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Possibilities, boundaries, and consequences of choice architecture: The case of green defaults and environmental attitudes

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Heidelberg, February 2016 Max Vetter

Abstract

In this publication-based dissertation, I focus on changes in the decision environment as a way to address urgent problems originating in human behavior and decision making. Unsustainable consumption patterns and their influence on climate change serve as the primary example for this approach. In three original publications and a broader framework, I introduce, test, and evaluate the concept that has recently been popularized as "nudges" (Thaler & Sunstein, 2008). Nudges are intentional changes to the decision environment or "choice architecture" based on psychological insights and aiming at changes in decision making and behavior. The first paper contributes to conceptual sharpening of nudges and choice architectures by a bottom-up identification of nine recurring and distinct techniques used to foster behavior change. In Papers 2 and 3, I integrate situational and individual predictors of behavior in three experimental studies in the realm of environmental decision making. Pro-environmental behavior is predicted by green defaults (i.e., preselected environmentally-friendly options) and environmental attitudes measured with different scales. The results from both experimental papers support the conclusion that defaults and attitudes additively influence decision making without limiting each other's impact. These findings imply that defaults provide a suitable complement to other regulatory measures and environmental educational approaches but do not substitute them. The research program presented in these three papers is situated within different psychological research traditions such as bounded rationality, the heuristics and biases program, and advancements of behaviorism. Against this background, theoretical and practical policy implications are discussed.

Keywords: Nudge, choice architecture, defaults, attitudes, behavior change, environmental behavior

Zusammenfassung

In dieser publikationsbasierten Dissertation fokussiere ich auf Veränderungen der Entscheidungsumwelt als ein Weg, drängende Probleme zu adressieren, deren Ursachen in menschlichem Verhalten und Entscheiden liegen. Nicht nachhaltige Konsummuster und deren Einfluss auf den Klimawandel dienen als primäres Beispiel für diesen Ansatz. In drei Originalpublikationen und einem breiteren theoretischen Rahmen definiere, teste und bewerte ich Ansätze, die kürzlich unter dem Titel „Nudges“ (Thaler & Sunstein, 2008) populär wurden. Nudges sind intentionale Veränderungen der Entscheidungsumwelt beziehungsweise der Entscheidungsarchitektur, die auf psychologischen Erkenntnissen beruhen und auf verändertes Entscheiden und Handeln abzielen. Das erste Papier trägt zur konzeptuellen Schärfung von Nudges und Entscheidungsarchitekturen bei, indem induktiv neun wiederkehrende Techniken identifiziert werden, die verändertes Handeln anstoßen sollen. In den Papieren zwei und drei integriere ich situative und individuelle Prädiktoren menschlichen Handelns in drei Experimenten im Kontext nachhaltiger Entscheidungen. Umweltbewusstes Handeln wird durch grüne Defaults (d.h. vorausgewählte umweltfreundliche Optionen) und die individuelle Umwelteinstellung vorhergesagt. Die Ergebnisse beider Papiere führen zu der Schlussfolgerung, dass Defaults und Einstellungen Entscheidungen additiv beeinflussen, ohne sich gegenseitig zu limitieren. Diese Befunde implizieren, dass Defaults eine nützliche Ergänzung zu anderen regulativen Mechanismen und Umweltbildung sein können, diese jedoch nicht ersetzen. Das dargestellte Forschungsprogramm wird innerhalb verschiedener psychologischer Forschungstraditionen wie begrenzter Rationalität, kognitiven Heuristiken und Verzerrungen, und Weiterführungen des Behaviorismus verortet. Vor diesem Hintergrund werden die theoretischen und praktischen Implikationen diskutiert.

Schlüsselwörter: Nudge, Entscheidungsarchitektur, Defaults, Einstellungen, Verhaltensänderung, Umweltverhalten

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List of scientific publications for the publication-based dissertation

I. Paper

Münscher, Robert†, Vetter, Max†, & Scheuerle, Thomas (2015). A review and taxonomy of choice architecture techniques. *Journal of Behavioral Decision Making.* Advance online publication. doi:10.1002/bdm.1897

II. Paper

Vetter, Max & Kutzner, Florian (2016). Nudge me if you can – how defaults and attitude strength interact to change behavior. *Comprehensive Results in Social Psychology.* Advance online publication. doi:10.1080/23743603.2016.1139390.

III. Paper

Vetter, Max† & Arnold, Oliver† (under review). How defaults and environmental attitudes influence ecological choices: Testing an additive model against a conditional model.

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Possibilities, boundaries, and consequences of choice architecture: The case of green defaults and environmental attitudes

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1 Introduction: Context and behavior change

The list of challenges humanity currently faces is long and, at first glance, it is not related to psychology more than it is to any other discipline. Climate change, extreme poverty, and infectious and acquired diseases are just a few out of a long list of "severe societal challenges" (Wissenschaftsrat, 2015) societies are confronted with and need to find solutions for. What unites most of these challenges, from obesity and overconsumption to global warming, a lack of organ donations, and unvaccinated children is that they often result from human behavior (intended and unintended) and decision making. As such, changes in human behavior and decision making can contribute to their solution (Oskamp, 2000). At this point, behavioral scientists and psychology research come into play to explain, predict, and help to change human behavior in order to approach problems with non-technical and non-financial solutions (Swim et al., 2011). The behavioral focus distinguishes psychological contributions from traditional political approaches (legislative), economical approaches (incentive-/tax-based), and contributions from the natural sciences (technological improvements).

The promise to contribute to behavior change on the basis of relatively cheap and easy alterations of features on "the interfaces between decision problems and decision makers" (Sugden, 2009, p. 366), that is, in decision environments, has recently sparked public interest in social scientists' work and led to the formation of behavioral science units in governments (e.g., the Behavioural Insights Team in the United Kingdom, the Office of Information and Regulatory Affairs in the United States, and a small team in the German Office of the Federal Chancellor). Other Institutions such as the EU and the World Bank followed (World Bank, 2015). Stimulated by Thaler and Sunstein's (2008) book *Nudge*, the notion that a considerable part of our behavior is influenced by the context in which it takes place is translated into concrete policies and interventions by the aforementioned "psychological science advisors" (Teachman, Norton, & Spellman, 2015). Labelled somewhat metaphorically as "choice architecture" (Thaler, Sunstein, & Balz, 2010) and "nudging", the basic idea is to design contexts based on psychological evidence from decision making research. By giving people a gentle "nudge" instead of a hard shove, a desired behavior is supported respectively an undesired behavior is inhibited. Choice architecture is defined as the context in which a decision is made, whereas nudges are concrete interventions within the choice architecture aiming at

changing people's behavior (Barton & Grüne-Yanoff, 2015). The field is embedded in "libertarian paternalism" (Thaler & Sunstein, 2003), a term introduced to describe the school of thought that applies nudges in policy making and delineates it from purely liberal or paternalistic policies. Summed up by Thaler and Sunstein (2008, p. 6) who coined the term, a nudge alters "people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives".

The accumulated evidence of how humans react, for instance, to different framings of the same message or the opportunity to postpone costs to the future instead of paying for them in the present stems from a long and rich research tradition grounded in (social-cognitive) psychology and dealing with cognitive biases (Tversky & Kahneman, 1974), heuristics (Gigerenzer, Todd, & ABC Research Group, 1999; Tversky & Kahneman, 1981) or, more negatively, "anomalies" in human decision making (Kahneman, Knetsch, & Thaler, 1991; Loewenstein & Prelec, 1992). Against this background, choice architecture is not a new idea (as will be outlined in more detail in Chapter 2). However, systematically checking whether peculiarities (the more neutral alternative to bias and anomaly) in human decision making can be harnessed to foster a desired behavior is novel. This "new branch to the 'prescriptive' part of the field of judgement and decision making" (Baron, 2010, p. 224) is what stimulated governments to think about changing the defaults in organ donation, made cafeterias change plate sizes, and inspired tax authorities to reframe their letters to taxpayers (Cabinet Office, Behavioural Insights Team, 2012).

The growing interest in context-based approaches is also due to the relatively small effects of classical information and education interventions aiming at attitude change and behavior change. Extensive campaigns to increase organ donations in Germany have resulted in a high acceptance of organ donation, but although 68% of the German population are willing to donate organs, only 28% actually have a donor card (Bundeszentrale für gesundheitliche Aufklärung, 2014). Deliberately influencing context variables known to causally influence behavior thus offers a solution to the problem that psychological insights have not yet contributed to solving the various problems outlined above to its full potential, as criticized by some (e.g., Ernst & Wenzel, 2014). As such, choice architecture can be understood as a counterpart to traditional approaches such as education, information, or persuasion but does not necessarily contradict them as I outline in the following chapters. Rather, it acknowledges that all too often decision

making does not result from thorough and well-informed cost-benefit analyses but from quick heuristic judgments in a given situation.

From a psychological perspective, the interplay of external (situational) and internal factors (e.g., attitudes) has received surprisingly little attention in recent choice architecture research. However, to achieve the most accurate prediction of human behavior and decision making, the focus should shift from an "either / or", that is external or internal, to an "as-well-as" perspective. I present research integrating external and internal causes of behavior under the choice architecture framework in this dissertation, focusing on defaults as a prototypical example of nudges and attitudes as a core psychological construct to explain human behavior.

Overview of the present research program

This dissertation consists of three papers, two of which have been published in peer-reviewed journals while one is currently under review. I developed the study concepts and designs, collected, analyzed, and interpreted the data, drafted and revised the manuscripts, and oversaw the publication processes for all three papers. In Papers 1 and 3, the close collaboration with coauthors during some or all of these steps resulted in shared first authorships. The three papers as published or submitted can be found at the end of this dissertation.

In the three papers that form the body of this dissertation, I systematically analyze and test the potential of choice architectures as a means for behavior change. I present experimental tests of concrete interventions (green defaults) in internally and ecologically valid settings and specify the connection between defaults and individual attitudes. In Paper 1, I review existing choice architectures from various sources and cluster them into nine distinct categories (Münscher, Vetter, & Scheuerle, 2015). This taxonomy provides a comprehensive overview on the different fields of application in which behavioral insights are currently used. In the second paper of this dissertation (Vetter & Kutzner, 2016), I focus on defaults as a prototypical example of a nudge and one of the most commonly used techniques. This paper reports two preregistered replications of a study on default effects in electricity provider choices extended by an analysis of the interplay between attitude strength and defaults. In the third paper (Vetter & Arnold, under review), I also examine how defaults and environmental

attitudes interact to change behavior. This study uses a newly developed experimental setup with sustainable consumer choices as the target behavior.

Before focusing on specific research questions and outlining the methods applied, the procedure, and the results in detail within each paper, I will present a more general overview of the theoretical background of choice architecture and nudging. For this aim, I situate nudging research within judgement and decision making research and point out its connection to concepts such as bounded rationality and heuristics and biases in Chapter 2. The chapter also includes a definition of nudging based on the literature.

In Chapter 3, I focus on central issues that connect the papers that form my research program. These issues include defining the concept of nudging, identifying and testing concrete nudges (namely pro-environmental defaults), and examining the interplay of contextual factors such as defaults and individual attitudes. Implications for the idea of libertarian paternalism are outlined based on the papers and enriched by unpublished empirical data on the association between reactance and the acceptance of nudges.

Conclusions and implications from the joint considerations of all three papers are presented in Chapter 4. I first outline the theoretical implications of my research before deducing practical policy implications. In the final part of Chapter 4, I point out limitations of my research program and outline several open questions that arise from them. The general overview of the research program presented in this dissertation is concluded with some final remarks in Chapter 5.

2 How homo economicus became a choice architect: Nudging and decision making research

As mentioned above, summarizing behavioral insights under the term "choice architecture" merely stressed their *prescriptive* relevance, that is, what ought to be done, especially but not exclusively for policy making (Shafir, 2012). The concept originates from *normative* models of decision making such as rational agent models ("homo economicus", expected-utility theory) and their *descriptive* advancements like the idea of "bounded rationality" (Simon, 1955) and prospect theory (Kahneman & Tversky, 1979). Whereas normative models provide a standard against which to evaluate decision making, descriptive models describe deviations from these standards and explain why these deviations occur (Baron, 2010). The virtue of a prescriptive approach lies in concrete recommendations on how to deal with deviations from optimal decision making identified by descriptive models. To apply behavioral insights to real world problems, this triad of normative, descriptive, and prescriptive is necessary but had been incomplete prior to the debate about choice architectures and nudges when prescriptive conclusions were frequently missing.

Table 1 provides a schematic framework comparing normative, descriptive, and prescriptive approaches in judgement and decision making research. This framework serves to locate choice architecture on the scientific map of decision making research. As I will outline in this chapter, choice architecture research is closely connected to normative and descriptive models and should be evaluated in light of its scientific ancestors. Conceptions of human rationality are a key connecting link between these approaches. Instead of reviewing the history of rationality in chronological order, I will focus on the theoretical assumptions and empirical findings which I consider fundamental for the development of a prescriptive judgement and decision making science.

Table 1

Framework of normative, descriptive, and prescriptive judgement and decision making approaches

	Type of decision	**Decision explained**	**Theoretical models**	**Characteristics**
Normative	Optimal decision	How people *should* decide.	Rational agents, expected-utility	time-consistency, description invariance
Descriptive	Actual decision	How people *do* decide.	Prospect theory, bounded rationality	Preference reversals, temporal discounting
Prescriptive	Desired decision	How people *ought to* decide.	Nudge, libertarian paternalism	Directed behavior change, freedom of choice

2.1 From bounded rationality to heuristics and biases

The independence of a decisional outcome from information presentation, decision elicitation, and context is a cornerstone of rational agent models (Slovic, 1995). According to *description invariance*, it should not, for example, influence preferences and subsequent decisions differently, whether people are informed that donating blood saves lives or prevents deaths since the outcome is the same (Chou & Murnighan, 2013). Similarly, *procedure invariance* posits that different measurements of a preference order and decisions should not change their intransitive order. The choice between two equivalent gambles (a common paradigm in economic experiments) should not be influenced by the response mode used to assess the preference for one gamble (bidding/selling vs. preference ranking). *Time-consistency* of preferences is another characteristic of rational agents. If a person prefers 12€ over 10€ today (and this is a very robust finding), she should also choose 12€ in a week rather than 10€ today because the monetary difference between 12€ and 10€ does not change over a week. Finally, *context-independent* choices between two options should not be influenced by the presence of a third, inferior option. In other words, a restaurant client's choice between a Barolo from 2012 and a 2010 Bordeaux should not be different whether there is a 2015 Lambrusco on the wine list or not.

As the frequent use of the word "should" already indicates, normative models using utility maximization as the standard for rationality have proven untenable in real life.

Doubts in the quality of human judgement and decision making date back as far as Adam Smith or John Stuart Mill, who questioned the quality of human reasoning and, in more drastic words, Schumpeter, who calls associative and affective thinking primitive (Schumpeter, 2005). More recent research programs using empirical methods, most notably the *heuristics and biases program*, have demonstrated that human decision making deviates from these normative assumptions (Tversky & Kahneman, 1973; Tversky & Kahneman, 1974).

