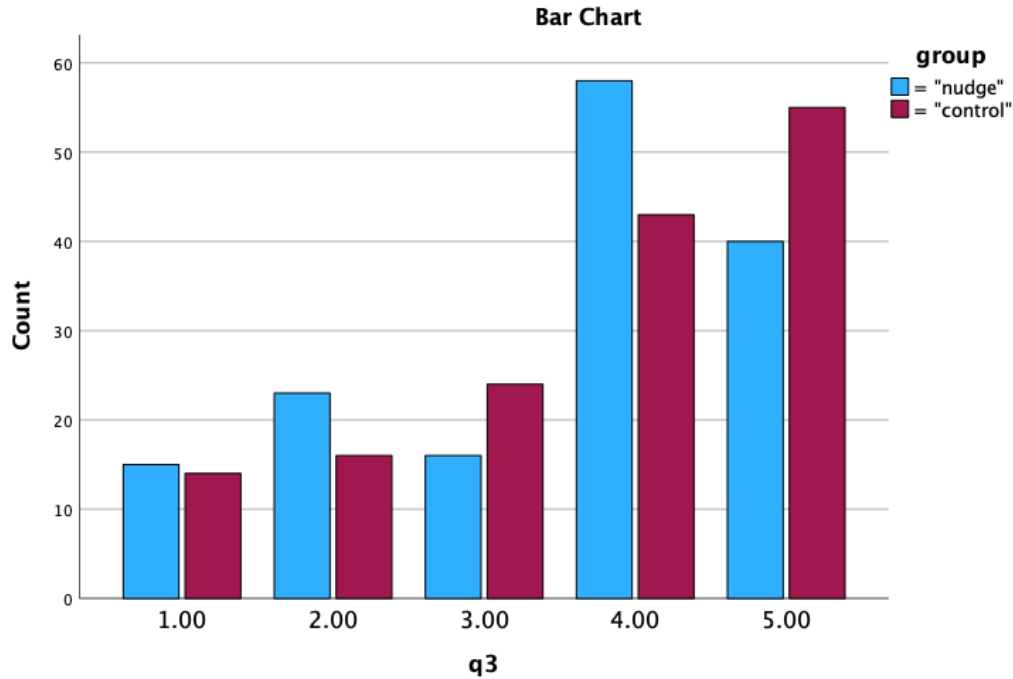


Figure 8: Bar Chart Pro-environmental Behavior Nudge and Control Group

The *bar chart* shows differences between the groups: While the nudge group scored slightly higher than the control in parameter values 1 and 2 (*Extremely unlikely, Somewhat unlikely*), it scored notably higher than the control in parameter value 4 (*Somewhat likely*). The control group however scores slightly higher in parameter value 3 (*Neither likely or unlikely*) and notably higher in parameter value 5 (*Extremely likely*).

4.1.2 T-Test Results

An *independent sample summary t-test* was employed with variable Q3 to compare the mean likelihood scores between the nudge- and control groups.

The results revealed that there was a statistically non-significant difference in the likelihood of choosing reusable packaging between the nudge group ($M = 3.56$, $SD = 1.296$) and the control group ($M = 3.72$, $SD = 1.304$), $t(302) = 1.073$, $p = 0.284$ (Table 1). This means that the control group was actually slightly more likely to choose reusable packaging over single use than the nudge group, but the difference is not statistically significant. The mean difference between the groups is 0.160, with a 95% confidence interval ranging from -0.452 to 0.132 (Table 2). Additionally, the assumption of equal variances between the groups is not violated, and thus

the null hypothesis for the *Levene* test is maintained: No difference between the variances of the two groups - $p = 0.938$, therefore higher than 0.05 (Table 2).

These findings need to be framed with the manipulation check results. These showed that 41% (71 participants) of the nudged group said 'No' when asked whether the nudge was present and 11% (18 participants) said they did not know whether it was present. The implications of these results will be discussed in the next chapter.

Table 1: Group Statistics

Group Statistics					
	group	N	Mean	Std. Deviation	Std. Error Mean
q3	= "nudge"	152	3.5592	1.29560	.10509
	= "control"	152	3.7171	1.30418	.10578

Table 2: T-Test

Independent Samples Test										
Levene's Test for Equality of Variances			t-test for Equality of Means							
	F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					One-Sided p	Two-Sided p			Lower	Upper
q3 Equal variances assumed	.006	.938	-1.059	302	.145	.290	-.15789	.14911	-.45132	.13553
Equal variances not assumed			-1.059	301.987	.145	.290	-.15789	.14911	-.45132	.13553

In keeping with the results above, the independent samples effect sizes show a very weak negative effect of -0.121 for *Cohen's d*. (Table 3).

Table 3: Independent Samples Effect Sizes

Independent Samples Effect Sizes					
		Standardizer ^a	Point Estimate	95% Confidence Interval	
				Lower	Upper
q3	Cohen's d	1.29990	-.121	-.346	.104
	Hedges' correction	1.30314	-.121	-.346	.103
	Glass's delta	1.30418	-.121	-.346	.104

a. The denominator used in estimating the effect sizes.

Cohen's d uses the pooled standard deviation.

Hedges' correction uses the pooled standard deviation, plus a correction factor.

Glass's delta uses the sample standard deviation of the control group.

Finally, the test summaries show: The medians of Q3a_1 and Q3b_1 are assumed to both be at 4, therefore being the same, which means the null hypothesis for the test is retained (Table 4, Table 5)

Table 4: T-Test Summary A

Nonparametric Tests

Hypothesis Test Summary			
	Null Hypothesis	Test	Sig. ^{a,b}
1	The medians of q3 are the same across categories of group.	Independent-Samples Median Test	.083 ^c

a. The significance level is .050.

b. Asymptotic significance is displayed.

c. Yates's Continuity Corrected Asymptotic Sig.

Table 5: T-Test Summary B

q3 across group

Independent-Samples Median Test Summary			
Total N			304
Median			4.000
Test Statistic			3.445 ^a
Degree Of Freedom			1
Asymptotic Sig.(2-sided test)			.063
Yates's Continuity Correction	Chi-Square		3.001
	Degree Of Freedom		1
	Asymptotic Sig.(2-sided test)		.083

a. Multiple comparisons are not performed because there are less than three test fields.

These findings suggest that the nudge intervention did not lead to a statistically significant difference in the likelihood of choosing reusable packaging compared to the control condition. Therefore, H1 must be discarded and H0 accepted: A social norm nudge does not lead to more pro-environmental behavior than no nudge. The possible reasons and implications of this finding will be discussed in the discussion chapter of this thesis.

4.2 Testing Hypothesis 2-5: Correlation Between Big Five Personality Factors and Nudge Effectiveness

Hypothesis 2:

H1: The higher a participant scores for *agreeableness*, the higher the effectiveness of the social norm nudge.

Hypothesis 3:

H1: The higher a participant scores for *conscientiousness*, the higher the effectiveness of the social norm nudge.

Hypothesis 4:

H1: The higher a participant scores for *extraversion*, the higher the effectiveness of the social norm nudge.

Hypothesis 5:

H1: The higher a participant scores for *openness*, the lower the effectiveness of the social norm nudge.

In addition to examining the impact of the nudge intervention, this study explored the relationship between individuals' personality traits and their responsiveness to the nudge. Specifically, the moderating effect of the *big five* personality factors (*extraversion*, *agreeableness*, *conscientiousness*, *neuroticism*, and *openness*) on the effectiveness of the nudge in promoting pro-environmental behavior was analyzed. As discussed in chapter 2.3, previous research indicates that there may be a positive correlation between the effectiveness of the nudge and *agreeableness*, *conscientiousness* and *extraversion*. For *openness*, there may be a negative correlation. *Neuroticism* was not included in hypotheses 2 to 5; however, for completeness reasons, all *big five* personality factors were correlated with nudge effectiveness.

4.2.1 Ordinal Regression

To determine whether there is a causal relationship between the *big five* and nudge effectiveness, one ordinal regression was performed for the *big five* personality factors and the control condition (Q3a_1) and one for the factors and the nudge condition (Q3b_1).

This test aimed to evaluate the influence of personality traits—*agreeableness*, *conscientiousness*, *openness*, *extraversion*, and *neuroticism*—on the dependent variables Q3a_1 (control group) and Q3b_1 (nudge group). The nudge intervention was expected to enhance pro-environmental behavior compared to the control group, based on previous research. However, the ordinal regression analysis revealed contrasting findings, with no significant effect of the nudge intervention observed. These are the detailed results, first for the ordinal regression for q3a_1, then the ones for q3b_1:

The *goodness-of-fit measures* indicate that the model appropriately described the data for the control group (Q3a_1), with a *Pearson significance of 0,0001* ($p=0,05$), suggesting the predictors are well-chosen and relevant (Appendix C).

The ordinal regression model indicates that specific levels of *agreeableness*, *neuroticism* and *extraversion* were significant predictors of the outcome variable, as can be seen in detail in the appendix (Appendix C). For *openness* and *conscientiousness*, no level was significant.

This means *agreeableness*, *neuroticism* and *extraversion* had somewhat of a positive influence on pro-environmental behavior in the control condition.

For the nudge group (Q3b_1), while the *goodness-of-fit measures* also indicate that the model appropriately describes the data for the nudge group ($p=0.001$), the ordinal regression model did not reveal any significant predictors. None of the personality traits included (*agreeableness*, *conscientiousness*, *openness*, *extraversion*, and *neuroticism*) showed a statistically significant relationship with Q3b_1 (all p -values > 0.05).

The comparison between the two regressions thus shows that the personality factors did not have a significant effect on nudge effectiveness as compared to the control group. Rather, the personality factors *agreeableness*, *neuroticism* and *extraversion* had positive effects on pro-environmental behavior directly in this condition.