Logically and numerically equivalent information has been shown to lead to different decisions depending on its presentation format, thereby violating the description invariance axiom as, for example, in the Asian disease dilemma (Tversky & Kahneman, 1981). In this scenario, 600 people are threatened by an Asian disease and participants have to choose between a certain option (saving 200 people out of 600) and an uncertain option (1/3 probability that all will be saved and 2/3 probability that no one will survive). Although both options have the same expected value (a survival of 200), framing the choice in terms of gains (saved lives) makes people prefer the certain option whereas framing the choice in terms of losses (lost lives) leads to a preference for the uncertain option. The method of elicitation has also been shown to influence preferences, thus violating procedure invariance. Lichtenstein and Slovic (1971) could show that participants' preferences for one of two gambles with equivalent expected utilities changed when the method of measuring this preference changed: although participants chose an option with a high winning probability and assigned higher preference ratings in the first step, they later bid more money for a different option with a higher jackpot. Likewise, temporal discounting functions show that choices between the same two options differ depending on the timing of the decision. The finding that value is discounted over time and 10€ now are preferred to 12€ in a week violates the assumption of time consistent preferences (Green, Fristoe, & Myerson, 1994; Soman et al., 2005). Finally, adding an inferior wine (e.g., Lambrusco, cheap and low quality) to two equally attractive wines (one is cheaper, the other is higher quality) can change preferences for one of the equally attractive options compared to a choice between the two equally attractive options alone. Although the inferior option (also called a "decoy") is never chosen, it influences other choices (Huber, Payne, & Puto, 1982). Despite serious attempts to refute these "anomalies" (Loewenstein & Prelec, 1992) by proponents of rational agent models (for a summary, see Slovic, 1995), systematic

deviations from the aforementioned axioms, and thus from the idea of a "homo economicus", have prevailed and proven robust and replicable: description, elicitation, timing, and context do matter. From these findings, researchers drew opposing conclusions (for a detailed description, see also Fiedler & Wänke, 2009). The one side more pessimistically describes the human mind as fallible, whereas the other side points out the advantages of deviating from purely computational, probabilistic decision making and criticizes the applied norms of rationality as too "narrow" (Gigerenzer, 1996). However, both sides agree with Simon (1955, p. 101), who pointed out the "physiological and psychological limitations of the organism" in terms of computing capacity. Because of these limitations, which are both external (time, available information) and internal to the organism (speed, capacity), Simon argued that human reasoning and decision making does not follow the rules of the "economic man" (homo economicus) who possesses complete knowledge, stable preferences, and sufficient computation skills to calculate his or her personal optimum. Rather, Simon introduced the idea of *bounded rationality*, that is, a rationality more oriented at descriptive, actual decision making than at normative, ideal decision making. Most notably, Simon (1985, p. 297) claimed that "bounded rationality is not irrationality". In the current debate about choice architecture, these two concepts are frequently equated (e.g., in the book *Predictably Irrational* by Dan Ariely, 2008) and bounded rationality has thus erroneously become an argument for nudging (as in Blumenthal-Barby & Burroughs, 2012; Camerer, Issacharoff, Loewenstein, O'Donoghue, & Rabin, 2003). Irrespective of conclusions about human rationality drawn from the finding that human decision making and behavior deviates from that of a homo economicus, nudges make use of these heuristics and biases.

The outlined effects (framing, temporal discounting, and decoy options) are complemented by a constantly growing number of cognitive biases such as the findings that: frequency and probability judgements are influenced by the availability of relevant instances (availability heuristic, Tversky & Kahneman, 1973); even arbitrary starting points can influence outcomes (anchoring and adjustment, Tversky & Kahneman, 1974); other people's behavior is an important factor for people's own behavior (social norms, Cialdini & Trost, 1998); people are overconfident when assessing their own performance (Weinstein, 1980); money and other resources are often evenly diversified among the available options independent of the number of options (naïve

diversification, Benartzi & Thaler, 2001); "losses loom larger than gains" (Kahneman et al., 1991; Kahneman & Tversky, 1979, p. 279); and the status quo is frequently preferred over an alternative (Samuelson & Zeckhauser, 1988), to name just a few examples (for an overview, see Pohl, 2004).

To sum up, how and when information and options are presented and described influences which option is chosen. In other words, the decision environment co-determines the decision outcome. From a prescriptive perspective, making use of these contextual factors allows for the creation of a decision environment in which the probability that people decide how they *ought to* decide[1] is higher than in normative or descriptive models. Thus, rational agent models – despite being refuted in many respects – should not be undervalued for they, together with descriptive models, provide the theoretical foundation that the prescriptive applications discussed in this thesis rest upon.

2.2 Choice architecture and nudges

From the influence of *passively present* decision structure on decision making, it is only a small step to the influence of *consciously created* choice architectures on behavior and choices (see Purnhagen & Reisch, 2015 for the differentiation of decision structure and choice architecture). Cognitive biases and ostensible deviations from rational behavior led some behavioral economists to conclude: "It is such errors – apparent violations of rationality – that can justify the need for paternalistic policies to help people make better decisions and come closer to behaving in their own best interest" (Camerer et al., 2003, p. 1218). Descriptive research on heuristics and biases thus provided the foundation for the next step: prescriptive policies with the intent to steer choices by giving people a gentle "nudge".

In their 2008 book *Nudge*, economist Richard Thaler and legal scholar Cass Sunstein review findings on the context sensitivity of choices and behavior and popularize the idea that active choice architecture influences behavior in a way that differs from classical regulation, education, or economic incentives. The basic idea of nudging is closely connected to the previous branches of research noted above; however, what actually defines a nudge has still only been vaguely described. Part of this vagueness

[1] It would be a separate dissertation to discuss the question how and by whom to determine how people *ought to* decide. I will not be able to answer this question, but I would like to point out that this is a crucial and controversial question.

might be caused by the concept's interdisciplinarity. Although the topic is an inherently psychological one, behavioral economists, political scientists, and legal scholars also contribute to research on choice architectures. Obviously, different disciplines focus on different aspects such as ethical problems with nudging (Bovens, 2009; Raihani, 2013), constitutional concerns (Purnhagen & Reisch, 2015), or the compatibility with the concept of rational agents (Gigerenzer, 2015). Further vagueness is introduced by the continuous retelling of anecdotes like "the fly in the urinal" often used as the prime example of a nudge. Putting a little picture of a fly in urinals to "aim" at is said to have reduced cleaning costs in airport toilets in Amsterdam. It is implied that men are gently nudged to aim at the fly which reduces spilling. These and other anecdotes not resulting from actual research hamper a bottom-up sharpening of the concept through a larger body of evidence (i.e., a collection of nudges from which to deduce criteria for a definition). Simultaneously, a top-down theoretical definition is missing, a state of affairs that led Gigerenzer to conclude that "almost everything that affects behavior has been renamed a nudge, which renders this concept meaningless" (Gigerenzer, 2015, p. 363). Indeed, one of the authors of *Nudge* claims: "Even weather can count as a nudge" (Sunstein, 2014, p. 584). Both claims – a meaningless concept as well as a concept that includes even the weather – appear not particularly suited to build a research program on or to deduce testable hypotheses from. Consequently, I will further sharpen the core concept of this thesis and establish some common ground on what nudging and choice architecture are.

Nudges are defined as "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" (Thaler & Sunstein, 2008, p. 6). The defining features of a nudge can thus be summarized as: 1) predictably behavior-steering, 2) choice preserving, and 3) not changing the economic incentive structure (for a similar definition, see also Barton & Grüne-Yanoff, 2015). Importantly, although nudges are based on predictable patterns of human behavior (and usually cognition), this does not imply that nudges only target the automatic processes often referred to as System 1 in dual-process approaches. Accordingly, nudges can either harness heuristics and biases or control for them, but nudges can also provide information. These three types have been labelled "heuristics-triggering", "heuristics-blocking", and "informing" nudge-types (Barton & Grüne-Yanoff, 2015, p. 343).

Although this top-down definition helps to differentiate a nudge from the weather (which is often less predictable and choice preserving than assumed), it leaves ample room for debate and probably raises more questions than it answers, such as: To which degree can a choice be aggravated and still count as free? Which amount of money constitutes a change in the economic incentive structure for whom? How can a predictable behavior change be reconciled with preserved choices? Due to these difficulties with top-down definitions, I will present a different, bottom-up approach complementing the top-down definition of nudges in Chapter 3.1 and Paper 1 of this thesis.

Whereas nudges were originally intended "to influence choices in a way that will make choosers better off, *as judged by themselves*" (italics original, Thaler & Sunstein, 2008, p. 5), the intraindividual benchmark for success is not present in many applications of nudges. Frequently, the choice architect decides what constitutes "better off" either for the decision maker (pro-self) or for society (pro-social, cf. Barton & Grüne-Yanoff, 2015). However, assuming a benevolent, unbiased choice architect is in itself problematic (for a critical discussion of this fact, see Gigerenzer, 2015; White, 2011).

A final remark on what constitutes a nudge concerns sector specific labels for the same basic idea. "Behavioral political economy" defined as "the psychologically informed, economic analysis of behavior and its effects in the political arena" (Schnellenbach & Schubert, 2015, p. 2), "behavioral public policy", and "behaviorally informed regulation" (Barr, Mullainathan, & Shafir, 2012; Purnhagen & Reisch, 2015) all build on the same body of research described in this chapter and apply it to different areas (voters' behavior, public policy, law). One could add marketing science, although the focus of target behaviors is narrower here (and mostly consumer-related, such as consumption, satisfaction, and loyalty).

2.3 External and internal causation of human behavior

When locating choice architecture on the scientific map of behavior change research, one has to mention *contextual behavioral science* which "seeks the development of basic and applied scientific concepts and methods that are useful in predicting-and-influencing the contextually embedded actions of whole organisms" (Hayes, Barnes-Holmes, & Wilson, 2012, p. 2). Similarly, one could compare the idea of

nudging to behavioristic stimulus-response models in which the decision environment is akin to the stimulus triggering a predictable and unanimous response.

However, focusing only on external (contextual) factors is an unnecessarily narrow view of human behavior. This opinion has been largely accepted in scientific psychology since the cognitive turn (Dember, 1974) and applies to research on choice architectures as well. In current psychological models of human behavior, the notion that "external causation does not prevent internal responsibility" (Fiedler & Wänke, 2009, p. 701) is largely accepted. Herbert Simon, whose concept of bounded rationality is frequently used to justify focusing more on contexts and less on the human mind, proposed the metaphor of a pair of scissors to illustrate how human behavior is shaped by external and internal influences (Simon, 1990). In Simon's metaphor, the pair of scissors' two blades constitute two sources of bounds on rationality (Todd & Gigerenzer, 2003). The internal blade of the scissors is limited computational capability and the external blade is the decision environment, both of which impede perfectly rational decisions. Extending this metaphor, I will focus on the two blades of the scissors that *drive* behavior. In this dissertation, the internal blade is represented by individual attitudes, whereas the external blade constitutes the decision environment. This integration of external and internal causes of behavior under the theoretical umbrella of choice architecture takes current applications of nudges into account without ignoring psychological insights about intraindividual causes of behavior. It should be noted that, by equating the internal blade with attitudes in this thesis, I deliberately exclude other internal factors that might cause behavior such as motives, control beliefs, or intentions. The latter two are crucial parts of the theory of planned behavior, a dominant process theory linking beliefs and behavior (Ajzen, 1991). Thus, the two blades metaphor is more in line with the Campbell paradigm, a parsimonious theoretical model that explains behavior as resulting from only two factors: (internal) attitudes and (external) behavioral costs (Kaiser, Byrka, & Hartig, 2010, see also Paper 3 in this thesis).

To sum up, nudging and choice architecture research are closely connected to descriptive research on human decision making. Both approaches acknowledge that purely computational models of rationality will frequently fail to predict actual human behavior. Whereas descriptive approaches like the heuristics and biases program focus on exploring systematic deviations from normative models of rationality, nudging and choice architecture research focus on the prescriptive implications of these deviations

and how they can be used to influence behavior. Despite lacking a clear definition and being applied under various labels, core defining characteristics of nudges exist to differentiate a nudge from a non-nudge. As nudging research has largely neglected internal factors (such as attitudes) as the causes of behavior, an integrative approach looking at both blades of the scissors is warranted and will be one of the central issues of the present work.

3 Central issues of the present work

The present thesis is based on three papers focusing on different aspects of choice architecture. In Paper 1 (Münscher, Vetter, & Scheuerle, 2015), we[2] review existing choice architectures from various sources and cluster them into nine distinct categories. Both the second (Vetter & Kutzner, 2016) and the third paper (Vetter & Arnold, under review) experimentally test the impact of defaults in environmental decision making and expand previous research by an analysis of the interplay of attitudes and defaults. Whereas Paper 1 focuses mostly on external factors, Papers 2 and 3 explicitly target the integration of 'both blades of the behavioral scissors' to stick to the metaphor outlined in the previous chapter.

Rather than summarizing the three papers, I will outline central issues and research questions that motivated this research and that connect these papers. The major focus of this chapter is to jointly consider the results of the papers that form the body of this dissertation. It will complement rather than substitute a more fine-grained approach which can be found in each individual paper. Therefore, the reader is referred to the original publications at the end of this dissertation for more detailed theoretical backgrounds, hypotheses, methods used, results, and statistical information.

3.1 The identification of choice architecture techniques

As outlined in Chapter 2.2, although choice architecture research is based on concepts from judgement and decision making such as bounded rationality or heuristics and biases, the evidence base of nudges in policy making that have significantly influenced behavior (in terms of statistical as well as practical significance) is still relatively small. Few governments have actually tested large scale nudges empirically (for an exception, see the UK's Behavioural Insights Team reports, e.g., Cabinet Office, Behavioural Insights Team, 2013; Haynes, Goldacre, & Torgerson, 2012). Furthermore, effect sizes in field studies using nudges might be very small and thus difficult to detect in research using modest sample sizes as discussed by Sanders and Chonaire (2015).

It is yet unclear which kinds of nudges are actually applied and tested in the various sectors (public policy, markets, NGOs) and whether it is possible to identify a clear-cut toolbox of nudges. As outlined in more detail in Paper 1, previous attempts to identify

[2] Since all of the papers referred to are the work of me and at least one coauthor, I will use "we" when referring directly to these papers.

such a toolbox lack a convincing, transparent methodology and an evidence base from which the frameworks are constructed or to which they are applied. Mnemonic frameworks such as MINDSPACE (Dolan et al., 2012), EAST (Cabinet Office, Behavioural Insights Team, 2014) and others (as, e.g., Datta & Mullainathan, 2012; Johnson et al., 2012) are constructed top-down. However, a top-down construction in the absence of a clear definition of nudges is problematic (see Chapter 2.2 and Gigerenzer, 2015 who calls the concept "meaningless"). Top-down attempts to classify nudges based on their underlying processes bear the problem that most nudge-type interventions are effective due to several processes which introduces ambiguity. Default effects, for instance, are potentially caused by different processes, among them loss aversion (Dinner, Johnson, Goldstein, & Liu, 2011), implied endorsement (McKenzie, Liersch, & Finkelstein, 2006), decision inertia (Johnson & Goldstein, 2003), and selectively triggered queries (Dinner et al., 2011). Furthermore, a process responsible for the effectiveness of a nudge is not exclusive to this nudge. Any of the processes causing default effects can also underlie other intervention techniques besides default setting (e.g., loss aversion might also be responsible for reframing). As such, using processes to build a framework of different nudges is not sufficient and distinct.

Identifying recurring nudging techniques bottom-up provides an alternative to a top-down definition. It is a useful first step in a research program concerned with the evaluation of nudges, their applicability, and (empirical) evaluation and will further sharpen the concept. Developing a taxonomy of nudges also addresses the question of what actually constitutes a nudge by providing prototypes and examples. This seems necessary to avoid working with a concept that classifies more or less everything as a nudge and stands in contrast to Sunstein's (2014, p. 584) claim that "Even weather can count as a nudge". To counter the criticism related to top-down categorization approaches, we used inductive category development as a bottom-up approach to extract nudging techniques from documented examples of choice architecture interventions. Although the underlying database of documented nudges can neither claim to be representative nor does it contain every nudge that has ever been tested, it does help to identify recurring techniques that are documented and have been tested empirically. As such, it enables researchers and practitioners to identify best practices and to develop new hypotheses and testable designs. As a first step in the research program presented in this dissertation, the taxonomy helps to structure choice

architecture research and sharpen the concept of nudging by identifying a limited set of choice architecture techniques in a bottom-up approach rather than top-down.

We identified three basic categories dealing with *information provision* (e.g., reframing and simplifying information, providing feedback or social reference points such as descriptive social norms), *decision structure* (e.g., setting defaults, influencing effort, changing the grouping of options), and *decision assistance* (e.g., offering reminders and commitment possibilities). Within these broad categories, we defined nine distinct techniques, for example, to make information visible by providing feedback on water consumption, to provide social norms as reference points for individual behavior, and to change default options (see Table 2 and Paper 1 for detailed descriptions). Note that the three nudging categories conceptually overlap with the categories "heuristics-triggering", "heuristics-blocking", and "informing" suggested by Barton and Grüne-Yanoff (2015). Decision structures such as defaults or decoy options mostly trigger heuristics or biases, decision assistance like commitment possibilities counteract suboptimal heuristics and biases, and information provision (e.g., via simplification) enriches the informational background against which decisions are made. Although not a classical cross-validation, this overlap supports the assumption that nudges do not only work unconsciously since providing information or commitment opportunities are very conscious interventions.

Table 2

A taxonomy of choice architecture categories and techniques

Category	Technique	
A. Decision information	A 1	Translate information
	A 2	Make information visible
	A 3	Provide social reference point
B. Decision structure	B 1	Change choice defaults
	B 2	Change option-related effort
	B 3	Change range or composition of options
	B 4	Change option consequences
C. Decision assistance	C 1	Provide reminders
	C 2	Facilitate commitment

3.2 Promising choice architecture techniques and their impact: The case of defaults

Having extracted nine basic nudging techniques from the wealth of reported choice architectures, a logical next question of both researchers and practitioners is: What works? Despite extremely ambitious promises concerning the effectiveness and cost efficiency of nudging raised in the book "Nudge" (Thaler & Sunstein, 2008), a closer look at the evidence base reveals that much evidence does not suffice empirical and scientific standards. As the search for documented examples of nudges in Paper 1 revealed, a considerable amount of frequently cited nudges has not or insufficiently been tested and replications are scarce. Among these negative examples are the *fly in the urinal* mentioned earlier and the *dollar a day* program which is referred to as "extremely promising" (Thaler & Sunstein, 2008, p. 234) despite being evaluated in a study without a control group (Brown, Saunders, & Dick, 1999; for a similar criticism, see Gigerenzer, 2015). A similar case concerns a frequently cited experiment on default meals in a school cafeteria. Researchers replaced the unhealthy French fries default by a healthier alternative (apple fries). However, school children chose the unhealthy (but tasty) French fries irrespective of whether they were offered as the default option or not (Just & Wansink, 2009). Only 43 children participated in this field experiment, but it is often

used as evidence for how preferences limit defaults. Given the small sample size and a lack of experimental control, the French fries experiment seems inappropriate to draw any generalizable conclusions (but see 3.3 and Papers 2 and 3 for different conclusions based on larger samples).

These examples demonstrate that evaluating the potential, the limits, and the evidence base of nudges can only be done on a case by case basis. For the experimental part of this thesis (Papers 2 and 3), I will focus on defaults as one of the most prototypical nudges. A default is a pre-selected option that becomes effective unless a decision maker explicitly specifies otherwise (Brown & Krishna, 2004). Choosing a default requires no additional action while at the same time it is possible to opt-out, that is, decide against the default and choose an alternative. Defaults promise very low implementation efforts, applicability in many areas (above and beyond health, wealth, and happiness), and tremendous impact such as saving lives by increasing organ donations (Johnson & Goldstein, 2003), better medicine by avoiding prescription errors (Ansher et al., 2014), and greener lifestyles by introducing environmentally friendly defaults (Sunstein & Reisch, 2013). However, the track record of choice architectures using defaults and demonstrating their impact empirically and in rigorous designs lags behind the grandiose promises. Natural field studies such as comparing organ donation rates of countries with an organ donation default with those with a non-donor default provide impressive effect sizes but impede causally attributing donation rates on defaults since the latter were not experimentally varied (Johnson & Goldstein, 2003). The same applies to comparisons of communities with renewable energy defaults to communities with conventional energy providers (Pichert & Katsikopoulos, 2008). Despite methodological criticism and the need for conceptual replications, these studies indicate that defaults are promising nudges to be explored further. Indeed, experimental studies examining the influence of defaults in domains such as energy provider choices (Ebeling & Lotz, 2015; Pichert & Katsikopoulos, 2008), consumer behavior (Dinner et al., 2011; Herrmann et al., 2011), and online privacy (Johnson, Bellman, & Lohse, 2002) support claims that defaults can make a significant difference. In search of promising techniques, defaults are a good example of choice architectures for which preliminary evidence exists but which require further testing. In light of publication bias probably preventing a more complete picture of (non-significant) default experiments and the

lack of independent replications, a better evaluation of the power of defaults requires further research; this research is presented in Papers 2 and 3.

In Paper 2 (Vetter & Kutzner, 2016), we conducted two preregistered, extended replications of experiments on green defaults following the procedure of Pichert and Katsikopoulos (2008). Participants either received a green or a gray electricity default and were given the opportunity to opt-out to an alternative provider. In a hypothetical choice scenario, we replicated the findings from Pichert and Katsikopoulos (2008): People confronted with a green default were roughly four times more likely to choose green electricity than people confronted with the alternative gray default provider (odds ratios > 4 in both experiments). Given two independent and successful preregistered replications with high power due to sample sizes of $N_{\text{Study 1}} = 560$ and $N_{\text{Study 2}} = 535$ and large effect sizes, these findings support the assumption that green defaults influence environmental decision making at least in the domain of electricity provider choices. I will discuss practical implications of these results in Chapter 4.5.

Of course, if defaults are to be considered as a policy instrument, their benefits should be independent of the domain they are applied in, the experimental procedure used to test them, and the sample they are applied to. Environmental decisions such as the electricity provider choices examined in Paper 2 might differ from decisions where the goal is less consensually shared and socially desirable than it is the case for CO^2 reduction. Critics might also argue that hypothetical lab/online studies as used in Paper 1 differ from real choices although this criticism could be countered by a randomized controlled trial demonstrating similar effects of green defaults in the field (see Ebeling & Lotz, 2015). For these reasons, in Paper 3 (Vetter & Arnold, under review), defaults are tested in a different experiment targeting consumption decisions in the context of environmental decision making. In a simulated online shopping scenario, we asked 242 participants to choose products (e.g., juice, chocolate, paper towel) from an online shop. They received either green (i.e., eco-friendly / organic) or conventional default products and could then stick to the default product or choose an alternative product from a real online shop. One out of six participants was sent the chosen products home, so choices were less hypothetical than in a scenario. The results further support the impact of defaults on choices: Participants who received a green default chose significantly more organic respectively eco-friendly products than participants who received a

conventional default. The size of this effect (d = 0.92) indicates a strong influence of the default.

Taken together, the findings from Papers 2 and 3 consistently show that green defaults raise the probability to choose green products. The effect persists for different choices (consumer goods, electricity providers), different samples, and in different experimental designs. Besides statistical significance, the effect sizes of the presented studies indicate that the effect is also practically meaningful and green defaults thus qualify as tools for environmental policy. In light of the relatively weak evidence base of experimental demonstrations of nudges using defaults, the approach taken in this research program is promising. As the joint consideration of all three papers shows, identifying fruitful nudging techniques (Paper 1), testing them and transferring them to different settings (Papers 2 and 3) can go hand in hand.

3.3 The interplay of defaults and attitudes

Despite the repeated demonstration of the influence of green defaults on environmental decision making, a model including defaults as a single predictor will explain only a small proportion of variance in people's choices. This is due to several reasons: 1) Defaults are only one of several contextual factors influencing decision making, 2) most behavior is not solely determined by contextual factors but also by individual factors such as attitudes, motives, or needs (see also Chapter 2.3 on external and internal causes of behavior), and 3) environmental attitudes have received little attention in nudging research dealing with environmental decision making. Taking attitudes and defaults simultaneously into account in a model of decision making and behavior change instantly raises the question how the two predictors relate to each other. This question resonates with processing models like the theory of planned behavior (Ajzen, 1991) in which attitudes (in addition to normative beliefs and control beliefs) are assumed to fuel intention building which in turn leads to behavior. Whereas the relationship of attitudes and behavior is explained in the theory of planned behavior (namely attitudes leading to intention building), it is subject to speculation in research on choice architectures. Existing hypotheses on the interplay of defaults and attitudes lack empirical testing. Two possibilities of a default and attitude relation are currently discussed. The majority of researchers assume a moderating influence of attitudes on default effects such that default effects decrease or disappear for stronger attitudes

(Johnson & Goldstein, 2003; Sunstein & Reisch, 2014; Sunstein & Thaler, 2003). An alternative relationship of defaults and attitudes is described by independent, additive effects of both (Kaiser, Arnold, & Otto, 2014). In Papers 2 and 3, we examine the interplay of defaults and attitudes by testing whether an interaction or additive main effects of defaults and attitudes best predict choices.

In Paper 2, we tested the dominant hypothesis which assumes a moderating role of attitude strength. The results of two independent experiments from Paper 2 contradict the hypothesis that attitudes limit default effects. Instead, stronger (and more pro-environmental) attitudes and green defaults independent of each other raised the probability to choose a green energy provider. This result contradicts the assumption of attitude-conditional default effects. The lack of a significant interaction between defaults and attitudes and their additive main effects are more in line with a compensatory model (Kaiser et al., 2014). The compensatory model is derived from the Campbell paradigm (Kaiser et al., 2010), an alternative theoretical model of the attitude-behavior relationship. Both the Campbell paradigm and the test of a conditional model against a compensatory model are outlined in more detail in Paper 3.

In the online shop experiment (Paper 3), we found a pattern that conceptually replicates the results from the electricity provider experiment. Despite a different operationalization of defaults and choices and a different attitude measure, defaults and attitudes independently predicted choices and did not interact. In other words, green product defaults and more pro-environmental attitudes both predicted the amount of green products participants chose. The influence of a default persisted along the attitude continuum for participants with low environmental attitudes as well as for participants with high environmental attitudes. Because we measured actual choices but not intentions in both papers, it is not possible to directly map the results onto the theory of planned behavior. Whereas attitudes play an important role in both models, it would be worthwhile to examine whether defaults influence normative beliefs and control beliefs (the other two determinants of intentions and behavior in the theory of planned behavior) and would thus fit into the theory.

Taken together, the results from the two papers provide converging support for the relative independence of default effects from attitudes and attitude strength at least for environmental decision making. As such, both papers present falsifying data on the intuitively appealing hypothesis that defaults work asymmetrically (Camerer et al.,

2003) and only for people with weak attitudes. A potential objection is that an additive influence of defaults and attitudes as predicted by the compensatory model does not consider the difference between pro-environmental attitudes and strong attitudes (attitude position vs. attitude strength). One could imagine a person holding strong anti-environmental attitudes (e.g., a convinced climate-change denier). We dealt with this objection in Paper 2 by measuring attitude position (pro/anti) and attitude strength (high/low) separately. Despite the successful construction of a reliable (internally consistent as well as stable over time) and valid measure of environmental attitude strength, differentiating between attitude and its strength proved difficult for environmental attitudes. Both constructs overlapped as indicated by their correlation ($.37 < r < .40$). Thus, the passionate climate-change denier does either not exist or was not part of our samples. Still, the results in Paper 2 using attitude strength as a potential moderator do not support the hypothesis that attitude strength moderates the influence of defaults on decision making.

3.4 The predictive power of attitudes and their measurement

In addition to the independence of defaults and attitudes, all three experiments from Papers 2 and 3 demonstrate that individual attitudes explain a significant proportion of variance in people's choices. Thus, the internal blade of the behavior predicting 'scissors' (see Chapter 2.3 and Simon, 1990) is a valuable predictor. However, comparing the predictive power of the different scales used also highlights the challenge to measure latent constructs such as attitudes for the prediction of manifest behaviors. The widely used New Ecological Paradigm scale (NEP, Dunlap, van Liere, Mertig, & Jones, 2000) employed in Paper 2 to measure environmental attitudes proved inferior to the newly created environmental attitude strength scale used in the same paper. A direct comparison between the NEP and the attitude strength scale reveals that the strength measure is superior in terms of incremental variance explanation and homogeneity ($\alpha > .84$). It also proved stable over a period of eight weeks ($r_{tt} = .75$). This makes the newly developed measure a viable alternative for environmental attitude measurement. In Paper 3, we used the more established general ecological behavior scale (GEB, Kaiser & Wilson, 2004) which is based on self-reported past behavior and is constructed based on the Rasch model. It also predicted green consumer choices well.

Comparing the performance of these three different measures of the same underlying construct illustrates that a reliable and valid attitude measurement is essential, albeit not trivial, to draw correct conclusions about the individual influence of each predictor as well as their interplay. The mere absence of a relationship between NEP scores and pro-environmental behavior is not sufficient to conclude that environmental attitudes do not influence behavior.

3.5 How libertarian is libertarian paternalism?

A frequent criticism concerning the use of nudges and defaults is that they reduce autonomy and restrict freedom of choice by manipulating the decision context. As the results from Papers 2 and 3 show, claiming that defaults only work for indifferent people and thus leave people with pronounced attitudes immune to their influence is not supported by empirical data. On the one hand, this speaks against the idea of libertarian paternalism or "asymmetric paternalism" (Camerer et al., 2003) because at least in the case of defaults, their influence seems to be relatively unanimous and symmetric. On the other hand, the studies from Papers 2 and 3 demonstrate that individual attitudes influence behavior independent of the choice architecture. This could be interpreted as an argument for the libertarian side of libertarian paternalistic interventions, although it stands in contrast to the claim from (mostly) economists who assume preferences (respectively attitudes) to be constructed on the spot rather than being stable dispositions (Slovic, 1995). Both the studies presented in Papers 2 and 3 (using different attitude measures) as well as previous research on attitudes show that it is possible to measure attitudes in a stable and behavior-predictive way (Kaiser & Byrka, 2015). As such, attitudes could represent the libertarian, context-independent side of libertarian paternalism. Thus, the data presented in this thesis provides arguments that could be used to defend the libertarian side by pointing out that attitudes do play a role in decision making. However, the finding that defaults exert influence even for people with very strong attitudes could also be interpreted as evidence for the high degree of manipulation that nudges in general and particularly defaults exert. What can be concluded from the presented data about libertarian paternalism then?