This outcome suggests that the nudge intervention did not produce the anticipated impact on pro-environmental behavior, contrary to prior expectations based on existing literature. Thus, the hypotheses 2, 3, 4 and 5 have to be rejected. These results will be dissected in detail in the next chapter.

4.3 Other Results: Age, Gender, Education

The two-tailed Spearman rank correlations for age, education and gender showed limited results (Appendice E-J). Age showed a very weak positive correlation to more pro-environmental behavior in the nudge condition ($\rho = 0.076$) and a very weak negative correlation in the control condition ($\rho = -0.047$). However, both were statistically not significant ($p = 0.351$, $p = 0.562$ respectively). For education, there is no correlation in the control condition and this is not significant ($\rho = -0.006$, $p = 0.946$). In the nudge condition, there is a non-significant almost non-existent negative correlation ($\rho = -0.014$, $p = 0.868$). Finally, gender shows a very weak positive correlation to choosing reusable packaging in the control group ($\rho = 0.160$) and this result is statistically significant at the 0.05 level ($p = 0.024$). In the nudge group, there is almost no correlation between the two ($\rho = 0.014$) and this is not statistically significant ($p = 0.863$).

To conclude this results chapter, all five hypotheses have to be rejected, and the null hypothesis has to be assumed for all of them. The possible implications of these findings will be discussed in the upcoming chapter.

5. Discussion

This chapter discusses the findings of the results section in the context of the rest of this thesis and the literature it uses, going first into the findings, discussion, and limitations of this work regarding hypothesis 1 and hypotheses 2 to 5 as well as a further discussion of the results around age, gender and education and finally future research impulses based on the findings of this thesis.

5.1 Discussion H1 to H5

The results regarding Hypothesis 1 showed no significant difference between the nudge- and control groups, hence the hypothesis had to be rejected.

Surprisingly I found that the difference in the box plots for the nudge and control groups (Figure 7) did not look as expected. Instead of the nudge group scoring higher than the control group in terms of pro-environmental behavior, or at least equal, their first quartile started lower than the control groups (2,5 vs 3,0). This is further exacerbated by the bar chart (Figure 8): While in the control group for each higher level of pro-environmental behavior, more study participants picked each higher level than the one below, the pattern in the nudge group seems almost random. Here, the largest group by far picked 4 (Somewhat likely), followed by level 5 (Extremely likely) and then 2 (Somewhat unlikely). These were also supported by the Cohen's D results from the t-test performed on the same data: Cohen's d was -0.121, meaning that the results for both groups almost entirely overlap, but it is probable that a random participant from the control group would score slightly higher than someone in the nudge group on pro-environmental behavior (Table 3). These findings contrast with previous literature on the topic, which showed nudge conditions to perform better than control conditions (e.g. Loschelder et al., 2019; Mertens et al., 2022; Wensing et al., 2020). Since the wording of the nudge was so similar to one – successfully – used in Loschelder et al.'s work (2019), the question is: Why did it not work in this study?

There are several possible explanations for this result. First, a look at the implementation of the nudge intervention in this study: Potentially the nudge was not prominent enough for the treatment group (Figure 2), and participants missed it altogether, which is a limitation of this study. This would be suggested by only 46% of participants passing the manipulation check.

Another reason for so many participants missing the manipulation may be the payment structure of *prolific*, the research participant database used: Users on the platform get the same payout for a survey whether they spend 10 minutes or 3 minutes on it; hence they are enticed to complete a study as fast as possible – thus potentially missing information on the page, such as the nudge. The lack of qualitative information to learn participants' reasoning is a further limitation of this study.

An additional possible explanation could be that, conversely, not the nudge's lack of visibility was the issue, but rather the focus of the control group on the informative text about *vytal* – positioned below the nudge in the nudge group and underneath the price information in the control group (Figure 1, Figure 2). As participants of the control group were not focused on the intended social norm nudge, the information about *vytal* could have served as a sort of informational nudge for that group. Informational nudges have been shown to work in past studies on interventions for more pro-environmental behavior (Nelson et al., 2021; Grilli & John, 2021).

If we assume the nudge was in fact visible enough for the participants, the reason for it not working as intended may be an adverse reaction by the viewers: Potentially, being told to use reusable packaging made people antagonistic to the idea of it. This boomerang effect has been observed in some past research (Envistle, 2024, p. 88).

However, the pilot study with the same nudge showed a significantly higher rate of pro-environmental behavior for the nudge group than the control group, making it likely this behavior would be consistent in the main study. A reason for this erroneous belief could be the small *n* of both rounds: They were simply not reliable enough against statistical outliers, which is another limitation of this thesis.

Regarding the small *n* of the research, there may also have been contextual rather than research design-based reasons for the nudge not working. Other factors outside of the control of this research may have influenced the nudge group – due to the small *n* potentially coincidentally more than the control group. An example of this may be previous bad experiences with the service *vytal* making participants unwilling to choose the reusable packaging option.

To briefly recap, the reason(s) for the social norm nudge not leading to more pro-environmental behavior than the control condition could be the social norm not being prominent enough on the image it was presented on, survey participants rushing through the study and thus not seeing it, the control group being nudged by the informational text about *vytal*, an adverse reaction by the nudge group to being told what to do, an adverse effect of the dynamic nature of the nudge, previous poor experiences with the service *vytal* or a reason that lays in a blind spot of the researcher and would have to be determined in further research.

However, if none of the described potential shortcomings of the nudge were an issue to participants another conclusion presents itself: Potentially, social norm nudges are just not as effective as previously believed. This finding aligns with a current wave of research finding nudges not as effective as other behavioral incentives to encourage pro-environmental behavior, or even not effective at all. As discussed in the theory chapter of this thesis, these findings were seen in different geographies and across interventions, such as energy-saving behaviors (Murakami, 2022), optimized electrical vehicle charging (Marxen et al., 2023) and consumption of plant-based alternatives (Van der Vliet et al., 2024).

Based on this counter-evidence, in addition to the findings of this research, it seems that social norm nudging may not be as promising in promoting pro-environmental behavior as previously hoped. This opens up a wide field of potential future research, as alternative behavioral interventions for encouraging pro-environmental behavior need to be found. Alternatives to nudges, such as financial incentives, have been shown to work well in some instances (Murakami et al., 2022; Marxen et al., 2023), however, the impact-to-cost ratio for a financial incentive would in most cases still be worse than for a nudge. Policy changes also would be effective but lengthy and difficult to get approval for and implement (Groot et al., 2012, p. 1839). Thus, alternative interventions, or successful combinations of different interventions, need to be determined by further research.

Moving on to Hypothesis 2 to 5, regarding the possible moderating effect of the *big five* personality factors on nudge effectiveness, the analysis showed no effect of personality on nudge effectiveness.

My hypotheses were all rejected here, as personality did not moderate nudge intervention effectiveness.

However, the ordinal regression analyses for the control group provided valuable insights into the influence of personality traits on pro-environmental behavior. The significant impact of *agreeableness*, *neuroticism* and *extraversion* on the control group highlights the importance of the confounding factor of the influence of personality traits on pro-environmental behavior. They echo some past research on the direct influence of personality on pro-environmental behavior, stating that agreeableness is strongly linked to environmental engagement, while going against their linkage of it with *openness* and *conscientiousness* (Gifford and Nilsson, 2014, p. 143).

The lack of effect of personality factors on the social norm nudge confirms the findings by Schär et al. (2019) and thus answers their call for further research on the topic. Why did this thesis not find effects of personality factors on social norm nudge effectiveness, as suggested by Oyibo and Vassileva (2019)?

Several reasons can likely be found in the issues discussed relating to hypothesis 1, as they partially explain why there was no significant difference between the nudge and control groups. These were discussed in detail above.

Furthermore, there may be additional predictors that influence nudge effectiveness or pro-environmental behavior that were not covered by this study. Examples of those may be prior environmental attitudes, prior behaviors relating to and experiences with reusable packaging, individually held social norms and situational factors.

Finally, if none of these options offer a different explanation, one has to assume that personality attributes may simply not, as previously expected, influence nudge effectiveness.

In sum, as all hypotheses had to be rejected, it seems that social norm nudges do not produce the intended positive effect on pro-environmental behavior and the *big five* personality factors also seem to not influence nudge effectiveness (however, *agreeableness*, *extraversion* and *neuroticism* seem to affect pro-environmental behavior directly). As discussed in this section, these findings may be due to one or multiple reasons, such as the nudge or study design, the population or sample, or potential other effects that exist in the blind spot of the researcher. Or it is time to rethink the paradigm of the nudge: maybe they are not the most fruitful direction to go in to encourage pro-environmental behavior.

5.2 Future Research

The above-discussed implications of my findings suggest the following routes of future research. Firstly, pertaining to the discussion around hypothesis 1, a more prominent social norm nudge should be tested, and if possible, in a research environment with a different payout structure than prolific.

Furthermore, qualitative elements in the research and/or tools such as eye-tracking would have to determine whether the unintentional informational nudge was salient for the studied subjects in the control group. If yes, informational nudges may therefore be a worthwhile quest for future research. Likewise, qualitative elements – at least further text field questions for participants to explain their reasoning – would be necessary to determine whether a boomerang effect was at play and caused adverse reactions to the social norm nudge. Qualitative research would also be advisable to discern whether any other element of the nudge itself or the setup of the study, unbeknownst to the researcher, influenced nudge effectiveness negatively and thus led to it not being effective.