If "libertarian" is defined by the mere existence of alternative options to choose from, a green default with the possibility to opt-out and to choose other energy sources instead can be classified as a libertarian measure. Still, the mere theoretical existence of

an alternative option that is not chosen in practice would not be sufficient to speak of a truly libertarian choice situation. However, in all three experiments participants also made practical use of the opportunity to opt-out and alternative options were also chosen despite strong default effects. Thus, the green energy and organic product defaults qualify as libertarian paternalistic. Given that Papers 2 and 3 demonstrate that defaults exert influence across all levels of attitudes, they can nevertheless be compared to other paternalistic measures with uniform consequences such as mandates or bans. Taken together, the present research allows situating default nudges between paternalistic laws and more libertarian educational approaches.

As Paper 1 and the taxonomy of choice architecture interventions demonstrate, 'nudge' is still a heterogeneous label and conclusions drawn from a specific intervention using a specific nudge cannot easily be transferred to the whole toolbox without oversimplifying. This also applies to evaluations of the degree of paternalism of an intervention. A nudge simplifying statistical information about risk propensities, for example, is very similar to an educational approach and as such certainly less paternalistic than a default nudge.

For a more definite answer to the question *How libertarian is libertarian paternalism?,* further conceptual clarification and sharpening of the term is necessary and ethical issues might be more important than psychological questions. Psychology, on the other hand, has a long tradition in examining how people *perceive* certain stimuli and situations, oftentimes driven primarily by interest in people's perceptions rather than the actual 'truth'. To further examine the question *How libertarian do people perceive libertarian paternalism?,* I present a study on the perceived limitations of freedom evoked by different choice architectures in the following section.

3.5.1 Libertarian paternalism and reactance

In a different approach to examine how paternalistic a nudge is, I used perceived manipulation (a descriptive and quantifiable approach) instead of a normative definition of manipulation. Rather than theoretically determining whether one intervention is more manipulating than another, people indicated the degree of perceived manipulation of a nudge. I took this approach in a separate (yet unpublished) study in which I examined the acceptability of nudges and the connection to perceived restrictions of freedom. I will present the design and central findings of this study in the following.

The aforementioned criticism concerning the use of choice architectures (restricted freedom to choose and manipulation) is also an integral part of reactance theory which claims that persuasive message and external force can arouse the motivation to restore one's freedom (Brehm, 1966). Reactance theory posits that this motivation cannot be measured directly but is expressed in behaviors such as direct restoration of freedom by enacting the threatened behavior, increased liking of the threatened behavior, derogating the source of threat, or exercising complementary behaviors. This conceptual definition of reactance as "the motivational state that is hypothesized to occur when a freedom is eliminated or threatened with elimination" (Brehm & Brehm, 1981, p. 37) renders its direct measurement impossible. However, its status as an intervening variable was also acknowledged by Brehm and Brehm (1981) who concluded that reactance can only be indirectly assessed via predicting behavioral effects. In case of nudges, these behavioral effects are, for instance, a lower acceptance of the measure.

In an online study, I examined whether a perceived threat to individual freedom mediates whether a nudge is accepted or rejected. The central hypothesis derived from reactance theory is that nudges differ in the degree of acceptance due to the amount of freedom threat they provoke. This hypothesis was tested with a sample of $N = 1740$ participants ($M_{age} = 34$ years, $SD = 11.5$, 50% female) recruited via Amazon's Mechanical Turk. Participants were presented a vignette describing one of six different nudges either presented as a regular nudge introduced by a choice architect or as a self-nudge which they could choose to implement themselves. For example, in the nudge condition, people were told that the default for printing in offices was changed from one-sided to double-sided printing. As with every default, this did not force them to print double-sided as the setting could be changed for every print job. In the self-nudge condition, participants were told that they could change the default at their office printer to double-sided printing and thus nudge themselves. In total, six different scenarios[3] with a nudge and self-nudge condition each were constructed in this way resulting in twelve different vignettes. Each participant randomly received only one of the twelve vignettes. After reading the vignette, participants indicated the amount of perceived freedom threat on a four item scale ($\alpha = .84$, example-item: "The measure threatens my freedom

[3] The other five nudges targeted savings rates with a saving default, food intake with smaller plates at buffets, grocery shopping with partitioned supermarket trolleys, energy consumption with smart meters, and snack food consumption with visual cues in chips containers. All of these nudges belonged to categories from the taxonomy presented in Paper 1.

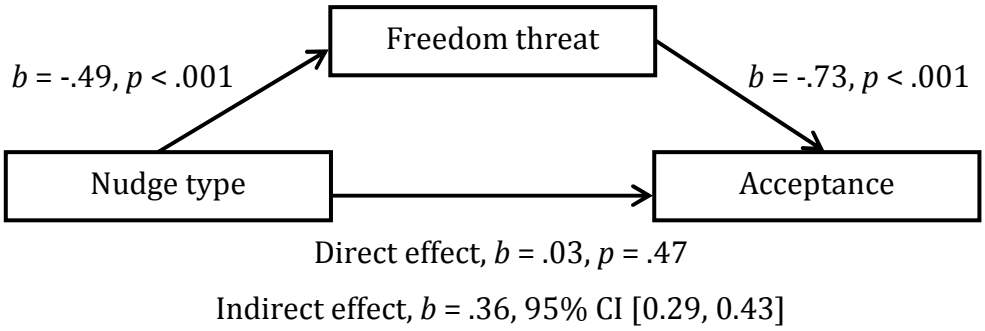

Figure 1. Model of nudge type as a predictor of acceptance, mediated by freedom threat. The confidence interval (CI) for the indirect effect is a bootstrapped CI based on 1000 samples.

to choose"). Then, the dependent variable "degree of acceptability" was assessed on a five-point semantic differential scale (α = .95, examples: un/acceptable, un/desirable). Further control variables were also assessed.

Because the pattern was similar for each vignette, I aggregated measures over all six nudges. Self-nudges were preferred to regular nudges, M = 3.45 (SD = 1.19) vs. M = 3.84 (SD = 1.05), $t(1738) = 7.12$, $p < .001$, d = 0.35. In line with the hypothesis, there was a significant indirect effect of nudge type on acceptance mediated by the amount of perceived freedom threat (see Figure 1). Self-nudges led to less freedom threat than regular nudges and a higher degree of freedom threat was associated with lower acceptance ratings of a nudge.

One could argue that the mediator (freedom threat as a proxy for reactance) and the criterion (acceptance) are in fact two different manifestations of the same construct. However, although both measures correlate substantially (r = -.66), there remains a large proportion of unshared variance (56%). Besides statistical considerations, I consider both measures as sufficiently distinct in content to assume they represent distinct constructs.

A joint consideration of the results from Papers 2 and 3 and the unpublished data on nudge acceptance suggests that research on the question "How libertarian is libertarian paternalism?" should consider external (nudges) and internal (attitudes) predictors of a decision and their interplay. Furthermore, the subjective experience of free choice (and its opposite freedom threat) can help to explain whether a measure is perceived as more libertarian or more paternalistic. The stronger people perceive the paternalistic side of a nudge (limiting freedom to choose, manipulating decisions), the

lower is the acceptance of that measure. This is in line with predictions derived from reactance theory and points out how important it is to avoid reactance – even if objectively no freedom is limited because nudges do by definition preserve the freedom to choose an alternative (see also the defining criteria of nudges in section 2.2).

4 General discussion and implications

In the previous chapter I have outlined the central issues to which the presented research provides new insight, which methods were used to deal with these issues, and which results were obtained. I will continue by pointing out the theoretical and practical implications these findings have for understanding and using choice architectures. It is possible that different approaches to tackle the issues raised would have yielded different answers and as such the conclusions presented (as any conclusions) are limited. I will point out some of these limitations and sketch alternative approaches to those presented in this thesis. Finally, in the course of searching for answers, new questions constantly come up to which the presented research does not speak. It is still useful to ask some of these follow-up questions which I will do to conclude this chapter.

4.1 Conceptual sharpening of nudging

The development of a taxonomy of nine nudge types provides further bottom-up sharpening of the concept by providing examples. Together with existing top-down definitions of nudges outlined in chapter 2.2, it helps to answer question like *Does weather count as a nudge?* Given the first three techniques which all deal with information provision, the taxonomy also supports definitions of nudging that include "information-nudges" (see Barton & Grüne-Yanoff, 2015). Thus, the taxonomy indicates that nudging is not limited to automatic (heuristic) processing or the exploitation of cognitive biases. This softens apprehensions that nudges target only intuitive, emotional processes (often referred to "System 1") and prevent more durable changes due to neglecting complex, deliberate processing ("System 2"). The strict separation of the two Systems seems problematic in this light because nudges might ease deliberate processing by translating otherwise unused information into usable information (e.g., by simplification or providing feedback).

Inevitably, the applied method of inductive category development is susceptible to subjective influences from the researchers developing the categories. Determining inter-rater reliability of the developed categories (as done in Paper 1) provides one way to quantify the degree of subjectivity involved. It should be noted that previous categorizations refrained from using any specific (quantitative or qualitative) method at all. Nudge categories were developed intransparently, probably by intuition and experience of the researchers. Furthermore, despite problems with qualitative

methodology, one should keep in mind that also quantitative methods are far from objective. The operationalization of latent constructs, the translation of real world situations into the lab, significance thresholds, and the interpretation of sample-dependent values and indices are similar gateways for subjectivity. I do not want to argue against the use of quantitative approaches as they frequently render subjectivity transparent, for example, by providing confidence intervals; however, for the aim of structuring the large amount of nudges into a finite number of categories, inductive category development is an appropriate method. An interesting (albeit similarly interpretation-intensive) alternative method would be multidimensional scaling (MDS). In MDS, participants rate how similar different stimuli (e.g., nudges) are. Because dimensions are not a priori determined by the researcher, this method can unveil latent factors that connect different stimuli without identifying them a priori. However, because comparing stimuli on more than two or three dimensions simultaneously is extremely complex and demanding, MDS would probably prevent the emergence of more than three dimensions. To detect basic underlying dimensions, it is still a very useful method. For developing a more fine-grained taxonomy that can be used to create new choice architectures, the chosen approach proved more suitable.

4.2 Processes behind default effects: Defaults as behavioral cost factors

From the experimental studies of default effects it can be concluded that defaults work by imposing or alleviating costs on decision making. Conceptualizing defaults as person-unspecific cost factors is in line with a compensatory understanding of how behavioral costs and individual attitudes change behavior (Kaiser et al., 2014; Kaiser et al., 2010). *Behavioral costs*, however, is a rather broad term (cf. the utility concept in neoclassical economic models). On the one hand, it allows for a parsimonious theoretical umbrella incorporating existing process explanations for defaults like effort or implied endorsement (McKenzie et al., 2006). On the other hand, it runs the risk of becoming too broad to be falsifiable which would reduce its epistemological utility. In this context, behavioral costs are akin to item difficulty in item-analysis: The lower the behavioral costs of a behavior, the more people show this behavior and vice versa. In Papers 2 and 3, I tested the hypothesis that behavioral costs imposed by defaults are similar for a sample with heterogeneous attitudes. These tests support the assumption of comparable costs despite varying attitudes. However, if defaults work relatively similar for people

with different environmental attitudes, their influence should also be similar for people differing on further measures such as the need for cognition, knowledge, and other attitudes. In statistical terms, other needs or attitudes should also not interact with defaults. These tests have not been conducted yet. A challenge in conducting these tests is to a priori determine a cost-level that allows for variation in people's choices without ceiling or floor effects. For example, an extremely high effort to change a default will prevent almost everyone from opting-out and introduce ceiling effects. Especially in experimental research extremely low costs of switching (e.g., a mouse click) are common and impede finding default effects. This was the case in a donation-by-default-study I conducted in which participants could donate their participation gratification by default. Almost no one did so because opting-out was possible at no (behavioral or social) cost just by clicking. Thus, to achieve behavior change with defaults, knowledge about the size of behavioral costs a default imposes or alleviates is necessary.

Another research design would be to experimentally vary the behavioral costs introduced by a default which should result in different actions. For instance, if the effort of switching from a default to an alternative increases, the amount of switching should decrease. If defaults are perceived as the recommended option (Tannenbaum & Ditto, 2011), defaults in ambiguous situations should outperform defaults in certain situations because the costs of ignoring a recommendation in an uncertain situation are higher than in a certain situation. A challenge in all of these hypotheses is isolating and manipulating a single process (like the recommendation function of defaults). Most likely, different processes produce default effects simultaneously and to different degrees.

Another process that might be responsible for the impact of defaults on choices is the perceived endowment a default elicits. According to the endowment effect (Kahneman et al., 1991; Knetsch, 1989) people are more willing to keep an endowment than they are to acquire the same object. This has been demonstrated with various objects (from duck habitats to coffee mugs) for which people demanded a higher price when they owned the object than they were willing to pay for it when they could buy it. In the case of defaults, this means that giving up a default (when it is perceived as an endowment) comes with a higher cost than choosing the same object when it is not the default. For experimental research on default effects this explanation implies that the scenario has to ensure a default option is actually perceived as an endowment. Although

speculative, this might have been another reason for an absent default effect in the donation-by-default-study mentioned above. Participants might not have perceived any endowment with the default, which could then not affect their behavior. By contrast, in Papers 2 and 3, the scenarios ensured that participants were actually endowed with a default before they received the possibility to opt-out.

4.3 Attitudes as independent predictors and their measurement

Moving from contextual factors to individual factors as predictors of behavior, Papers 2 and 3 demonstrated that individual attitudes increase the precision of a choice-predicting model. Without drawing any definite conclusion concerning the existence or nonexistence of an attitude-behavior gap, three experiments with three different measurement approaches towards environmental attitudes indicate that attitude measurement plays an important role and is not trivial. The conceptual distance between the newly developed measure of environmental attitude strength (see Paper 2) and actual behavior as the criterion is larger than in the GEB as a behavioral attitude measure. It is well known that past behavior is a good predictor of future behavior, but it is probably not the only one. In contrast to the GEB, the attitude strength measure is not behavior-based but refers to different dimensions of attitude strength applied to environmental attitudes, namely importance, certainty, relevance, elaboration, knowledge, and ambivalence (Krosnick & Petty, 1995; Wegener, Downing, Krosnick, & Petty, 1995). Although assessing latent constructs like attitudes with self-report measures such as questionnaires can be difficult, the presented research demonstrates that it is worthwhile.

If the editors' claim in a recent special issue on nudging is true and "Libertarian paternalists, in contrast to other forms of paternalism, take individuals' own preferences seriously" (Barton & Grüne-Yanoff, 2015, p. 346), this should result in more sophisticated attempts to capture attitudes than deriving them from one shot behaviors or choices only. Measuring latent constructs in psychology (as one of the core characteristics of empirical psychology) is certainly more difficult than measuring temperature or length. Conclusions about the reliability or change in a construct such as a person's attitude also depend on its measurement. As such, conclusions about human irrationality drawn from a preference reversal in a preference measure using one-shot behaviors might provide more insight into irrational measurement practices than into

human irrationality. Note that this is not an argument against behavior-based attitude measurement per se. Even in the Campbell paradigm which provides the theoretical basis for the construction of the behavior-based GEB scale, an attitude is derived from several rank-ordered instances of behavior and their associated difficulties (see Kaiser et al., 2010 for a detailed description of the Campbell paradigm).

Ultimately, different approaches suggest different methods for attitude measurement (e.g., classical test theory vs. item-response-theory). In the present thesis, I took individuals' preferences seriously by jointly considering situational factors and individual attitudes. I used different methods for the measurement of environmental attitudes (classical in Paper 2, Rasch-based in Paper 3) to be able to draw conclusions that are not limited to a very specific scale or measurement method. This is necessary since my research questions focused on the influence of attitudes on defaults, not on the influence of attitude *measurement* on defaults. Despite the different measurements of attitudes, a recurring pattern of the default-attitude-behavior relationship emerged. The findings also allow for preliminary conclusions concerning their interplay. Despite the intuitively appealing hypothesis that attitudes moderate the influence of defaults and defaults should work asymmetrically influencing people with weak attitudes more than people with strong attitudes, this hypothesis proved untenable. From this it follows that defaults work relatively unconstrained by attitudes and possibly also unconstrained by further variables, although the present research provides no data for the latter assumption. The unconstrained effectiveness also has some important practical implications for the use of defaults in policy making to which I will return in Chapter 4.5. Prior to this, I will discuss implications of the three papers in this thesis for the different concepts of human rationality outlined in Chapter 2.

4.4 Implications for human rationality

Given that the experiments from Paper 2 and 3 repeatedly showed that people's choices can be influenced by nudges such as defaults, one could conclude that human decision making is indeed biased, flawed, and utterly irrational. Indeed, it cannot be denied that decision making is context-dependent. Because random contexts (e.g., a randomly chosen green or gray default) exert a similar influence, this is often interpreted as a proof for irrationality. Conclusions markedly different from those of a cognitive bias perspective are drawn by both the *cognitive-ecological approach* (Fiedler

& Juslin, 2006; Fiedler & Wänke, 2009) and *ecological rationality* (Gigerenzer et al., 1999; Todd & Gigerenzer, 2007). Both approaches shift the focus from a purely "intra-psychic bias" perspective (Fiedler & Wänke, 2009, p. 704) towards the consideration of the human mind in a given information environment. In contrast to much of the research referring to bounded rationality (see also Chapter 2), the cognitive-ecological approach and ecological rationality stress the *two* potential gateways for seemingly irrational decisions: a biased mind and a biasing information environment. Ecological rationality criticizes the basic premise that context-dependence of human information processing is taken as a sign for irrationality. Rather, Gigerenzer and colleagues suggest that the use of heuristics and "biases" (such as sticking to the status quo) reflects the ability to derive meaning from contexts and cope with available information in a "fast and frugal" way (Hertwig & Herzog, 2009). This perspective is represented in one explanation of default effects which points out that defaults often reflect endorsement or advice from the person who sets the default (McKenzie et al., 2006; Tannenbaum & Ditto, 2011).

Furthermore, whereas the source of deviation from what might be in a person's best interest is found within the person in research on cognitive biases, Gigerenzer demands to locate it outside of the individual on an institutional level. Rather than blaming biased processing of ostensibly unbiased information, he turns the tables and blames massive "flaws in human institutions" (Gigerenzer, 2015, p. 367) for suboptimal decision making. Smoking advertisements serve as an example for this claim. Although people know that smoking kills, some smoke. This might be irrational, however, a billion-dollar industry works on promoting irrational behavior (smoking) by advertisement. One could also call this the major irrationality and locate it in the decision environment, not in the human mind.

Despite these different assumptions about the reasons for biased decision making, the conclusions potentially drawn from an ecological rationality perspective are very similar to suggestions from proponents of choice architecture. Todd and Gigerenzer (2007, p. 167), for instance, conclude: "Knowing when and how people use particular heuristics can facilitate the shaping of environments to engender better decisions." As a concrete measure they suggest to change organ donation defaults to increase donation rates, a suggestion that also appears in choice architecture research (Johnson & Goldstein, 2003). Thus, context-dependent human behavior such as the behavior guidance of pre-selected default options is not necessarily a sign of irrationality.

Irrespective of whether "predictably irrational" (Ariely, 2008) or "ecologically rational" human minds are responsible (Todd & Gigerenzer, 2007), the demonstration of context-dependent human behavior allows for converging practical (policy) implications.

4.5 Practical (policy) implications

Behavioral sciences have certainly gained attention from policy makers as the installation of special units and the staffing of advisor positions in the UK, the US, Australia, Denmark, and Germany show. The expectation of concrete policy implications from research on nudging is thus even more prevalent than in other research areas.

The presented taxonomy aims at a high practical value allowing for the creation of concrete nudges without being a mere toolbox detached from any theoretical foundation. As described in more detail in Paper 1, designing a behavioral intervention entails a definition of the target behavior, the identification of barriers, checking whether choice architecture is suited at all (see also the discussion of choice architecture as complementary regulation in this chapter), as well as choosing and testing a technique. Thus, the process is more complex than simple trial and error, but the taxonomy should be helpful for the last step in the behavioral design process (choosing and testing), as it outlines and describes the available options.

The experimental papers on green defaults provide evidence for two starting points to achieve behavior change in the realm of environmental decision making: First, green defaults can foster pro-environmental decision making. Possible green defaults may range from the tested large-scale renewable energy defaults to small-scale waste reduction defaults (e.g., one-sided printing or reducing plastic bag use). Other green defaults might include sustainable consumption defaults, vegetarian defaults in schools or cafeterias, energy efficient wash cycle defaults, sustainable shipping defaults, or low emission defaults in individual transportation (taking the train instead of a plane). When these defaults are perceived as endowments, when opting-out introduces an extra effort (e.g., physical or temporal), and when their recommendation function does not restrict the perceived freedom of choice, green defaults increase the likelihood for pro-environmental decisions in addition to the influence of a decision maker's environmental attitude.

Notwithstanding a clear recommendation for the use of nudges, the present research does not support the conclusion that nudges should completely substitute

other forms of regulation such as incentives, taxes, and the law. Rather, nudges complement the toolbox of regulatory means (see also Purnhagen & Reisch, 2015). This is especially important since the repeated demonstration of a successful nudge is independent from the success of other regulatory means such as bans or taxes. If green defaults foster sustainable shopping, this does not imply that banning or increasing prices for unsustainable consumer goods becomes unnecessary. To the contrary, truly cross-disciplinary approaches promise to be more successful than unidirectional measures. If technological improvements neglect psychological insights about how humans adopt new technologies, their impact might be severely limited or even lead to a rebound effect. In the realm of environmental behavior, rebound effects occur, for example, when more energy efficient technologies lead to higher emissions because people adapt their energy consumption due to a perceived technological improvement (Herring & Roy, 2007; Otto, Kaiser, & Arnold, 2014). Most probably, the technological fix – besides being a risky, uncertain, and complex option – cannot solve a societal challenge such as climate change without considering psychological insights (Amelung & Funke, 2013). Similarly, as the hybrid discipline of behavioral economics shows, a purely cost-benefit economic perspective neglecting how financial incentives are perceived by the individual will fail to produce lasting behavior change.

4.5.1 Nudging and education

A discussion of viable alternative approaches to achieve behavior change besides regulation by legislation, technological improvements, and financial incentives has to include educational approaches. Traditionally, environmental education is a popular alternative approach to achieve behavior change by enabling a person "to strive for and to attain a more ecological way of life" (Roczen, Kaiser, Bogner, & Wilson, 2014, p. 972) by increasing the relevant knowledge base. Environmental programs address knowledge more frequently than attitudes or behavior (see, for example, a meta-analysis from Pomerantz, 1991). However, whether an increase in the environmental knowledge base alone actually has a strong effect on behavior is disputed. Rather, appreciation for nature and environmental attitudes are assumed to motivate the search for information which in turn enables people to act pro-environmentally (Roczen et al., 2014). Thus, educational approaches as well as choice architecture interventions that neglect the influence of attitudes might similarly fall short in achieving behavior change. Despite

being compared as different means to achieve behavior change, educational approaches and choice architectures are not necessarily opposites. Nudges in Category A of the newly developed taxonomy target "decision information" (see Chapter 3.1 and Paper 1). This category provides techniques to facilitate the processing and understanding of decision-relevant information; in other words, they increase the relevant knowledge base, which is comparable to education. Whether the influence of nudges on attitudes is similar to the influence of nudges on learning, for example by achieving attitude change through consistent behavior change, is an open question. A take-home message for policymakers is not to focus either on educating or nudging their citizens but rather to consider both approaches as more connected and less mutually exclusive.

A final practical implication of the presented data concerns the connection of reactance and acceptability of nudges. Policy makers are strongly urged to pay close attention to the communication of a nudge and to avoid reactance. Any indication of manipulation or restricted personal freedom can lead to reactance and will increase the likelihood that a nudge is rejected irrespective of the good intentions that led to its implementation.

4.6 Limitations and open questions

Despite the outlined theoretical and practical implications, the present research is of course limited in scope and leaves several questions unanswered. Keeping these limitations in mind can stimulate further research and will help to assess the implications outlined above.

Within the central area of application (environmental decision making), I focused on only two examples of sustainable behavior as dependent variables: electricity provider choices and sustainable consumption. Both provide large leverage potential, but defaults can potentially be applied to other behaviors, too, such as meat consumption (vegetarian defaults), energy usage (recharging defaults of electric cars in a smart grid), and mobility (no plane defaults in companies). By focusing on environmental decision making, Papers 2 and 3 applied defaults to the same area. This precluded the test of defaults to foster other behaviors in domains outside of environmental decision making (e.g., financial decisions like saving or donating, or medical decision making). As mentioned earlier, environmental decision making might differ from other domains due to its consensual ultimate goal, which is less controversial

than the goals in other potential domains of application (e.g., organ donation or vaccination). Thus, claims made about the interplay of defaults and attitudes are limited to green defaults and environmental attitudes. Although there is no reason to believe that the relationship between defaults and attitudes should be fundamentally different in other areas, the present research does not speak to this question. Generalization warrants further conceptual replications of the findings in experiments targeting organ donation defaults and pro-social attitudes or political decisions and political orientation, to name just two examples.

While this thesis presents an overview of choice architecture techniques in Paper 1, only one technique was tested in the experiments presented. Further techniques to foster sustainable decisions would potentially be fruitful but were not compared to defaults in this thesis. One possible approach would be a systematic test of different nudges against each other to explore best practices (see van der Linden, Sander, Maibach, & Leiserowitz, 2015). Despite this dissertation's focus on nudges, I consider it crucial not to forget the high practical value of further psychological theories to tackle societal challenges. An example for one such theory is construal level theory (CLT, Trope & Liberman, 2010). CLT helps to explain why (temporally/spatially) distant events are treated differently from proximal events. As such, it is highly valuable to describe why climate change as a fact with distant consequences taking place thousands of miles away or in a distant future is currently handled on such an inappropriately abstract level. The descriptive value of psychological theories such as CLT can certainly be combined with prescriptive implications for policy making over and above the choice architecture approach.

For more specific and methodological limitations concerning the individual experiments and the applied methods, the reader is referred to the discussion sections in each of the individual papers.

Before concluding this part of this thesis and presenting the individual papers, I would like to focus on several general and specific, important yet unresolved questions concerning research on choice architectures and their application. Frequent criticism of nudges concerns their long-term effects and sustainability. Whether changing contexts also changes minds and ultimately attitudes (Dolan, Elliott, Metcalfe, & Vlaev, 2012) or leads to habituation and a gradual decline in effectiveness are crucial questions if nudges are discussed as viable alternatives to legislative regulation, information, or

economic incentives. Closely connected to this question are the processes relevant for a specific nudge. In the case of defaults, we found initial indications that defaults influence reasoning processes by selectively stimulating different queries (Dinner et al., 2011). Although one should treat introspective self-reports with caution, in Paper 2 (see Experiment 2), answers to the question of why participants made a certain choice were systematically influenced by the default they received. In other words, participants answered "greener" after a green electricity default than after a gray default. As such, defaults possibly also change information processing and post-decisional reasoning. Whether pre-decisional reasoning processes are also influenced by defaults is an open question the experiment cannot answer because we assessed queries after the decision. Others have tackled similar questions (Dinner et al., 2011) and raised the question of whether opting-out causes more thorough processing due to higher personal involvement (Toft, Schuitema, & Thøgersen, 2014). However, it is unclear whether this creates lasting patterns and transfers to other situations (e.g., via self-perception, Bem, 1967) or is limited to the concrete default situation. Since nudges are often presented as an alternative to behavior change via attitude change, the opposite direction (attitude change via behavior change) is certainly worth examining and demonstrating the sustainability of a nudge would be great news.

A more general open question that applies to every nudge is how to determine the desired target behavior. How do we arrive at a target behavior that can be called "desirable" and whose definition of "desirable" should be adopted? In the experiments on green electricity and sustainable consumer choices, I chose the green option as the target behavior. However, this is an arbitrary and subjective choice fueled by my own conviction that green energy is better than gray energy. Originally, nudges were defined to enable people to make better decisions "*as judged by themselves*" (italics in the original, Thaler & Sunstein, 2008, p. 5). However, this becomes problematic when the same nudge is applied to large groups, which probably assess different outcomes as desirable, as is the case in policy making. For defaults, different ways to determine a target behavior have been suggested, among them impersonal defaults, personalized defaults, and majority rules (Sunstein, 2013). One pitfall that should be avoided is judging the means by their ends. Whereas this dissertation is primarily concerned with research on nudges as a *means* to achieve behavior change – and sustainable decisions in particular – and uses empirical methods to do this, it should be separated from research

on suitable *ends,* which would most likely combine empirical methods (e.g., surveys or life-cycle assessment) with analytical methods (e.g., political, legal, and ethical analyses). As such, it is possible to conduct research on promising means to increase market share for renewable energy while the question whether green electricity is more desirable than nuclear power could remain open. This is even more important when answers are less consensual and capable of winning a broad civic majority as, for instance, concerning organ donation or pension saving rates (Choi, Laibson, Madrian, & Metrick, 2003).

5 Concluding remarks

The public and scientific debate whether "To nudge or not to nudge" (Hausman & Welch, 2010) is in full swing covering minor questions like "Why couldn't I be nudged to dislike a Big Mac?" (Bovens, 2013) and major questions like "Should we be 'nudging' for cadaveric organ donations?" (Hansen, 2012). The growing evidence base about the influence of decision environments on choices and behavior has tempted some to focus exclusively on features of the choice architecture, neglecting individual causes of behavior which, in turn, provoked an almost reactant rejection of the idea to use this evidence. Reactance, as does any threat to freedom, reduces the degree of acceptance of a measure.