Regarding hypotheses 2 to 5, the unexpected findings for the control group – the correlations between *agreeableness*, *neuroticism* and *extraversion* and pro-environmental behavior – open up a new field of potential future research as they refute previous findings, which suggested that higher *agreeableness*, *openness* and *conscientiousness* would be correlated with higher levels of pro-environmental behavior (Gifford & Nilsson, 2014, p. 143). Hence, *neuroticism* and *extraversion* were surprising findings, which open up a new field of potential research into the connection between personality traits and pro-environmental behavior. These should be explored in future quantitative and qualitative research, as they may also solve the issue of single-use packaging use without going through the ‘detour’ of nudges.

Similarly, as the additional findings found a weak correlation between pro-environmental behavior and gender, exploring direct links between other individual factors and pro-environmental behavior is suggested.

Furthermore, the analysis of age, gender and education level in relation to nudge effectiveness showed weak results for gender making a difference in pro-environmental behavior. This, together with other individual factors, is an avenue to be explored in future research, especially

as it echoes findings such as by Tate et al. (2022), which determined gender as a predictor of norm adherence.

Also, Austria and Germany are only one – or two very similar – cultural setting(s). This study focused solely on them, but nudges may work differently in other cultural contexts. Therefore, prospective experiments in different cultural contexts may be fruitful.

This study did not cover the personalization of nudge messages. Current developments, such as the strides being made in the realm of generative AI may offer the opportunity to personalize nudge messages within moments, therefore offering up a new level of nudging opportunities. Future research on these new technologies will have to show their possible applications; however, this study could not work on the issue.

Another factor that could be relevant to nudge research is the attitude-behavior gap, also known as the value-action gap (Thorun et al., 2017, p. 19). This describes the difference in actual behavior from proclaimed values (Gupta & Ogden, 2006, p. 200). When looking at sustainable packaging of FMCGs in the German-speaking countries for example, the attitude-behavior gap 2022 was a 9-point difference between 45 out of 100 people claiming to care about sustainable packaging and only 36 actually acting on it (Statista, 2023). In the cases of supermarket experiments, in which consumers spent their own money (e.g. Bauer et al, 2022; Loschelder, 2019) this is not an issue, but for the research designs that worked only with consumer attitudees (e.g. Luo & Zhao, 2023; Wensing, 2020; Boenke, 2021), this is a gap that needs to be explored.

However, this gap, just like the lack of hands-on data from supermarkets (Bauer et al., 2022, p. 7; Ensaff, 2021, p. 200), while important, is unfortunately not filled by this thesis due to financial, time and access restraints.

Finally, by using solely the *Big Five* personality model, personality attributes outside of this model are not accounted for in this thesis and may be valuable approaches for future research.

Another element that can't be investigated is whether the social norm nudge used in this study causes any unintended consequences in the behavior of test subjects, as well as why the intervention may not work at all for some people. There could also be a blind spot regarding certain confounders, such as the exact wording or length of the normative message.

Furthermore, no long-term changes of behavior can be recorded in this study, as there is no longitudinal data. Therefore, it is not clear whether the nudge may change pro-environmental behavior over time or whether a change in behavior can be maintained.

Due to monetary constraints, the size of the sample also determines the generalizability of the sample in question. Future research with a higher n will have to determine the findings' generalizability.

In sum, there are many avenues this research did not explore due to time- or monetary constraints, however, these topics invite further research.

6. Conclusion

The aim of this thesis was to find out whether personality factors influence the efficacy of social norm nudges in the realm of pro-environmental behavior.

The central research questions were:

- 1) Whether the use of a social norm nudge will lead to a display of more pro-environmental behavior than no nudge.
- 2) If there is a moderating effect of consumers' personality structure on the effectiveness of a nudge. Based on previous research, there are four possible correlations to nudge effectiveness: *agreeableness*, *conscientiousness*, *extraversion* and *openness*.

In short, the answer to both research questions is no; hence, all hypotheses created in this research must be rejected.

The first step to answer these questions entailed an in-depth analysis of past literature on the topic. While the exact research topic – assessing the moderating effect of personality on nudging for pro-environmental behavior in the realm of reusable food delivery boxes – had not been researched at the time of writing, the results of studies in similar domains have been used as references. Nudges had proven to be successful in encouraging pro-environmental behavior ranging from towel reusal in hotels (Goldstein et al., 2008; Wesley et al., 2008; Nisa et al., 2017, pp. 356ff.) to water and energy conservation in households (Smith et al., 2012; Nielsen et al., 2017, pp. 29ff.; Jaeger/Schultz, 2017; Buckley, 2020) and making food choices more climate friendly (Bauer et al., 2022; Boenke et al., 2021; Ensaff, 2021). Most similarly to the topic of this research, Loschelder's work on reusable paper cups, which also used a dynamic social norm nudge, found that the nudge increased usage of the reusable alternatives by 17,1% (Loschelder et al., 2019, p. 1). Thus, at this point it was hypothesized that a social norm nudge would lead to more pro-environmental behavior in the application of reusable take-away boxes. Furthermore, past research suggests that personality may moderate nudge effectiveness (Hummel & Maedche, 2019, pp. 55f.). The conflicting results of research papers on personality as a moderator for social norm nudges called for a retest of the moderating effect of the *Big Five* on nudge effectiveness (Oyibo & Vassileva, 2019; Schär et al., 2019). Based on past studies, connections between social norm adherence and the trait *agreeableness* (Wilmot & Ones, 2022, p. 264), were so be expected, as well as potentially for *conscientiousness* and

extraversion (Eck & Gebauer, 2022, p. 559). Opposite results were expected to be seen for *openness* (ibid.)

Due to the research gap regarding this interaction, the research question asking for their connections informed hypotheses 2 to 5.

The heart of this research, an experimental online study, based its questions on past literature on the topic and, after iterations being made in a pre-test and two rounds of pilot studies, asked 304 respondents from Austria and Germany to answer the 10 final questions. Half of those respondents were randomly assigned to be part of the nudge, and the other half to the control group.

After all responses were collected, the analysis consisted of various tests regarding the difference between the nudge and control groups, as well as ordinal regressions for the two groups, in correlation to the *Big Five* personality factors. These analyses found no significant difference between the nudge and control groups and no significant effect of any of the personality factors on the nudge group. *Agreeableness*, *extraversion* and *neuroticism* had a significant effect on pro-environmental behavior in the control group, suggesting there may be a moderating effect between the trait and pro-environmental behavior directly, though not on nudge effectiveness.

In short, the answer was no to both research questions. A social norm nudge did not lead to more pro-environmental behavior than no nudge, and no correlation between the personality factors and nudge effectiveness was found. Hence, all five hypotheses had to be rejected.

As to why this may be and what these findings mean, many interpretations and possible avenues open themselves up. On one hand, they could be explained by issues with the research (setup) itself, such as nudge visibility, adverse reactions to the nudge, unintended informational nudging in the control group or too little statistical power due to the small size of the sample. On the other hand, assuming these were not the reason, one is faced with one very prominent explanation: Contrary to previous belief, social norm nudges may simply not be effective. This has been shown by some current research, finding nudges useless in different settings and across geographies: from energy-saving behavior (Murakami et al., 2022) to optimized electrical vehicle charging (Marxen et al., 2023), plant-based alternative consumption (Van der

Vliet et al., 2024) and finally 118 different sustainable tourism interventions (Greene et al., 2024), all of them found nudges to have only very limited effect or no effect at all.

The findings in this thesis thus contribute to research and life outside of research by suggesting a shift away from the school of thought of nudging as a catch-all solution for encouraging pro-environmental behavior. Institutions and businesses cannot rely on non-monetary behavioral interventions alone to gently nudge consumers to do the right thing.

Instead, they could take their power back and move forward with promising solutions such as policy changes and financial incentives. These may give consumers less freedom of choice (or make it more expensive to exercise this right), but that may be a sacrifice worth making for the privilege of living on a thriving planet.

To bring it back to the very beginning of this thesis: If we want fewer turtles suffocating from plastic waste, the findings in this research suggest that social norm nudging may not be the way to get us there.

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Appendices:

Appendix A: Big Five Personality Scale and Scoring

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Appendix

The Big Five Inventory (BFI)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree strongly 1	Disagree a little 2	Neither agree nor disagree 3	Agree a little 4	Agree strongly 5
---------------------------	---------------------------	------------------------------------	------------------------	------------------------

I see Myself as Someone Who...

- | | |
|--|---|
| ___ 1. Is talkative | ___ 23. Tends to be lazy |
| ___ 2. Tends to find fault with others | ___ 24. Is emotionally stable, not easily upset |
| ___ 3. Does a thorough job | ___ 25. Is inventive |
| ___ 4. Is depressed, blue | ___ 26. Has an assertive personality |
| ___ 5. Is original, comes up with new ideas | ___ 27. Can be cold and aloof |
| ___ 6. Is reserved | ___ 28. Perseveres until the task is finished |
| ___ 7. Is helpful and unselfish with others | ___ 29. Can be moody |
| ___ 8. Can be somewhat careless | ___ 30. Values artistic, aesthetic experiences |
| ___ 9. Is relaxed, handles stress well | ___ 31. Is sometimes shy, inhibited |
| ___ 10. Is curious about many different things | ___ 32. Is considerate and kind to almost everyone |
| ___ 11. Is full of energy | ___ 33. Does things efficiently |
| ___ 12. Starts quarrels with others | ___ 34. Remains calm in tense situations |
| ___ 13. Is a reliable worker | ___ 35. Prefers work that is routine |
| ___ 14. Can be tense | ___ 36. Is outgoing, sociable |
| ___ 15. Is ingenious, a deep thinker | ___ 37. Is sometimes rude to others |
| ___ 16. Generates a lot of enthusiasm | ___ 38. Makes plans and follows through with them |
| ___ 17. Has a forgiving nature | ___ 39. Gets nervous easily |
| ___ 18. Tends to be disorganized | ___ 40. Likes to reflect, play with ideas |
| ___ 19. Worries a lot | ___ 41. Has few artistic interests |
| ___ 20. Has an active imagination | ___ 42. Likes to cooperate with others |
| ___ 21. Tends to be quiet | ___ 43. Is easily distracted |
| ___ 22. Is generally trusting | ___ 44. Is sophisticated in art, music, or literature |

Please check: Did you write a number in front of each statement?