In this dissertation, I pointed out how nudges and individual attitudes jointly contribute to behavior change; in contrast to intuitive assumptions, this happens relatively independently and without limiting the individual impact of either one. This finding also answers the question why one couldn't be nudged to dislike a Big Mac: because liking (or a favorable attitude) is independent of the nudge. Both factors influence behavior but do not influence each other. As such, one could describe nudging as "impact-oriented" rather than "intent-oriented" (Stern, 2000). I consider neither orientation superior per se. Rather, for severe societal challenges like climate change, it is crucial that people fly less and eat less meat – it is of secondary importance whether they do this because they are deeply convinced or due to a vegetarian default or their company's social norm of taking the train. As the organ donation approval rates in Germany show, intentions do not guarantee impact (see p. 3). It remains an open question whether a choice architecture that fosters flying less would be negatively "compensated" by increased meat consumption and if this rebound effect could be avoided by a change in attitudes.

In light of this question and my research, I conclude that choice architectures do lead to behavior change but are no substitute for other forms of regulation, or for other predictors of behavior such as attitudes. Taking attitudes seriously includes serious attempts to measure them, which I assume will lead to fewer conclusions about human irrationality. With a not so irrational mind and clever choice architectures combined, behavior is a powerful leverage point for many severe societal challenges from the liking of Big Macs to organ donation and sustainable consumption.

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Papers

7 Paper 1: A review and taxonomy of choice architecture techniques

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A review and taxonomy of choice architecture techniques

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Abstract

We present a taxonomy of choice architecture techniques that focus on intervention design, as opposed to the underlying cognitive processes that make an intervention work. We argue that this distinction will facilitate further empirical testing and will assist practitioners in designing interventions. The framework is inductively derived from empirically tested examples of choice architecture and consists of nine techniques targeting decision information, decision structure, and decision assistance. An inter-rater reliability test demonstrates that these techniques can be used in an intersubjectively replicable way to describe sample choice architectures. We conclude by discussing limitations of the framework and key issues concerning the use of the techniques in the development of new choice architectures.

Keywords: behavior change; decision making; choice architecture; nudge; intervention design

A review and taxonomy of choice architecture techniques

The growing field of choice architecture research investigates how the structure and presentation of decision situations influences certain behavioral choices over alternatives (Thaler & Sunstein, 2008). Choice architecture research has gained attention in recent years for its promise to apply insights from behavioral research to areas beyond marketing, such as policy making (Shafir, 2012) or development aid (Banerjee & Duflo, 2011).

Choice architecture emerged when researchers began to take an applied stance on cognitive peculiarities of human decision making drawing upon established judgment and decision making research. The wide focus on deviations in human decision making from the rational choice model ranges from Simon's (1955) bounded rationality proposal and Tversky and Kahneman's (1974) heuristics and biases program to contemporary behavioral economics (Camerer, Loewenstein, & Rabin, 2004) or "applied behavioral science" (Kahneman, 2012, p. ix). Research on choice architectures was triggered by Thaler and Sunstein's (2008) policy-oriented publication *Nudge*, which suggests that researchers should investigate how predictable deviations from rational behavior can be used to "nudge" people into socially desirable directions, e.g., improving their health or financial security. A "new branch to the 'prescriptive' part of the field of judgment and decision making" was added (Baron, 2010, p. 224). "Choice architecture" (Thaler, Sunstein, & Balz, 2010) refers to the idea that changes in the decision environment can affect individual decision-making and behavior while preserving freedom of choice. The approach alters "people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2008, p. 6). From this it follows that neither mandates nor classical economic incentives count as choice architecture. In contrast to persuasion, the focus of change is behavior rather than general attitudes or beliefs. Nudges can be understood as a specific type of behavior change technique primarily relying on reflexive cognitive processes (Oliver, 2013) often referred to as cognitive biases or heuristics (Gigerenzer & Todd, 1999; Tversky & Kahneman, 1974). A more general overview of behavior change techniques over and above nudges (including, e.g., mandates and incentives) is presented in the "behavior change technique taxonomy" (Michie et al., 2013).

In recent years, research on how choice architecture interventions can influence individual behavior has been conducted in a growing number of fields, including

consumer protection (Shafir, 2006), public health (Blumenthal-Barby & Burroughs, 2012; Cabinet Office, Behavioural Insights Team, 2010), environmental behavior (Cornforth, 2009; Weber, 2012), financial decision making (Thaler & Benartzi, 2004), and development aid (Banerjee & Duflo, 2011). Such research both adapts existing (descriptive) findings about judgment and decision making to the choice architecture paradigm and contributes new insights from research that has been carried out from a (prescriptive) choice architecture point of view (see Baron, 2010 for a similar argument). However, the field still lacks an integrative framework for the development and transfer of successful choice architecture interventions. To provide such a framework, we review the literature, noting both the necessity and the benefits of more clearly distinguishing intervention design from processes, and propose a taxonomy of nine intervention techniques derived through inductive category development from documented cases of choice architecture.

Intervention design and underlying processes

Michie and colleagues (2011) analyzed existing frameworks for behavior change interventions and concluded that "none are comprehensive and conceptually coherent" (p. 2). We argue that this applies for the subfield of choice architecture frameworks as well.

As outlined for the broader field of behavior change, specifying the range of available intervention techniques in a systematic and theoretically sound way helps guiding the development of new testable interventions (Abraham & Michie, 2008). Likewise, choice architecture research and the widespread testing in this field would profit from a systematic outline of the techniques available for testing across contexts and domains.

Previous attempts to enumerate techniques of choice architecture have followed two main approaches. The first approach focuses on the underlying *(cognitive) processes*, i.e., the mental constraints and cognitive biases targeted by an intervention. Datta and Mullainathan (2012) suggest that four basic "mental constraints" serve as a starting point for choice architecture interventions: *self-control*, *attention*, *cognitive capacity,* and *understanding*. Dolan et al. (2012) provide a framework of nine categories that consider psychological phenomena and processes, such as *priming*, *salience*, and *affect,* on which choice architectures can be built. In the second approach, choice architecture techniques

are structured according to the kinds of *interventions* used to modify the decision situation. Johnson et al. (2012) suggest as categories of intervention: *reducing the number of alternatives*, *using technology and decision aids*, *setting defaults*, *adjusting the time frames and sequences of choices*, *partitioning options and attributes,* and *designing attributes*. Abrahamse, Steg, Vlek and Rothengatter (2005) single out *commitment*, *goal setting*, *information*, *modeling* (i.e., giving examples of recommended behavior), *feedback,* and *rewards*.

However, these two approaches are often intermixed. Dolan et al. (2012) admit that a possible critique of their taxonomy is the resultant blurring between internal psychological mechanisms, such as affect, and external levers, such as defaults – both of which are part of their taxonomy. Also Datta and Mullainathan (2012) draw upon both approaches when formulating techniques of choice architecture such as "facilitate self-control by employing commitment devices" and "reduce inattention: reminders and implementation intentions". However, such suggestions of direct relationships between mental constraints (e.g., self-control) on the one hand, and interventions (e.g., providing reminders) on the other hand cannot claim to be exclusive: reminders, for example, might also strengthen self-control. Moreover, the list of constraints and biases does not explicitly refer to prominent effects such as priming. Similarly, Johnson et al. (2012) describe problems such as *decision inertia*, *alternative overload,* and *long searching processes* and relate them directly to certain interventions which again suggests an exclusive link between a problem in decision making and a choice architecture technique.

Beyond these two basic approaches, a variety of broad and nonspecific intervention categories are discussed; examples include *encouraging vs. discouraging a certain behavior*, *functioning in a mindful vs. mindless way* from the perspective of the target person, *being transparent or non-transparent* to the subject (Hansen & Jespersen, 2013; Ly, Mažar, Zhao, & Soman, 2013), *structuring the choice task vs. describing the choice options* (Johnson et al., 2012), and *influencing the antecedents vs. the consequences of a decision* (Abrahamse et al., 2005). These categories may help to describe a decision situation but provide little guidance in setting up concrete interventions that can be tested empirically.

Summing up, there are several attempts in the field of choice architecture to build a more systematic theoretical framework taking into account the large body of evidence

on constraints and biases of human decision making and the resulting opportunities for choice architecture interventions. However, some confusion results from disregarding the factual many-to-many nature of the relationship between intervention techniques (the prescriptive part) and cognitive processes (the explanatory part). One intervention technique might alternatively draw on different cognitive processes, while one such process might underlie different intervention techniques. Consider one of the most prominent examples of choice architecture, default setting: Several processes are discussed to cause default effects, among them loss aversion (Dinner, Johnson, Goldstein, & Liu, 2011), implied endorsement (McKenzie, Liersch, & Finkelstein, 2006), and decision inertia (Johnson & Goldstein, 2003). Conversely, any of these processes can also underlie other intervention techniques besides default setting (e.g., loss aversion might also underlie information translation by reframing gains as losses). Furthermore, the same process might appear in two different techniques, but this does not increase similarity from the perspective of the choice architect who might, e.g., only be able to intervene on the level of information framing but not on the level of default setting. As a consequence, attempts to more stringently systematize the field need to opt for *either* techniques (cf. Johnson et al., 2012) *or* processes (cf. Vlaev & Dolan, 2015) as the basic categorization logic.

We provide a suggestion of how to use intervention techniques as the structuring principle. We view this alternative as particularly suited for facilitating the development of new, testable choice architecture interventions.

Integration with an underlying model of behavior

The development process for choice architectures can be specified as a systematic approach of sequenced steps as, e.g., suggested by Datta and Mullainathan (2012) for development aid policy. In the following, we propose a more general and revised version building on the "behaviour change wheel" model by Michie et al. (2011):

Step 1. Define behavioral problem and target behavior

Step 2. Analyze applicability of choice architecture framework

Step 3. Check for behavioral bottlenecks

Step 4. Build hypotheses on promising choice architecture interventions

Initially, any choice architecture intervention (and any behavior change attempt in general) requires a definition of the target behavior. Second, the kind of behavior change

approach applicable to the behavioral context should be determined. This includes checking whether choice architecture is applicable at all. If people strongly oppose a behavior or are forced not to display it due to external factors, choice architecture does not appear suited. Alternative measures of behavior change (such as education, bans or mandates, or economic incentives) might be more promising than choice architecture. However, choice architecture might be pertinent for pragmatic reasons if alternative measures are not available, too expensive, or not admissible.

Third, the reasons why people fail to display the target behavior should be analyzed. The crucial question is whether they are to be found in the psychology of human decision-making. This analysis has been termed the check for a "behavioral bottleneck" (Datta & Mullainathan, 2012, p. 15). It yields hypotheses on why the target behavior is not displayed, opening up a path towards choosing potentially effective intervention techniques. To do so, we suggest focusing on the central determinants of behavior in the "behaviour change wheel" (Michie et al., 2011): capability, opportunity, and motivation, and to identify corresponding biases or constraints such as limits in self-control, attention, cognitive capacity, and understanding (see Datta & Mullainathan, 2012). Possible results of this analysis could be that *capability* is constrained by a lack of understandable information (e.g., complicated information on the costs of insurance alternatives); the physical setup might negatively impact *opportunity* (e.g., inaccessible healthy food options), or self-control deficits might undermine the translation of *motivation* into behavior (e.g., in smoking cessation attempts).

Due to the complex influence of multiple variables, a general description of the analysis for behavioral bottlenecks necessarily remains vague. Thus, there can be no straightforward how-to for connecting the results of the bottleneck analysis with distinct choice architecture intervention techniques as a fourth step. Nonetheless, knowing about pertinent biases or constraints which prevent a target behavior while step-by-step checking each of the intervention techniques from the presented taxonomy, provides a more systematic way of developing choice architectures than currently available. In the following section, we first describe the development of our framework of choice architecture techniques and then explain the techniques in more detail.

A taxonomy of choice architecture techniques

Taxonomy development

While a large range of techniques for behavior change, including choice architecture, has been described, particularly in health and social psychology, they tend to be presented "as practical tools without reference to their evidence base" (Michie, Johnston, Francis, Hardeman, & Eccles, 2008, p. 665). To remedy this fact, we based category development on a sample of 127 documented examples of empirically tested choice architecture interventions. These were collected from academic publications and practitioner reports provided by organizations such as the British Cabinet Office's *Behavioural Insights Team* and MIT's *Abdul Latif Jameel Poverty Action Lab*. Examples mentioned in blogs or non-academic publications were also included after the original publication was checked for academic soundness.

The aim of any taxonomy or classification scheme is to "categorize phenomena into mutually exclusive and exhaustive sets" (Doty & Glick, 1994, p. 232), so that those sets describe the greatest possible share of the respective phenomena. To adopt a traceable approach to develop categories of choice architecture techniques meeting these requirements, we used inductive category development (Chenail, 2008; Corbin & Strauss, 2008; Mayring, 2010). Just as quantitative data reduction techniques (e.g., principal component analysis, cluster analysis), inductive category development aims at providing a limited number of categories suited to describe a given data set. The method is used to identify thematic relationships between units and to build categories through a recursive process of analyzing units and accordingly creating new or adapting existing categories (for a similar application, see Abraham & Michie, 2008; Michie et al., 2011). Ultimately, saturation in category development is expected because – if an adequate set of categories could be developed – no further categories need to be defined but further units can be subsumed under the previously defined categories (Corbin & Strauss, 2008). In order to define the units for analysis, we first compiled a unified description for all 127 interventions in our database, specifying a) the actors, b) the desired behavior, c) a description of the intervention, and d) the effect of the intervention on behavior. Processing each of these units we then developed and recursively refined a set of descriptive categories of types of interventions suited to subsume all studied interventions. For each newly processed intervention, we checked whether it could be

subsumed under the definition of one of the previously created categories, required further specification of the category's definition, or required the creation of an additional category. To maximize intersubjectivity during category development, all three authors discussed the sample cases in an iterative process. The sample database was large enough to continue category development to the point of saturation where all further sample interventions could be subsumed under existing categories, resulting in a stable classification scheme (cf. Eisenhardt, 1989). We thus found that heterogeneous choice architecture *interventions* can be described using a limited number of common choice architecture *techniques*.

The resulting taxonomy was then subjected to an inter-rater reliability test to quantify the degree of how well the taxonomy enables independent others to subsume given choice architecture interventions under the pre-defined categories. Four coders (two female and two male) categorized a random subset of 55 of the 127 choice architecture examples (see supplementary material for a table containing descriptions and references of all 55 coded interventions). Prior to the categorization, all coders received written definitions of techniques and examples which they were free to use during coding. After practicing with 20 examples, the coders were presented with the target cases in a random, identical order. Complete inter-rater agreement was achieved in 47 % of cases, at least three coders agreed in 73 % of cases, and only 5 % (three cases) were rated entirely different. Given that complete agreement by chance is extremely unlikely (0.14 % per case), the high agreement rates already indicate inter-rater-reliability. Following Hallgren's (2012) recommendations for fully crossed designs with nominal data, Cohen's Kappa was computed for each pair of coders and then averaged to provide a single index (Light, 1971). Pairwise Kappas lie between $\kappa = .56$ and $\kappa = .65$, all $p < .001$. The overall mean Kappa of $\kappa = .60$ ($SD = .03$) provides a conservative estimate of inter-rater reliability and indicates moderate to substantial agreement (Landis & Koch, 1977).