BFI scale scoring ("R" denotes reverse-scored items):

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

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Appendix B: Study Questionnaire

10/03/2024, 15:45

Qualtrics Survey Software

Purpose of the study

Informed Consent. **The Purpose of this study is understanding consumer perception for marketing purposes**

This study consists of 8 questions plus a short demographic data questionnaire and will take you approximately 7 minutes to fill out. Your participation in this study is entirely voluntary and your data is completely anonymous at all times. Please read everything very carefully and answer honestly so you can help us to get good quality data for our study!

If you have any questions or concerns regarding this research, please contact Anja-Lene Melchert (a01150700@unet.univie.ac.at).

- ☐ I have read all of the above. I confirm that I am 18 years old or older and I want to parttake in this study.
- ☐ I have read all of the above. I do not want to participate or I am not eligible.

Prolific ID

Prolific ID. 'What is your Prolific ID? Please note that this response should auto-fill with the correct ID'

Condition 1 (No Nudge)

Q0. Please take your time to read the following information carefully: Imagine it's been a long day and you are really hungry, so you decide to order food online from a new place in town. You go for a healthy bowl and a piece of chocolate cake. Below, you see an image of the restaurants check-out screen. You encounter this page just before finishing your order.

Personal details

First and last name

Type your first and last name

E-mail

name@example.com

Phone number

Type your phone number

Address

Type your address

Address line 2

Type your address

When placing an order, you will receive a confirmation, Food Tracker status messages and a request to review the restaurant via email or otherwise (such as push messages).

☒ CHOOSE Vytal Reusable Packaging

0,00 €

☐ CHOOSE single-use plastic packaging

0,00 €

 Delivery time

Estimated arrival: 30-55 min

 Pay with

Select your payment method

Order and pay (??,?)

Basket

1 Health Bowl

??,?

-

+

1 Chocolate cake

??,?

-

+

Subtotal

??,?

Delivery costs

??,?

Total

??,?

Vytal Reusable Packaging

VYTAL:

Time for more sustainability! Now you can order your favourite food in environmentally friendly reusable packaging.

- Click 'CHOOSE vytal reusable packaging' with your order

- Bring the packaging back to any of our many return locations within 2-4 weeks

0,00 €



Q1a. Based on the above design, how much do you think the meal costs (in Euros)?

Q2a. How likely would you be to order food from this restaurant instead of cooking at home?

Extremely unlikely

Somewhat unlikely

Neither likely nor unlikely

Somewhat likely

Extremely likely

Please indicate on a scale of extremely unlikely to extremely likely

Q3a. How likely would you be to order the food in reusable packaging instead of single-use?

Extremely unlikely

Somewhat unlikely

Neither likely nor unlikely

Somewhat likely

Extremely likely

Please indicate on a scale of extremely unlikely to extremely likely

Condition 2 (Nudge: Injunctive norm)

https://qfreeaccountssjc1.az1.qualtrics.com/Q/EditSection/Blocks/Ajax/GetSurveyPrintPreview?ContextSurveyID=SV_5762jiVj863PbZc&ContextLibraryID=...

2/9

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Q0b. Please take your time to read the following information carefully: Imagine it's been a long day and you are really hungry, so you decide to order food online from a new place in town. You go for a healthy bowl and a piece of chocolate cake. On the next page, you will see an image of the restaurants check-out screen. You encounter this page just before finishing your order.

Personal details

First and last name E-mail

Phone number

Address Address line 2

When placing an order, you will receive a confirmation, Food Tracker status messages and a request to review the restaurant via email or otherwise (such as push messages).

☐ CHOOSE Vytal Reusable Packaging
0,00 €

☐ CHOOSE single-use plastic packaging
0,00 €

Delivery time
Estimated arrival: 30-55 min

Pay with
Select your payment method

Order and pay (??,?)

Basket

1 Health Bowl	??,?
-	+
1 Chocolate cake	??,?
-	+
Subtotal	??,?
Delivery costs	??,?
Total	??,?

DID YOU KNOW?

More and more consumers in your area are willing to choose reusable packaging over single-use.

Vytal Reusable Packaging

VYTAL:

Time for more sustainability! Now you can order your favourite food in environmentally friendly reusable packaging.

- Click 'CHOOSE vytal reusable packaging' with your order
- Bring the packaging back to any of our many return locations within 2-4 weeks

0,00 €

Q1b. Based on the previous design, how much do you think the meal costs (in Euros)?

Q2b. How likely would you be to order food from this restaurant instead of cooking at home?

Extremely unlikely Somewhat unlikely Neither likely nor unlikely Somewhat likely Extremely likely

Please indicate on a scale of extremely unlikely to extremely likely

☐ ☐ ☐ ☐ ☐

Q3b. How likely would you be to order the food in reusable packaging instead of single-use?

10/03/2024, 15:45

Qualtrics Survey Software

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Please indicate on a scale of extremely unlikely to extremely likely	☐	☐	☐	☐	☐

Check Question

Q4. Was the following sentence present in the layout: 'More and more consumers in your area are willing to choose reusable packaging over single-use'?

Please respond to this question honestly! If you don't remember or are unsure, please report that.

- ☐ Yes, it was present
- ☐ No, it wasn't
- ☐ I'm unsure or I don't remember

Personality questions

Q5. Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please indicate how accurate the following statements are to your personality, ranging from 1 (disagree strongly) to 5 (agree strongly).

I see myself as someone who...

	1 Disagree strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree Strongly
1. Is talkative	☐	☐	☐	☐	☐
2. Tends to find fault with others	☐	☐	☐	☐	☐
3. Does a thorough job	☐	☐	☐	☐	☐
4. Is depressed, blue	☐	☐	☐	☐	☐
5. Is original, comes up with new ideas	☐	☐	☐	☐	☐
6. Is reserved	☐	☐	☐	☐	☐
7. Is helpful and unselfish with others	☐	☐	☐	☐	☐
8. Can be somewhat careless	☐	☐	☐	☐	☐

	1 Disagree strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree Strongly
9. Is relaxed, handles stress well	☐	☐	☐	☐	☐
10. Is curious about many different things	☐	☐	☐	☐	☐
11. Is full of energy	☐	☐	☐	☐	☐
12. Starts quarrels with others	☐	☐	☐	☐	☐
13. Is a reliable worker	☐	☐	☐	☐	☐
14. Can be tense	☐	☐	☐	☐	☐
15. Is ingenious, a deep thinker	☐	☐	☐	☐	☐

1 Disagree strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree Strongly
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Q6. (Continued from last page) Here are a number of characteristics that may or may not apply to you. Please indicate how accurate the following statements are to your personality, ranging from 1 (disagree strongly) to 5 (agree strongly). I see myself as someone who...

	1 Disagree strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly
16. generates a lot of enthusiasm	☐	☐	☐	☐	☐
17. Has a forgiving nature	☐	☐	☐	☐	☐
18. Tends to be disorganized	☐	☐	☐	☐	☐
19. Worries a lot	☐	☐	☐	☐	☐
20. Has an active imagination	☐	☐	☐	☐	☐
21. Tends to be quiet	☐	☐	☐	☐	☐
22. Is generally trusting	☐	☐	☐	☐	☐
23. Tends to be lazy	☐	☐	☐	☐	☐
24. Is emotionally stable, not easily upset	☐	☐	☐	☐	☐
25. Is inventive	☐	☐	☐	☐	☐

	1 Disagree strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly
26. Has an assertive personality	☐	☐	☐	☐	☐
27. Can be cold and aloof	☐	☐	☐	☐	☐
28. Perseveres until the task is finished	☐	☐	☐	☐	☐
29. Can be moody	☐	☐	☐	☐	☐
30. Values artistic, aesthetic experiences	☐	☐	☐	☐	☐

	1 Disagree strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly
--	---------------------	---------------------	------------------------------	------------------	------------------

Q7. (Continued from previous page) Here are a number of characteristics that may or may not apply to you. Please indicate how accurate the following statements are to your personality, ranging from 1 (disagree strongly) to 5 (agree strongly). I see myself as someone who...

	1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly
31. Is sometimes shy, inhibited	☐	☐	☐	☐	☐
32. Is considerate and kind to almost everyone	☐	☐	☐	☐	☐
33. Does things efficiently	☐	☐	☐	☐	☐
34. Remains calm in tense situations	☐	☐	☐	☐	☐
35. Prefers work that is routine	☐	☐	☐	☐	☐
36. Is outgoing, sociable	☐	☐	☐	☐	☐
37. Is sometimes rude to others	☐	☐	☐	☐	☐
38. Makes plans and follows through with them	☐	☐	☐	☐	☐
39. Gets nervous easily	☐	☐	☐	☐	☐
40. Likes to reflect, play with ideas	☐	☐	☐	☐	☐

	1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly
41. Has few artistic interests	☐	☐	☐	☐	☐
42. Likes to cooperate with others	☐	☐	☐	☐	☐
43. Is easily distracted	☐	☐	☐	☐	☐
44. Is sophisticated in art, music, or literature	☐	☐	☐	☐	☐

	1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly
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Block 8

Q8. How much do you agree with this statement: "I feel connected to nature"

1 Disagree strongly
☐

2 Disagree
☐

3 Neutral
☐

4 Agree
☐

5 Agree Strongly
☐

Demographic Questions

Q9. Please indicate your age:

Q10. Please indicate your gender:

☐ Male

☐ Female

- ☐ Non-binary / third gender
- ☐ Prefer not to say

Q11. Please indicate your highest completed education level:

- ☐ Mandatory Basic Education
- ☐ High School Diploma
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ PhD or higher
- ☐ Prefer not to say

Purpose of the study

Q12. What do you think was the purpose of this study?