Structure of the taxonomy

We suggest three basic categories of choice architecture intervention techniques: *decision information*, *decision structure,* and *decision assistance*. These categories reflect different streams in the judgment and decision making literature.

Decision information. How people process available information has been a core topic in behavioral decision research since Simon's (1955) bounded rationality claim. Scholars have pointed to the relevance of "perceptual processes of problem representation, formulation, or framing" (Payne, Bettman, & Johnson, 1992, p. 111) to decision making. Accordingly, this category covers choice architecture techniques that target the presentation of decision-relevant information without altering the options themselves, e.g., by (re)arranging existing information or changing its presentation (how, by whom).

Decision structure. Many decision making models assume that decision-makers compare attributes or alternatives. Because maximizing strategies often prove impossible or maladaptive (Schwartz et al., 2002), alternative strategies have been suggested (e.g., weighted additive, satisficing, lexicographic, see Payne, Bettman, & Johnson, 1988 for an overview). Accordingly, choice architects can alter the decision structure, i.e., the arrangement of options and the decision making format, by modifying the available options in the decision situation, including their range or composition, the default option, or the effort required for selecting an option and the consequences of selecting it.

Decision assistance. A third stream of decision research has focused on self-regulation and "self-regulation failures" (Baumeister & Heatherton, 1996), i.e., problems of bridging the intention-behavior gap (Sheeran, 2002). Accordingly, choice architects can use techniques to provide decision-makers with further assistance which aims at helping them to follow through with their intentions. For example, choice architects can foster deliberate commitment or take measures to remind people of preferred behavioral options.

Each basic category contains a number of techniques. In the following sections, we will describe the techniques and cite examples of their effective application from empirical studies. The examples are structured according to subtypes, but the subtypes given do not constitute an exhaustive list. We will also refer to underlying cognitive processes which – as illustrated above – are not exclusively linked to a technique.

---------- INSERT TABLE 1 HERE ----------

Decision information

Decision makers usually base their decisions on available information, be it factual or social. The way this information is presented influences subsequent decisions, and

thus changing the presentation of information can be seen as part of the choice architect's role (Thaler & Sunstein, 2008).

Translate information (A1). Choice architects can translate existing, decision-relevant information for the decision maker by changing the format or presentation of information but not the content.

Reframe. One way to change the format of existing information is to reframe it by "shifting the perspectives of decision makers in ways that change their subjective evaluations of choice options" (Weber, 2012, p. 387). Following classical definitions, framing effects occur when the same (equivalent) information presented in different ways leads to systematically different decisions (Sher & McKenzie, 2011). According to this definition, translating information by reframing it includes formally, logically, and mathematically equivalent information presentation as illustrated by the following examples. Framing the call for blood donations as death-preventing rather than as life-saving raised the amount of blood donations in one study (Chou & Murnighan, 2013). Another study using this technique aimed at increasing teacher performance. By paying end-of-the-year bonuses for teachers in advance, bonuses were presented as conditionally awarded money which had to be paid back at the end of the year in case of poor performance (Fryer, Levitt, List, & Sadoff, 2012). But harnessing loss aversion is only one process that the reframing technique can draw on. Since the framing of probability and quantity estimates affects their communicative content (Halberg & Teigen, 2009), a reframing intervention can aim at influencing patients' decisions when confronted with health statistics (Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin, 2007). Whereas strict definitions of framing require equivalence, the term is often also used in a more loose sense including "linguistic redescriptions of the same decision problem" (Krüger, Vogel, & Wänke, p. 13). For choice architects it follows that variants of the reframe technique may not be equivalent as long as they target the same behavior and refer to the same decision problem. Reframing hygiene measures in a hospital to emphasize the patient's rather than the doctor's health is such an example of reframing decision-relevant information to target doctors' overconfidence in their own resilience (Grant & Hofmann, 2011). Clearly, the health frames are not logically equivalent (because doctors' health and patients' health are not the same) and do not suffice the criteria of a strict framing definition. However, the same target behavior (hand hygiene) is described with the same information (hygiene prevents disease) by

varying the framing of its consequences (me vs. others) and thus suffices a loose framing definition.

To count as a reframing, non-equivalent frames must not reveal new information as e.g. by making it visible (cf. technique A2) but rather shift the focus of decision makers by presenting existing information differently. This is exactly what equivalent frames also do.

Simplify. An alternative way of making existing information more helpful to decision makers is simplification, i.e., reducing the burden of cognitive effort necessary to process the information available and increase its usefulness in the decision making process. Simplification can, for instance, adjust for constraints in cognitive capacity and understanding. This technique can be easily implemented and substantially improve decision making because in many situations relevant information is theoretically available but practically underused. Simplified information has been shown to increase college enrolment rates and financial aid application rates (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2009). Micro-entrepreneurs with little knowledge of accounting or economic decision making also profit from simplification, such as the provision of rules of thumb (Drexler, Fischer, & Schoar, 2010). Further simplifications concern numerical information, e.g., on fuel efficiency (Larrick & Soll, 2008; Soll, Keeney, & Larrick, 2013). Generally, simplification facilitates processing existing information in a given decision situation and refers only to available information that is simplified (e.g., by translating it into plain language or understandable numerical formats). By contrast, reducing the number of options available to facilitate processing does not count as a simplification because it changes the decision structure and goes beyond information translation.

Make information visible (A2). Frequently, the information necessary for making a decision or for changing behavior is not apparent or readily available. For example, the daily amount of calories we consume can be made available for decision making by simple measurement and disclosure. Many current approaches to public policy strive to provide easier access to information that is normally invisible, such as annual credit card statements informing consumers how they have used their credit card or energy performance certificates containing information about house insulation (cf. Cabinet Office, Behavioural Insights Team, 2011b, chapter 1).

Make own behavior visible (feedback). Feedback can have a powerful influence on behavior (Hattie & Timperley, 2007). In particular, behavioral

consequences are often invisible in situations where feedback is infrequent or temporally and spatially disconnected from decision making. Such a lack of feedback manifests in both common behaviors (people taking a shower lack feedback on their consumption of water and energy) as well as infrequent situations (the annual utility bill aggregates a multitude of past energy consumption behaviors). More direct feedback on behavior can have various forms, including smart electricity meters displaying energy consumption (Jessoe & Rapson, 2014) as well as segmentation cues, such as including a red potato chip for every five chips, allowing an individual to track the amount of food already consumed (Geier, Wansink, & Rozin, 2012). In many cases, providing feedback about one's own behavior counteracts the constraints in attention and processing capacity that make this information inaccessible in daily life. Tools and devices that provide feedback (such as pedometers for counting steps) are becoming increasingly popular as part of a recent trend in self-optimization (Lubans, Morgan, & Tudor-Locke, 2009).

Make external information visible. Apart from the consequences of one's own behavior, much external decision-relevant information is also frequently unavailable, and making this information visible can empower decision makers. For example, when information about restaurant hygiene was bundled and conveniently displayed at the front door with a colored label, people could more easily choose to avoid unsanitary restaurants and the incidence of food-borne disease was reduced (Simon et al., 2005). Sponsor-a-child programs work similarly by ensuring the visibility of the donation's purpose (Small & Loewenstein, 2003). The visibility of relevant information is already a key tenant of consumer-protection (e.g., food nutrition labelling). The American government website www.data.gov provides another example of a large-scale attempt to facilitate access to external information. In contrast to feedback which is, in principle, available but requires effort to obtain, external information as mentioned in the examples above usually remains inaccessible if it is not made visible through choice architecture.

Provide social reference point (A3). People neither make decisions nor behave in total isolation, but in a social and cultural environment. Within this environment, the behavior of others influences the behavior of the individual and serves as a social reference point (Cialdini & Goldstein, 2004). The behavior of other people can appear in the form of group behavior or behavior of specific persons valued for special

reasons, such as knowledge, fame, group membership, or a specific function (teacher, parent, or role model). Providing such social reference points is therefore a choice architecture technique that encompasses Allport's (1968) observation that "the thought, feeling and behavior of individuals are influenced by the actual, imagined, or implied presence of others" (p. 3).

Refer to descriptive norm. Descriptive social norms depict the observable behavior of other people, i.e., what others actually do, in contrast to injunctive norms describing what one *should* do (Bicchieri & Xiao, 2009; Cialdini, Reno, & Kallgren, 1990). Choice architecture interventions which refer decision-makers to pertinent descriptive norms might draw on a variety of cognitive processes. According to Cialdini and Goldstein (2004), what drives people to follow norms is situational ambiguity and behavioral uncertainty combined with the goals to behave appropriately, receive approval, and maintain a positive self-concept. This manifests, e.g., in experiments on the bystander effect, in which people ignored smoke in a room if other people in the room ignored it (Latane & Darley, 1968). The need to belong (cf. social identity theory, Tajfel & Turner, 1986) and the fear of ostracism (cf. Cialdini & Goldstein, 2004) are further drivers for aligning one's behavior with others.

Empirical evidence about the efficiency of social norms comes from various fields. People informed about the energy consumption or recycling behavior of their neighbors adjusted their own behavior as a consequence (Allcott & Mullainathan, 2010; Cotterill, Moseley, & Richardson, 2012; Dolan & Metcalfe, 2013; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). In a classic study, the reuse of towels in a hotel room depended on the information people were given stating whether other hotel guests had used their towels more than once (Goldstein, Cialdini, & Griskevicius, 2008). Aside from environmental behavior, social norms have been shown to help lessen student substance abuse by pointing out that the majority of students do not drink to excess (DeJong et al., 2006; Perkins, 2003). Contributions to charity (Shang & Croson, 2009), environmental protection behaviors (Cialdini, 2003), and voting in elections (Bond et al., 2012; Gerber & Rogers, 2009) are also influenced by social norms. As all techniques, referring to the descriptive norms might also work contrary to the intention of the choice architect. Complaints about low voter turnout or teacher absence in developing countries can worsen such problems by the same process that can be used to improve

them: the contagious impact of others' behavior (Chaudhury, Hammer, Kremer, Muralidharan, & Rogers, 2006).

Refer to opinion leader. As known from dual processing models (Chaiken, 1980; Petty & Cacioppo, 1986), the source of information matters in addition to its contents. Highly valued, respected messengers (e.g., experts or role models) can influence opinions and behavior. From advertising to communicating health topics or technological innovation, opinion leaders are used as information disseminators to improve the impact of campaigning (Leonard-Barton, 1985; for a review, see Valente & Pumpuang, 2007). In development aid, changing the behavior of opinion leaders has been shown to improve the acceptance of safer and healthier non-traditional cook stoves (Miller & Mobarak, 2013). This technique makes use of peripheral processing (Petty & Cacioppo, 1986). With increasingly far-reaching social networks and heightened complexity in many domains, opinion leaders appear to be powerful social reference points, and thus this intervention technique can be a useful tool for choice architects.

Decision structure

A choice architect will not always be able to influence information presentation and as a consequence may be unable to use one of the techniques described above. In such cases, the choice architect can revert to techniques addressing the decision structure, i.e., the arrangement of options and the decision making format, which includes setting defaults, rearranging the composition of options, and changing option-related efforts or consequences.

Change choice defaults (B1). Defaults are pre-selected options that leave decision makers the freedom to actively select a different option. Research has shown that in many situations people accept the default. This effect is present in both minor decisions such as online privacy settings (Johnson, Bellman, & Lohse, 2002) and more important decisions concerning pension savings (Thaler & Benartzi, 2004), end-of-life-care (Halpern et al., 2013), and organ donation (Johnson & Goldstein, 2003). The effect of defaults on behavior is caused by a number of different processes, including effort reduction, implied endorsement, and the unwillingness to give up the status quo when it is understood as an endowment (Dinner et al., 2011; McKenzie et al., 2006).

Set no-action default. No-action defaults "refer to what happens in the absence of choice" (Dinner et al., 2011, p. 332) and can range from universal mass defaults to custom-made personalized defaults based on past behavior or past choices (Goldstein, Johnson, Herrmann, & Heitmann, 2008; Sunstein, 2013). Clever defaults can also help bridge the gap between intentions and behavior, such as in the choice of green electricity, which is favored by far more people than those who actually opt for it. When green energy was the default in a field experiment, more people used green energy compared to the traditional grey energy that was offered as the default in most communities (Pichert & Katsikopoulos, 2008; Sunstein & Reisch, 2013). Other fields in which setting defaults is used as a choice architecture intervention are financial behavior (Beshears, Choi, Laibson, & Madrian, 2009), medical decision making (Ansher et al., 2014), and health care (Halpern, Ubel, & Asch, 2007). Even room temperature in offices depended on the default in a field experiment, although not when the default setting was too extreme (Brown, Johnstone, Haščič, Vong, & Barascud, 2013).The size of a unit (e.g., a cup, a plate, a suitcase) also serves as a default. In restaurants, it may often be plate size rather than hunger which determines how much people eat (Wansink, 2006), as plate size is often taken for granted as an indicator of the appropriate amount of food (Geier, Rozin, & Doros, 2006; Kallbekken & Sælen, 2013). As illustrated by these very heterogeneous examples, default-setting can be applied successfully to promote behavior change in many different fields. Successfully using defaults in choice architecture is easier with homogeneous target groups. For controversial decisions or for very heterogeneous target groups, determining the optimal default can prove difficult (Choi, Laibson, Madrian, & Metrick, 2003).

Use prompted choice. For heterogeneous target groups, prompted choice, i.e., forcing people to actively decide without a preexisting default, can be more suitable than defaults. Prompted choice avoids the status-quo bias or default effects due to inertia or assumed recommendations. However, enforcing active choice and deliberation may give cognitive biases more influence due to greater reflection (Amir & Lobel, 2008). Thus, one bias (status quo bias) might just be replaced by another bias (e.g., choice aversion). As discussed by Sunstein (2014), further complexities might arise through prompted choice especially when people actively "choose not to choose". With the power and limits of defaults in mind, it must be a case by case decision of the choice architect whether to actively set defaults or make a decision mandatory. In any case,

knowledgeable choice architects can avoid disadvantageous defaults, such as one-sided printing preselected at most printers (Egebark & Ekström, 2013).

Change option-related effort (B2). The effort involved in choosing an option plays an important role in determining which of several options people choose. The higher the effort for choosing an option, the more this effort acts as a barrier. However, to qualify as choice architecture and differ from standard economic transaction costs, the change in effort should only be marginal which excludes imposing unsurmountable (economic or behavioral) costs on the decision maker (which would clearly not be in line with the metaphor of just giving a slight 'nudge', either). What exactly counts as a marginal effort is difficult to quantify and differs between situations and people but relatively little extra effort should not justify behavior change on rational grounds. Changing physical or financial effort modifies the decision structure. Note that choice architects can also modify the cognitive effort required; however, this alters the way decision-relevant information is presented and is thus covered in the section on decision information.