Powered by Qualtrics

Appendix C: Ordinal Regression for Control Group

PLUM q3a_1 BY Agreeableness, Openness, Conscientiousness, Neuroticism, Extra
 /CRITERIA=CIN(95) DELTA(0) LCONVERGE(0) MXITER(100) MXSTEP(5)
 PCONVERGE(1.0E-6) SINGULAR(1.0E-8)
 /LINK=LOGIT
 /PRINT=FIT PARAMETER SUMMARY.

Case Processing Summary

		N	Marginal Percentage
How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Extremely unlikely	14	9.2%
	Somewhat unlikely	16	10.5%
	Neither likely nor unlikely	24	15.8%
	Somewhat likely	43	28.3%
	Extremely likely	55	36.2%
Agreeableness	15.00	1	0.7%
	19.00	2	1.3%
	20.00	1	0.7%
	21.00	1	0.7%
	22.00	3	2.0%
	23.00	5	3.3%
	24.00	2	1.3%
	25.00	12	7.9%
	27.00	7	4.6%
	28.00	8	5.3%
	29.00	14	9.2%
	30.00	9	5.9%
	31.00	6	3.9%
	32.00	15	9.9%
	33.00	12	7.9%
	34.00	6	3.9%
	35.00	9	5.9%
	36.00	11	7.2%
	37.00	4	2.6%
	38.00	5	3.3%
	39.00	8	5.3%

	40.00	5	3.3%
	41.00	3	2.0%
	42.00	2	1.3%
	44.00	1	0.7%
Openness	18.00	1	0.7%
	22.00	1	0.7%
	24.00	1	0.7%
	27.00	2	1.3%
	28.00	6	3.9%
	29.00	10	6.6%
	30.00	9	5.9%
	31.00	7	4.6%
	32.00	3	2.0%
	33.00	3	2.0%
	34.00	20	13.2%
	35.00	6	3.9%
	36.00	8	5.3%
	37.00	16	10.5%
	38.00	11	7.2%
	39.00	8	5.3%
	40.00	5	3.3%
	41.00	12	7.9%
	42.00	6	3.9%
	43.00	1	0.7%
	44.00	4	2.6%
	45.00	5	3.3%
	46.00	2	1.3%
	47.00	1	0.7%
	48.00	3	2.0%
	49.00	1	0.7%
Conscientiousness	18.00	2	1.3%
	19.00	2	1.3%
	20.00	2	1.3%
	22.00	2	1.3%
	23.00	1	0.7%
	24.00	4	2.6%
	25.00	4	2.6%
	26.00	5	3.3%
	27.00	11	7.2%
	28.00	7	4.6%

	29.00	8	5.3%
	30.00	16	10.5%
	31.00	9	5.9%
	32.00	18	11.8%
	33.00	6	3.9%
	34.00	12	7.9%
	35.00	8	5.3%
	36.00	12	7.9%
	37.00	8	5.3%
	38.00	5	3.3%
	39.00	5	3.3%
	40.00	3	2.0%
	41.00	1	0.7%
	44.00	1	0.7%
Neuroticism	13.00	5	3.3%
	14.00	2	1.3%
	15.00	5	3.3%
	16.00	7	4.6%
	17.00	4	2.6%
	18.00	8	5.3%
	19.00	3	2.0%
	20.00	9	5.9%
	21.00	7	4.6%
	22.00	8	5.3%
	23.00	6	3.9%
	24.00	13	8.6%
	25.00	8	5.3%
	26.00	8	5.3%
	27.00	6	3.9%
	28.00	7	4.6%
	29.00	12	7.9%
	30.00	4	2.6%
	31.00	6	3.9%
	32.00	4	2.6%
	33.00	3	2.0%
	34.00	5	3.3%
	35.00	5	3.3%
	36.00	3	2.0%
	37.00	2	1.3%
	38.00	1	0.7%

	39.00	1	0.7%
Extraversion	9.00	1	0.7%
	10.00	2	1.3%
	11.00	3	2.0%
	12.00	1	0.7%
	13.00	3	2.0%
	14.00	3	2.0%
	15.00	7	4.6%
	16.00	7	4.6%
	17.00	10	6.6%
	18.00	6	3.9%
	19.00	11	7.2%
	20.00	8	5.3%
	21.00	9	5.9%
	22.00	5	3.3%
	23.00	5	3.3%
	24.00	11	7.2%
	25.00	3	2.0%
	26.00	5	3.3%
	27.00	9	5.9%
	28.00	9	5.9%
	29.00	6	3.9%
	30.00	9	5.9%
	31.00	6	3.9%
	32.00	4	2.6%
	33.00	1	0.7%
	34.00	2	1.3%
	36.00	4	2.6%
	39.00	2	1.3%
Valid		152	100.0%
Missing		152	
Total		304	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	447.827			
Final	4.711	443.115	121	<.001

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	14327.919	483	<.001
Deviance	117.406	483	1.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.946
Nagelkerke	.998
McFadden	.989

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	Upper Bound
							Lower Bound	
Threshold	[Q3a_1 = 1]	147.240	9041.832	.000	1	.987	-17574.426	17868.905
	[Q3a_1 = 2]	152.410	9041.834	.000	1	.987	-17569.259	17874.078
	[Q3a_1 = 3]	157.263	9041.835	.000	1	.986	-17564.409	17878.934
	[Q3a_1 = 4]	167.061	9041.848	.000	1	.985	-17554.636	17888.757
Logistic	[Agreeableness=15.00]	-9.675	.000	.	1	.	-9.675	-9.675
	[Agreeableness=19.00]	-51.803	4762.000	.000	1	.991	-9385.151	9281.546
	[Agreeableness=20.00]	-12.339	8737.308	.000	1	.999	-17137.148	17112.469
	[Agreeableness=21.00]	61.395	4944.030	.000	1	.990	-9628.726	9751.515
	[Agreeableness=22.00]	-3.511	13.315	.070	1	.792	-29.608	22.585
	[Agreeableness=23.00]	15.040	12.803	1.380	1	.240	-10.054	40.134

[Agreeableness=24.00]	57.914	11672.851	.000	1	.996	-22820.452	22936.281
[Agreeableness=25.00]	18.003	15.084	1.425	1	.233	-11.561	47.567
[Agreeableness=27.00]	1.486	14.313	.011	1	.917	-26.567	29.539
[Agreeableness=28.00]	27.965	13.995	3.993	1	.046	.535	55.395
[Agreeableness=29.00]	22.056	13.578	2.639	1	.104	-4.555	48.668
[Agreeableness=30.00]	10.908	13.199	.683	1	.409	-14.961	36.777
[Agreeableness=31.00]	37.010	14.633	6.397	1	.011	8.329	65.691
[Agreeableness=32.00]	28.510	14.122	4.076	1	.044	.832	56.187
[Agreeableness=33.00]	3.735	12.242	.093	1	.760	-20.259	27.730
[Agreeableness=34.00]	-2.360	15.650	.023	1	.880	-33.033	28.314
[Agreeableness=35.00]	27.592	14.036	3.864	1	.049	.081	55.103
[Agreeableness=36.00]	4.990	13.427	.138	1	.710	-21.325	31.306
[Agreeableness=37.00]	-2.882	11.817	.059	1	.807	-26.043	20.279
[Agreeableness=38.00]	31.359	12.893	5.916	1	.015	6.089	56.629
[Agreeableness=39.00]	29.030	13.390	4.701	1	.030	2.787	55.274
[Agreeableness=40.00]	9.092	14.962	.369	1	.543	-20.233	38.417
[Agreeableness=41.00]	-17.597	12.870	1.869	1	.172	-42.821	7.628
[Agreeableness=42.00]	54.330	5613.351	.000	1	.992	-10947.636	11056.296
[Agreeableness=44.00]	0 ^a	.	.	0	.	.	.
[Openness=18.00]	.067	13811.502	.000	1	1.000	-27069.980	27070.114
[Openness=22.00]	1.063	7382.560	.000	1	1.000	-14468.488	14470.614

[Openness=2 4.00]	-70.450	14866.185	.000	1	.996	-29207.637	29066 .737
[Openness=2 7.00]	63.887	12517.732	.000	1	.996	-24470.417	24598 .191
[Openness=2 8.00]	-4.448	7382.561	.000	1	1.000	-14474.001	14465 .105
[Openness=2 9.00]	21.104	7382.561	.000	1	.998	-14448.450	14490 .659
[Openness=3 0.00]	.509	7382.561	.000	1	1.000	-14469.045	14470 .062
[Openness=3 1.00]	5.305	7382.559	.000	1	.999	-14464.244	14474 .855
[Openness=3 2.00]	-18.407	7382.564	.000	1	.998	-14487.967	14451 .152
[Openness=3 3.00]	-27.958	7382.568	.000	1	.997	-14497.525	14441 .609
[Openness=3 4.00]	21.754	7382.559	.000	1	.998	-14447.796	14491 .304
[Openness=3 5.00]	-12.247	7382.566	.000	1	.999	-14481.810	14457 .316
[Openness=3 6.00]	31.671	7382.565	.000	1	.997	-14437.890	14501 .232
[Openness=3 7.00]	-3.374	7382.560	.000	1	1.000	-14472.925	14466 .177
[Openness=3 8.00]	3.365	7382.560	.000	1	1.000	-14466.186	14472 .917
[Openness=3 9.00]	5.924	7382.559	.000	1	.999	-14463.626	14475 .474
[Openness=4 0.00]	8.613	7382.561	.000	1	.999	-14460.941	14478 .166
[Openness=4 1.00]	35.960	7382.562	.000	1	.996	-14433.595	14505 .516
[Openness=4 2.00]	12.343	7382.563	.000	1	.999	-14457.214	14481 .900
[Openness=4 3.00]	38.047	.000	.	1	.	38.047	38.04 7
[Openness=4 4.00]	-18.198	7382.563	.000	1	.998	-14487.754	14451 .359
[Openness=4 5.00]	17.199	7382.561	.000	1	.998	-14452.354	14486 .753
[Openness=4 6.00]	117.725	10462.113	.000	1	.991	-20387.639	20623 .090

[Openness=47.00]	66.291	.000	.	1	.	66.291	66.291
[Openness=48.00]	42.213	7382.563	.000	1	.995	-14427.345	14511.772
[Openness=49.00]	0 ^a	.	.	0	.	.	.
[Conscientiousness=18.00]	6.835	9041.778	.000	1	.999	-17714.724	17728.393
[Conscientiousness=19.00]	-20.238	9041.750	.000	1	.998	-17741.742	17701.265
[Conscientiousness=20.00]	82.018	13562.646	.000	1	.995	-26500.281	26664.317
[Conscientiousness=22.00]	-58.403	9041.760	.000	1	.995	-17779.927	17663.120
[Conscientiousness=23.00]	-6.264	9041.757	.000	1	.999	-17727.781	17715.253
[Conscientiousness=24.00]	18.666	9041.765	.000	1	.998	-17702.867	17740.199
[Conscientiousness=25.00]	57.761	9041.779	.000	1	.995	-17663.801	17779.323
[Conscientiousness=26.00]	24.463	9041.761	.000	1	.998	-17697.063	17745.988
[Conscientiousness=27.00]	18.753	9041.756	.000	1	.998	-17702.764	17740.270
[Conscientiousness=28.00]	11.783	9041.756	.000	1	.999	-17709.732	17733.299
[Conscientiousness=29.00]	41.440	9041.765	.000	1	.996	-17680.095	17762.974
[Conscientiousness=30.00]	39.293	9041.764	.000	1	.997	-17682.238	17760.825

[Conscientiousness=31.00]	25.704	9041.762	.000	1	.998	-17695.823	17747.231
[Conscientiousness=32.00]	40.373	9041.765	.000	1	.996	-17681.160	17761.906
[Conscientiousness=33.00]	15.237	9041.756	.000	1	.999	-17706.280	17736.753
[Conscientiousness=34.00]	39.869	9041.765	.000	1	.996	-17681.664	17761.403
[Conscientiousness=35.00]	33.662	9041.761	.000	1	.997	-17687.863	17755.188
[Conscientiousness=36.00]	23.709	9041.759	.000	1	.998	-17697.813	17745.230
[Conscientiousness=37.00]	37.502	9041.763	.000	1	.997	-17684.027	17759.032
[Conscientiousness=38.00]	47.096	9041.770	.000	1	.996	-17674.448	17768.640
[Conscientiousness=39.00]	24.795	9041.759	.000	1	.998	-17696.727	17746.317
[Conscientiousness=40.00]	5.007	9041.756	.000	1	1.000	-17716.510	17726.523
[Conscientiousness=41.00]	0 ^a	.	.	0	.	.	.
[Conscientiousness=44.00]	0 ^a	.	.	0	.	.	.
[Neuroticism=13.00]	45.607	15.274	8.916	1	.003	15.672	75.543
[Neuroticism=14.00]	51.191	14.710	12.111	1	<.001	22.360	80.022
[Neuroticism=15.00]	66.191	15.998	17.119	1	<.001	34.836	97.546

[Neuroticism =16.00]	78.753	19.681	16.01 2	1	<.001	40.178	117.3 27
[Neuroticism =17.00]	53.859	14.717	13.39 3	1	<.001	25.014	82.70 3
[Neuroticism =18.00]	61.030	15.492	15.51 9	1	<.001	30.666	91.39 4
[Neuroticism =19.00]	62.177	16.363	14.43 9	1	<.001	30.107	94.24 8
[Neuroticism =20.00]	79.411	18.002	19.45 9	1	<.001	44.128	114.6 94
[Neuroticism =21.00]	63.311	16.925	13.99 3	1	<.001	30.139	96.48 2
[Neuroticism =22.00]	72.821	18.155	16.08 8	1	<.001	37.237	108.4 05
[Neuroticism =23.00]	106.945	25.778	17.21 1	1	<.001	56.420	157.4 70
[Neuroticism =24.00]	79.471	20.506	15.01 9	1	<.001	39.279	119.6 63
[Neuroticism =25.00]	95.538	23.488	16.54 5	1	<.001	49.504	141.5 73
[Neuroticism =26.00]	82.150	19.953	16.95 2	1	<.001	43.043	121.2 57
[Neuroticism =27.00]	76.625	17.973	18.17 5	1	<.001	41.398	111.8 52
[Neuroticism =28.00]	79.614	19.687	16.35 3	1	<.001	41.027	118.2 01
[Neuroticism =29.00]	72.165	18.489	15.23 5	1	<.001	35.928	108.4 03
[Neuroticism =30.00]	82.041	20.082	16.69 0	1	<.001	42.681	121.4 01
[Neuroticism =31.00]	116.838	31.053	14.15 7	1	<.001	55.976	177.7 00
[Neuroticism =32.00]	115.010	29.042	15.68 3	1	<.001	58.089	171.9 30
[Neuroticism =33.00]	151.540	37.575	16.26 5	1	<.001	77.894	225.1 86
[Neuroticism =34.00]	126.284	5499.624	.001	1	.982	-10652.781	10905 .349
[Neuroticism =35.00]	94.428	22.759	17.21 5	1	<.001	49.822	139.0 34
[Neuroticism =36.00]	11.846	4944.034	.000	1	.998	-9678.282	9701. 974

[Neuroticism =37.00]	108.383	4762.028	.001	1	.982	-9225.020	9441.785
[Neuroticism =38.00]	34.339	.000	.	1	.	34.339	34.339
[Neuroticism =39.00]	0 ^a	.	.	0	.	.	.
[Extra=9.00]	0 ^a	.	.	0	.	.	.
[Extra=10.00]	1.399	6.902	.041	1	.839	-12.130	14.928
[Extra=11.00]	15.854	11.930	1.766	1	.184	-7.528	39.235
[Extra=12.00]	0 ^a	.	.	0	.	.	.
[Extra=13.00]	-2.574	7.640	.113	1	.736	-17.548	12.401
[Extra=14.00]	11.417	11672.845	.000	1	.999	-22866.938	22889.773
[Extra=15.00]	41.579	12.991	10.244	1	.001	16.118	67.040
[Extra=16.00]	37.419	9.644	15.055	1	<.001	18.517	56.321
[Extra=17.00]	31.622	9.739	10.543	1	.001	12.534	50.709
[Extra=18.00]	38.177	14.683	6.760	1	.009	9.398	66.955
[Extra=19.00]	17.332	7.552	5.267	1	.022	2.530	32.134
[Extra=20.00]	28.139	9.241	9.272	1	.002	10.027	46.251
[Extra=21.00]	27.876	7.408	14.158	1	<.001	13.356	42.397
[Extra=22.00]	23.277	8.016	8.432	1	.004	7.566	38.988
[Extra=23.00]	8.790	6.157	2.038	1	.153	-3.277	20.857
[Extra=24.00]	46.214	13.146	12.358	1	<.001	20.448	71.980
[Extra=25.00]	35.948	12.823	7.859	1	.005	10.815	61.081
[Extra=26.00]	10.484	6.575	2.543	1	.111	-2.403	23.371
[Extra=27.00]	36.139	12.038	9.013	1	.003	12.546	59.733

[Extra=28.00]	25.262	9.253	7.453	1	.006	7.126	43.398
[Extra=29.00]	53.727	13.415	16.041	1	<.001	27.435	80.019
[Extra=30.00]	32.794	10.937	8.991	1	.003	11.359	54.229
[Extra=31.00]	37.857	12.056	9.861	1	.002	14.229	61.485
[Extra=32.00]	40.443	11.874	11.600	1	<.001	17.170	63.716
[Extra=33.00]	-13.074	8737.297	.000	1	.999	-17137.862	17111.714
[Extra=34.00]	0 ^a	.	.	0	.	.	.
[Extra=36.00]	30.074	8.995	11.178	1	<.001	12.444	47.704
[Extra=39.00]	0 ^a	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Appendix D: Ordinal Regression for Nudge Group

PLUM Q3b_1 BY Agreeableness, Openness, Conscientiousness, Neuroticism, Extra
 /CRITERIA=CIN(95) DELTA(0) LCONVERGE(0) MXITER(100) MXSTEP(5)
 PCONVERGE(1.0E-6) SINGULAR(1.0E-8)
 /LINK=LOGIT
 /PRINT=FIT PARAMETER SUMMARY.

Case Processing Summary

		N	Marginal Percentage
How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Extremely unlikely	15	9.9%
	Somewhat unlikely	23	15.1%
	Neither likely nor unlikely	16	10.5%
	Somewhat likely	58	38.2%
	Extremely likely	40	26.3%
Agreeableness	11.00	1	0.7%
	21.00	1	0.7%
	22.00	4	2.6%
	23.00	1	0.7%
	24.00	6	3.9%
	25.00	4	2.6%
	26.00	6	3.9%
	27.00	7	4.6%
	28.00	7	4.6%
	29.00	11	7.2%
	30.00	7	4.6%
	31.00	3	2.0%
	32.00	10	6.6%
	33.00	10	6.6%
	34.00	9	5.9%
	35.00	9	5.9%
	36.00	12	7.9%
	37.00	9	5.9%
	38.00	10	6.6%
	39.00	8	5.3%
	40.00	3	2.0%
	41.00	4	2.6%
	42.00	4	2.6%
	43.00	3	2.0%

	44.00	2	1.3%
	45.00	1	0.7%
Openness	20.00	1	0.7%
	24.00	1	0.7%
	25.00	1	0.7%
	26.00	5	3.3%
	27.00	2	1.3%
	28.00	1	0.7%
	29.00	5	3.3%
	30.00	4	2.6%
	31.00	10	6.6%
	32.00	8	5.3%
	33.00	10	6.6%
	34.00	14	9.2%
	35.00	13	8.6%
	36.00	13	8.6%
	37.00	11	7.2%
	38.00	10	6.6%
	39.00	6	3.9%
	40.00	6	3.9%
	41.00	6	3.9%
	42.00	7	4.6%
	43.00	6	3.9%
	44.00	5	3.3%
	45.00	1	0.7%
	46.00	1	0.7%
	47.00	3	2.0%
	49.00	1	0.7%
	50.00	1	0.7%
Conscientiousness	16.00	1	0.7%
	21.00	1	0.7%
	22.00	1	0.7%
	23.00	6	3.9%
	24.00	2	1.3%
	25.00	7	4.6%
	26.00	8	5.3%
	27.00	12	7.9%
	28.00	7	4.6%
	29.00	4	2.6%
	30.00	6	3.9%

	31.00	16	10.5%
	32.00	10	6.6%
	33.00	11	7.2%
	34.00	7	4.6%
	35.00	16	10.5%
	36.00	12	7.9%
	37.00	8	5.3%
	38.00	3	2.0%
	39.00	7	4.6%
	40.00	5	3.3%
	41.00	1	0.7%
	43.00	1	0.7%
	8.00	1	0.7%
Neuroticism	9.00	1	0.7%
	10.00	1	0.7%
	13.00	3	2.0%
	14.00	3	2.0%
	15.00	8	5.3%
	16.00	7	4.6%
	17.00	8	5.3%
	18.00	4	2.6%
	19.00	9	5.9%
	20.00	11	7.2%
	21.00	10	6.6%
	22.00	9	5.9%
	23.00	14	9.2%
	24.00	6	3.9%
	25.00	6	3.9%
	26.00	8	5.3%
	27.00	10	6.6%
	28.00	3	2.0%
	29.00	6	3.9%
	30.00	5	3.3%
	31.00	4	2.6%
	32.00	4	2.6%
	33.00	3	2.0%
	34.00	1	0.7%
	35.00	2	1.3%
	36.00	2	1.3%
	37.00	1	0.7%

	38.00	2	1.3%
Extraversion	9.00	1	0.7%
	10.00	1	0.7%
	11.00	2	1.3%
	12.00	2	1.3%
	13.00	1	0.7%
	14.00	3	2.0%
	15.00	4	2.6%
	16.00	1	0.7%
	17.00	3	2.0%
	18.00	5	3.3%
	19.00	13	8.6%
	20.00	9	5.9%
	21.00	9	5.9%
	22.00	16	10.5%
	23.00	10	6.6%
	24.00	7	4.6%
	25.00	7	4.6%
	26.00	9	5.9%
	27.00	11	7.2%
	28.00	9	5.9%
	29.00	7	4.6%
	30.00	3	2.0%
	31.00	5	3.3%
	32.00	7	4.6%
	33.00	3	2.0%
	34.00	1	0.7%
	35.00	1	0.7%
	36.00	2	1.3%
Valid		152	100.0%
Missing		152	
Total		304	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	446.941			
Final	206.454	240.487	123	<.001

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	1925.902	481	<.001
Deviance	206.454	481	1.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.794
Nagelkerke	.839
McFadden	.538

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Interval Lower Bound	Confidence Upper Bound
Threshold	[Q3b_1 = 1]	13.907	11491.301	.000	1	.999	-22508.628	22536.443
	[Q3b_1 = 2]	17.599	11491.301	.000	1	.999	-22504.937	22540.134
	[Q3b_1 = 3]	19.210	11491.301	.000	1	.999	-22503.325	22541.745
	[Q3b_1 = 4]	23.766	11491.301	.000	1	.998	-22498.769	22546.301
Logistic	[Agreeableness=11.00]	17.934	10616.815	.000	1	.999	-20790.641	20826.509
	[Agreeableness=21.00]	67.824	.000	.	1	.	67.824	67.824
	[Agreeableness=22.00]	17.827	6433.084	.000	1	.998	-12590.787	12626.440
	[Agreeableness=23.00]	3.710	.000	.	1	.	3.710	3.710
	[Agreeableness=24.00]	14.443	6433.084	.000	1	.998	-12594.170	12623.056
	[Agreeableness=25.00]	9.821	6433.085	.000	1	.999	-12598.793	12618.436
	[Agreeableness=26.00]	24.551	6433.084	.000	1	.997	-12584.062	12633.163

[Agreeableness=27.00]	9.517	6433.086	.000	1	.999	-12599.099	12618.133
[Agreeableness=28.00]	28.031	6433.084	.000	1	.997	-12580.582	12636.644
[Agreeableness=29.00]	18.107	6433.084	.000	1	.998	-12590.505	12626.720
[Agreeableness=30.00]	20.432	6433.084	.000	1	.997	-12588.181	12629.045
[Agreeableness=31.00]	48.232	8173.897	.000	1	.995	-15972.313	16068.776
[Agreeableness=32.00]	19.861	6433.084	.000	1	.998	-12588.752	12628.473
[Agreeableness=33.00]	24.274	6433.084	.000	1	.997	-12584.339	12632.886
[Agreeableness=34.00]	21.566	6433.084	.000	1	.997	-12587.046	12630.178
[Agreeableness=35.00]	27.739	6433.083	.000	1	.997	-12580.873	12636.351
[Agreeableness=36.00]	15.401	6433.084	.000	1	.998	-12593.213	12624.014
[Agreeableness=37.00]	25.290	6433.084	.000	1	.997	-12583.323	12633.903
[Agreeableness=38.00]	15.246	6433.084	.000	1	.998	-12593.367	12623.858
[Agreeableness=39.00]	24.194	6433.084	.000	1	.997	-12584.419	12632.807
[Agreeableness=40.00]	32.133	6433.084	.000	1	.996	-12576.480	12640.747
[Agreeableness=41.00]	27.618	6433.084	.000	1	.997	-12580.995	12636.231
[Agreeableness=42.00]	25.344	6433.084	.000	1	.997	-12583.269	12633.957
[Agreeableness=43.00]	20.019	6433.085	.000	1	.998	-12588.597	12628.634
[Agreeableness=44.00]	51.162	10234.333	.000	1	.996	-20007.762	20110.085
[Agreeableness=45.00]	0 ^a	.	.	0	.	.	.
[Openness=20.00]	-114.866	7728.492	.000	1	.988	-15262.432	15032.700
[Openness=24.00]	0 ^a	.	.	0	.	.	.

[Openness=25 .00]	-124.239	7728.492	.000	1	.987	-15271.805	15023.32 7
[Openness=26 .00]	-75.211	6030.505	.000	1	.990	-11894.785	11744.36 2
[Openness=27 .00]	-82.166	6030.506	.000	1	.989	-11901.742	11737.40 9
[Openness=28 .00]	-49.903	.000	.	1	.	-49.903	-49.903
[Openness=29 .00]	-67.131	6030.505	.000	1	.991	-11886.704	11752.44 2
[Openness=30 .00]	-66.422	6030.505	.000	1	.991	-11885.994	11753.15 0
[Openness=31 .00]	-67.608	6030.504	.000	1	.991	-11887.180	11751.96 3
[Openness=32 .00]	-59.999	6030.504	.000	1	.992	-11879.571	11759.57 2
[Openness=33 .00]	-65.162	6030.504	.000	1	.991	-11884.733	11754.40 9
[Openness=34 .00]	-61.734	6030.504	.000	1	.992	-11881.305	11757.83 7
[Openness=35 .00]	-68.854	6030.504	.000	1	.991	-11888.426	11750.71 7
[Openness=36 .00]	-64.488	6030.504	.000	1	.991	-11884.059	11755.08 3
[Openness=37 .00]	-67.971	6030.505	.000	1	.991	-11887.543	11751.60 1
[Openness=38 .00]	-74.833	6030.505	.000	1	.990	-11894.405	11744.73 9
[Openness=39 .00]	-69.337	6030.504	.000	1	.991	-11888.908	11750.23 5
[Openness=40 .00]	-68.467	6030.504	.000	1	.991	-11888.038	11751.10 5
[Openness=41 .00]	-65.175	6030.505	.000	1	.991	-11884.747	11754.39 7
[Openness=42 .00]	-73.259	6030.505	.000	1	.990	-11892.832	11746.31 4
[Openness=43 .00]	-67.697	6030.505	.000	1	.991	-11887.268	11751.87 5
[Openness=44 .00]	-62.072	6030.504	.000	1	.992	-11881.643	11757.49 9
[Openness=45 .00]	-75.037	10769.226	.000	1	.994	-21182.333	21032.25 9

[Openness=46.00]	-45.934	.000	.	1	.	-45.934	-45.934
[Openness=47.00]	-69.360	6030.506	.000	1	.991	-11888.935	11750.215
[Openness=49.00]	-36.659	6808.048	.000	1	.996	-13380.187	13306.869
[Openness=50.00]	0 ^a	.	.	0	.	.	.
[Conscientiousness=16.00]	-14.398	12122.452	.000	1	.999	-23773.967	23745.172
[Conscientiousness=21.00]	0 ^a	.	.	0	.	.	.
[Conscientiousness=22.00]	38.672	9688.014	.000	1	.997	-18949.486	19026.830
[Conscientiousness=23.00]	2.630	8206.375	.000	1	1.000	-16081.570	16086.830
[Conscientiousness=24.00]	12.298	8206.376	.000	1	.999	-16071.904	16096.500
[Conscientiousness=25.00]	14.012	8206.376	.000	1	.999	-16070.189	16098.212
[Conscientiousness=26.00]	6.063	8206.375	.000	1	.999	-16078.135	16090.262
[Conscientiousness=27.00]	12.388	8206.375	.000	1	.999	-16071.811	16096.586
[Conscientiousness=28.00]	8.344	8206.375	.000	1	.999	-16075.856	16092.543
[Conscientiousness=29.00]	20.420	8206.374	.000	1	.998	-16063.778	16104.618
[Conscientiousness=30.00]	14.178	8206.375	.000	1	.999	-16070.021	16098.377
[Conscientiousness=31.00]	1.915	8206.375	.000	1	1.000	-16082.285	16086.115
[Conscientiousness=32.00]	13.236	8206.374	.000	1	.999	-16070.962	16097.435
[Conscientiousness=33.00]	15.266	8206.375	.000	1	.999	-16068.933	16099.464
[Conscientiousness=34.00]	18.879	8206.374	.000	1	.998	-16065.319	16103.077
[Conscientiousness=35.00]	9.557	8206.375	.000	1	.999	-16074.643	16093.756
[Conscientiousness=36.00]	6.578	8206.375	.000	1	.999	-16077.621	16090.776

[Conscientiousness=37.00]	15.064	8206.375	.000	1	.999	-16069.135	16099.262
[Conscientiousness=38.00]	5.517	8206.376	.000	1	.999	-16078.684	16089.719
[Conscientiousness=39.00]	8.362	8206.375	.000	1	.999	-16075.838	16092.561
[Conscientiousness=40.00]	12.719	8206.375	.000	1	.999	-16071.481	16096.919
[Conscientiousness=41.00]	54.021	.000	.	1	.	54.021	54.021
[Conscientiousness=43.00]	0 ^a	.	.	0	.	.	.
[Neuroticism=8.00]	0 ^a	.	.	0	.	.	.
[Neuroticism=9.00]	0 ^a	.	.	0	.	.	.
[Neuroticism=10.00]	31.748	.000	.	1	.	31.748	31.748
[Neuroticism=13.00]	27.517	4104.337	.000	1	.995	-8016.837	8071.871
[Neuroticism=14.00]	15.324	4104.337	.000	1	.997	-8029.028	8059.677
[Neuroticism=15.00]	25.805	4104.337	.000	1	.995	-8018.548	8070.157
[Neuroticism=16.00]	19.234	4104.337	.000	1	.996	-8025.119	8063.586
[Neuroticism=17.00]	21.314	4104.338	.000	1	.996	-8023.041	8065.670
[Neuroticism=18.00]	17.677	4104.337	.000	1	.997	-8026.676	8062.030
[Neuroticism=19.00]	24.163	4104.337	.000	1	.995	-8020.190	8068.515
[Neuroticism=20.00]	18.279	4104.337	.000	1	.996	-8026.073	8062.632
[Neuroticism=21.00]	26.325	4104.337	.000	1	.995	-8018.027	8070.678
[Neuroticism=22.00]	21.085	4104.337	.000	1	.996	-8023.268	8065.439
[Neuroticism=23.00]	19.241	4104.337	.000	1	.996	-8025.111	8063.593
[Neuroticism=24.00]	14.933	4104.337	.000	1	.997	-8029.420	8059.286

[Neuroticism=25.00]	20.088	4104.337	.000	1	.996	-8024.264	8064.441
[Neuroticism=26.00]	19.519	4104.337	.000	1	.996	-8024.833	8063.872
[Neuroticism=27.00]	29.564	4104.338	.000	1	.994	-8014.791	8073.919
[Neuroticism=28.00]	35.431	4104.338	.000	1	.993	-8008.923	8079.786
[Neuroticism=29.00]	27.743	4104.338	.000	1	.995	-8016.611	8072.098
[Neuroticism=30.00]	68.961	6766.517	.000	1	.992	-13193.169	13331.092
[Neuroticism=31.00]	26.531	4104.338	.000	1	.995	-8017.823	8070.886
[Neuroticism=32.00]	25.502	4104.341	.000	1	.995	-8018.858	8069.862
[Neuroticism=33.00]	27.270	4104.338	.000	1	.995	-8017.084	8071.624
[Neuroticism=34.00]	8.918	9821.142	.000	1	.999	-19240.167	19258.002
[Neuroticism=35.00]	12.576	4104.342	.000	1	.998	-8031.786	8056.937
[Neuroticism=36.00]	49.795	8206.375	.000	1	.995	-16034.405	16133.995
[Neuroticism=37.00]	17.443	.000	.	1	.	17.443	17.443
[Neuroticism=38.00]	0 ^a	.	.	0	.	.	.
[Extra=9.00]	18.975	4707.500	.000	1	.997	-9207.556	9245.506
[Extra=10.00]	49.337	.000	.	1	.	49.337	49.337
[Extra=11.00]	46.077	4707.502	.000	1	.992	-9180.457	9272.611
[Extra=12.00]	28.728	4707.500	.000	1	.995	-9197.803	9255.258
[Extra=13.00]	-2.831	10088.101	.000	1	1.000	-19775.146	19769.484
[Extra=14.00]	34.972	4707.499	.000	1	.994	-9191.557	9261.500
[Extra=15.00]	29.153	4707.499	.000	1	.995	-9197.375	9255.682
[Extra=16.00]	0 ^a	.	.	0	.	.	.
[Extra=17.00]	-1.208	7081.354	.000	1	1.000	-13880.406	13877.990
[Extra=18.00]	29.894	4707.499	.000	1	.995	-9196.634	9256.423
[Extra=19.00]	32.730	4707.498	.000	1	.994	-9193.796	9259.256

[Extra=20.00]	33.943	4707.498	.000	1	.994	-9192.584	9260.470
[Extra=21.00]	26.790	4707.498	.000	1	.995	-9199.737	9253.317
[Extra=22.00]	36.587	4707.498	.000	1	.994	-9189.940	9263.114
[Extra=23.00]	36.308	4707.498	.000	1	.994	-9190.219	9262.835
[Extra=24.00]	29.873	4707.498	.000	1	.995	-9196.654	9256.400
[Extra=25.00]	33.414	4707.499	.000	1	.994	-9193.114	9259.942
[Extra=26.00]	38.546	4707.499	.000	1	.993	-9187.981	9265.074
[Extra=27.00]	32.148	4707.498	.000	1	.995	-9194.380	9258.675
[Extra=28.00]	33.917	4707.498	.000	1	.994	-9192.609	9260.444
[Extra=29.00]	35.321	4707.499	.000	1	.994	-9191.207	9261.848
[Extra=30.00]	26.916	4707.502	.000	1	.995	-9199.617	9253.450
[Extra=31.00]	31.610	4707.498	.000	1	.995	-9194.917	9258.138
[Extra=32.00]	35.615	4707.499	.000	1	.994	-9190.913	9262.142
[Extra=33.00]	47.294	4707.500	.000	1	.992	-9179.236	9273.824
[Extra=34.00]	41.859	4707.501	.000	1	.993	-9184.673	9268.392
[Extra=35.00]	64.513	.000	.	1	.	64.513	64.513
[Extra=36.00]	0 ^a	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Appendix E: Spearman Rank Coefficient for Gender, Control Group

Correlations

			How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Please indicate your gender:
Spearman's rho	How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Correlation Coefficient	1.000	.160*
		Sig. (2-tailed)	.	.049
		N	152	152
	Please indicate your gender:	Correlation Coefficient	.160*	1.000
		Sig. (2-tailed)	.049	.
		N	152	304

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix F: Spearman Rank Coefficient for Gender, Nudge Group

Correlations

		Please indicate your gender:		How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely
Spearman's rho	Please indicate your gender:	Correlation Coefficient	1.000	.014
		Sig. (2-tailed)	.	.863
		N	304	152
	How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Correlation Coefficient	.014	1.000
		Sig. (2-tailed)	.863	.
		N	152	152

Appendix G: Spearman Rank Coefficient for Education Level, Control Group

Correlations

			How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Please indicate your highest completed education level:
Spearman's rho	How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Correlation Coefficient	1.000	-.006
		Sig. (2-tailed)	.	.946
		N	152	152
	Please indicate your highest completed education level:	Correlation Coefficient	-.006	1.000
		Sig. (2-tailed)	.946	.
		N	152	304

Appendix H: Spearman Rank Coefficient for Education Level, Nudge Group

Correlations

			How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Please indicate your highest completed education level:
Spearman's rho	How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Correlation Coefficient	1.000	-.014
		Sig. (2-tailed)	.	.868
		N	152	152
	Please indicate your highest completed education level:	Correlation Coefficient	-.014	1.000
		Sig. (2-tailed)	.868	.
		N	152	304

Appendix I: Spearman Rank Coefficient for Age, Control Group

Correlations

			How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	MinAge
Spearman's rho	How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Correlation Coefficient	1.000	-.047
		Sig. (2-tailed)	.	.562
		N	152	152
	MinAge	Correlation Coefficient	-.047	1.000
		Sig. (2-tailed)	.562	.
		N	152	304

Appendix J: Spearman Rank Coefficient for Age, Nudge Group

Correlations

			How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	MinAge
Spearman's rho	How likely would you be to order the food in reusable packaging instead of single-use? - Please indicate on a scale of extremely unlikely to extremely likely	Correlation Coefficient	1.000	.076
		Sig. (2-tailed)	.	.351
		N	152	152
	MinAge	Correlation Coefficient	.076	1.000
		Sig. (2-tailed)	.351	.
		N	152	304