Increase / decrease physical effort. The physical effort necessary to realize a behavior is determined by a variety of factors, such as the accessibility or distance of a target object. The little extra effort introduced by a choice architect should not justify behavior change according to a rational cost-benefit analysis or else efforts would be standard economic transaction costs. Still, these marginal physical facilitations or barriers can lead to significant behavior change. Making an apple easier to grasp than less healthy alternatives is discussed as an example for promoting healthy choices in a situation where hunger or appetite deplete self-control, leading to regrettable decisions. More generally, facilitating access to healthy food options and increasing the effort needed to choose the unhealthy option by "changing places" (Ashe, Graff, & Spector, 2011) can support people in their intention to eat healthier (Wansink, 2004). In development aid, decreasing the effort for farmers to get fertilizer simply by delivering it to them helped raise fertilizer use and thus increased crop yield (Duflo, Kremer, & Robinson, 2011). The effort to clear out the attic entailed by opting for installing an energy-saving insulation is another example for a physical effort that functions as a "hassle factor" (Caird, Roy, & Herring, 2008) for people to use more efficient insulation.

Increase / decrease financial effort. We suggest the term "financial effort" to designate issues paralleling the concept of physical effort in decisions concerning

financial transactions. Independent of the actual amount in question, people perceive the realization of financial transactions as more or less costly. Choice architects can intervene to change the factors determining this perception of financial effort. Note that the economic fundamentals of an option such as the final price remain unchanged or else the technique would not differ from classical benefits. Examples include postponing costs to the future without changing actual final costs. This intervention was suggested by the British government in their "Green Deal": allowing citizens to pay for more energy efficient appliances or technologies using the savings generated by these should reduce the barrier of adopting green technology which pays off in the long run but poses high costs immediately (Cabinet Office, Behavioural Insights Team, 2011a). The otherwise discouraging financial effort tied to an investment that ultimately pays off is thus spread out over a larger period and perceived as smaller. Human tendencies to discount the future (costs and benefits) more than the present and limited self-control lead to different perceptions of the effort connected to a financial transaction depending on its timing (Loewenstein & Prelec, 1992; O'Donoghue & Rabin, 1999). Correspondingly, people save more money if they can opt for raising the amount saved in the future as opposed to increasing it on the spot (Thaler & Benartzi, 2004). The same applies to donations: when people were asked to increase their donations starting in the future ("Give more tomorrow"), the increase in donations was 32 % higher than in a control group asked to give more immediately (Breman, 2011). Furthermore, small but frequent donations are not perceived to be as costly as single large donations. Choice architects can make use of this so called "peanuts effect" (Weber & Chapman, 2005) by shaping the perception of effort connected to a financial decision.

Change range or composition of options (B3). Choice architects can not only change *how* something is presented but also *what* is presented to influence the relative attractiveness of choice options (Chang & Liu, 2008). Assuming that fixed preferences do not always guide behavior entails that many preferences are constructed in the decision situation and thus depend heavily on the alternatives offered (Ariely, Loewenstein, & Prelec, 2003; Slovic, 1995). For example, decoy alternatives (Huber, Payne, & Puto, 1982), i.e., the introduction of additional expensive options, are used strategically to influence consumer decisions (Heath & Chatterjee, 1995).

Change categories / grouping. Because resources like money or time are limited for most individuals, they have to be allocated across different goals following

some rationale. This necessity is a gateway for cognitive biases, among them the diversification bias, i.e., the tendency to divide resources by the amount of available categories and allocating them evenly (Fox, Ratner, & Lieb, 2005). A related bias is mental accounting (Thaler, 1999), i.e., treating a fungible resource like money as non-fungible between purposes (borrowing money to avoid taking money from a savings account). Studies have also found that a higher amount of money is spent when it appears in small units ($1 bills) than larger units ($20 bills) (labeled "denomination effect" by Raghubir and Srivastava, 2009). Allocation biases, such as the diversification bias, variety seeking, mental accounting, and the denomination effect, have a large influence on how people allocate available resources in decision situations. A choice architect can thus tactically arrange the respective categories or allocation alternatives, such as segregating healthy options into more diverse categories (Kahn & Wansink, 2004), partitioning safety and style attributes of a car differently (Martin & Norton, 2009), or presenting more fine grained, segregated charity purposes instead of presenting an overall goal (Fox et al., 2005).

Change option consequences (B4). Choice architects can also modify the consequences of decision options. This appears similar to incentivizing or disincentivizing particular behaviors. However, in contrast to the classical rational choice cost-benefit paradigm (according to which considerable (monetary) reasons for or against a behavior are provided), choice architecture provides 'micro-incentives', i.e., changes of the consequences of decision options that are insignificant from a rational choice perspective (e.g., providing an improbable chance of winning a lottery or requiring middle class shoppers to pay five cents for a shopping bag, cf. Homonoff, 2012). If this kind of intervention is effective, the choice behavior is affected by processes aside from rational cost-benefit analyses. From an intervention perspective, one can distinguish the manipulation of small, individual monetary benefits/costs from the social consequences of a choice option.

Connect decision to benefit or cost. Independent of the effort directly entailed by realizing a behavior (cf. above), the behavior might trigger additional costs or benefits. Connecting a desired behavior to a small benefit or an undesired behavior to a small cost changes the probability of occurrence, even if the respective benefit or cost is too small to "significantly [change the] economic incentives" (Thaler & Sunstein, 2008, p. 6). While we acknowledge that it is difficult to draw a hard line separating "significant"

from "insignificant" incentives, there are some clear examples. In one study, introducing a five-cent tax for shopping bags substantially reduced bag-use in US middle class supermarkets (Homonoff, 2012), but five cents is not a significant monetary incentive to middle class shoppers. In another study, offering participation in a lottery for each day that people took their medication properly generated an insignificant chance for a small payoff but did increase the regularity of taking medication (Volpp et al., 2008). In line with Thaler and Sunstein (2008), we posit that interventions involving such "micro-incentives" as a 5 cent tax for shopping bags are different from classical incentive schemes such as 35 % price cuts. However, it is not yet understood precisely how micro-incentives work. Lotteries might harness the tendency to overweigh small probabilities, whereas a micro-tax or the prospect of missing out on a small benefit already mentally booked as property might harness loss aversion. Note that choice architecture cost/benefit interventions serve as *additional* motivators for people, not as persuasive arguments as in advertising.

Change social consequences. The range of consequences that a choice option might have for an individual extends beyond (small) monetary costs and benefits. For example, consequences might also concern the social integrity of the individual. Choice architects can connect the choice of a specific option with the consequence to be regarded more positively or more negatively by others. This might draw, e.g., on image motivation as the desire to be liked and well-regarded by others, a concept which has been suggested to be "a driver in prosocial behavior" (Ariely, Bracha, & Meier, 2009). Likewise, competitive altruism (Barclay & Willer, 2007; van Vugt, Roberts, & Hardy, 2007) and costly signaling theory (Glazer & Konrad, 1996; Griskevicius et al., 2007) have been proposed to explain altruistic decisions through the socio-communicative messages associated with altruistic behavior and the desire for social approval. In addition to demonstrating socially desirable behavior, altruistic decisions signal the ability to spend money, time or effort on these decisions without suffering from disadvantages. In one study, activating status motives made people choose environmentally friendly products more often in a public situation where positive self-presentation through choice-behavior was possible (Griskevicius, Tybur, & van den Bergh, 2010). Choice architects can create such self-serving presentation possibilities for a desirable behavior. As an example for connecting a behavioral alternative to negative social consequences, in the Grameen model of microcredit a loan is given to each

member of a group only after the previous loan receiver has returned the loan. Not repaying is thus connected to the consequence of peer pressure by the others waiting for their loan (Auwal, 1996).

Decision assistance

Besides working on information and options, choice architects can provide decision-makers with further assistance to help them follow through with their intentions. To do so, choice architects can remind individuals of the preferred alternative in the decision situation and foster deliberate commitment to beneficial actions.

Provide reminders (C1). Within the daily flood of information and new stimuli, information that is salient and easy to access has a higher chance of guiding behavior and decisions. Oftentimes, however, important information is not salient and thus, due to limits in attention and cognitive capacity, it is not considered. Choice architects can intervene by providing positive reminders that heighten the salience of a desired option, e.g., reminding people of socially desirable concepts such as voting (Greenwald, Carnot, Beach, & Young, 1987) or honesty (Shu, Mazar, Gino, Ariely, & Bazerman, 2012). More specifically, reminding bank clients via text messages or letters of saving more increased savings in a field study, especially if reminders highlighted particular savings goals (Karlan, McConnell, Mullainathan, & Zinman, 2010). In addition to providing positive reminders, choice architects can also intervene to oppress cues which remind people of an undesired option. Choice architects can diminish the salience of undesired options or external cues that hint towards them by, e.g., putting unhealthy food in non-see-through containers (Wansink, Just, & Payne, 2009), or positioning unhealthy food options in the middle of the menu instead of at the beginning or at the end where they would have primacy or recency advantages of being chosen (Dayan & Bar-Hillel, 2011; Li & Epley, 2009).

Providing reminders should not be confused with the *make information visible* technique, which refers to making previously unknown or inaccessible information accessible to decision makers; providing reminders only changes the position of familiar stimuli by moving them into or out of the attention focus.

Facilitate commitment (C2). Private or public commitment towards certain behaviors makes individuals more likely to follow through because it counteracts self-control problems. Deviations lead to cognitive dissonance or the need to justify the

deviation in front of others. Facilitating commitment is thus a way to help people to overcome constrained self-control and bridge the intention-behavior gap.

Support self-commitment. As research on self-commitment has shown, people understand their own deficits in self-control such as temptation or procrastination and try to work against them by self-imposing deadlines (Ariely & Wertenbroch, 2002). Commitment devices, i.e., arrangements "with the aim of helping fulfil a plan" (Bryan, Karlan, & Nelson, 2010, p. 1), such as websites offering to formalize a commitment and set up a penalty for deviance (e.g., www.stickk.com), are choice architecture interventions tailored to support willpower when it reaches its limits. Other suggestions include addicted gamblers putting their name on a ban list (Thaler & Sunstein, 2008), browser applications blocking internet access for specific times, or depositing money to foster smoking cessation (Giné, Karlan, & Zinman, 2010). Among the processes harnessed by many of these self-commitments is cognitive dissonance that arises when goals (commitments) and action (behavior, decisions) are inconsistent.

Support public commitment. In a similar vein, commitments can be made in front of other people, thus introducing another "supervisor" in addition to the self. Publicly committing to a behavior (working out) or to refrain from a behavior (smoking) creates external pressure and possibly negative consequences in case of breaking the commitment (like face-management problems or a heightened need to justify one's behavior). Effects of public commitment have been found in studies on recycling behavior (Cotterill, John, Liu, & Nomura, 2009; DeLeon & Fuqua, 1995), weight loss (Nyer & Dellande, 2010), or formalized agreements between parents and schools (Evans, Hall, & Wreford, 2008). The degree of formality of public-commitment interventions can vary from simple public announcements or pledges up to formal written agreements, but in all cases the commitment is voluntary, preserving freedom of choice as in any choice architecture technique. The choice architect's task is to create and support public commitment possibilities.

Note that *public commitment* and *changing the social consequences* of a decision may work due to the same process (social pressure) but still represent separate interventions, as they are of different intervention types: connecting a choice to a social consequence (e.g., publicly appearing as an altruist / egoist) is a different intervention than providing an opportunity for public commitment. Public commitment likely does not work exclusively due to anticipated social pressure but also due to further processes

like preference for consistency (Cialdini, Trost, & Newsom, 1995). This illustrates our claim that, even if we separate interventions from processes, process overlap between intervention techniques remains possible. However, this overlap is exactly what allows the choice architect to design interventions: while she might not be able to install a commitment device, she might be able to connect a decision option with a positive social consequence. Thus, the separation of intervention techniques that work partially due to the same processes ensures the greatest flexibility for the choice architect to design intervention strategies.

Discussion

We have proposed a theoretical framework for choice architecture consisting of nine intervention techniques inductively derived from an analysis of documented empirical examples of choice architecture. The techniques target the provision of *decision information*, changes in the *decision structure*, and measures of *decision assistance.* These techniques structure options for designing choice architecture *interventions* as opposed to the underlying processes (cognitive biases or mental constraints) and thus belong to the prescriptive branch of the judgment and decision-making tree (cf. Baron, 2010). A potential benefit of a systematic framework of techniques summarizing concrete cases is its power to sharpen the concept of choice architecture in a bottom-up approach.

The nine techniques are conceived of as ideal types which can be found in different combinations in real-world situations. Furthermore, as we have pointed out, differentiating between the techniques is ultimately an issue of definition (cf. *reminders* vs. *make visible* or *public commitment* vs. *social consequences*). While the chosen method of inductive category development facilitates the development of a testable taxonomy, both throughout category development (developing definitions) and in using the categories (applying the definitions), subjective decisions are unavoidable. Hence, raters may disagree on the correct classification of a specific intervention, in particular if raters differ by educational background, training, or experience. On the other hand, a quantitative method to reduce data and detect latent categories like multidimensional scaling, even if requiring less interpretation, would hardly lead to a sufficiently fine-grained solution. This holds true, in particular, for categorizing choice architecture interventions which cannot easily be transformed into numerical data but are available as text data. Qualitative

differences between such interventions are thus better captured using a qualitative method. It is important to take measures to maximize intersubjectivity, both during category development (all cases were discussed by at least three researchers) and after finalizing category development. Therefore, inter-rater agreement in applying the categories was tested with four independent raters. The resulting kappa coefficient reflects the expectable amount of subjectivity involved while still allowing to conclude that the categories have proven inter-subjectively replicable.

Given the growth of new evidence from the heterogeneous field of choice architecture, we expect an inductively generated framework such as the one we propose to further develop in the future. As this is a cumulative process, additions are likely (Michie et al., 2008), but we assume that additions will primarily concern the subtypes which illustrate the techniques rather than representing an exhaustive list of subcategories.

We agree with Lunn (2012), who concludes in a review on choice architecture in policy making that the field is too complex to suggest a straightforward toolkit for generalists. Instead of a toolkit, we suggest that choice architects use the nine techniques to determine which one could be applicable to a specific challenge. By synthesizing evidence and providing a method to structure and evaluate interventions, taxonomies support the transfer of and access to successful interventions (Michie, Jochelson, Markham, & Bridle, 2009). This has been demonstrated domain-specifically, e.g. in public health (Michie et al., 2012) as well as across domains (Michie et al., 2013). Similarly, the presented framework is expected to facilitate the identification of potentials (generalizations) and pitfalls. Specific life circumstances (e.g., poverty, see Mani, Mullainathan, Shafir, & Zhao, 2013) or interpersonal differences (Beshears, Choi, Laibson, & Madrian, 2010) might impede transfer of interventions across situations. Thus, empirical testing remains crucial for clarifying what works.

To date, empirical evidence on the limitations and success conditions of choice architecture remains scarce (see Heilmann, 2013 for a methodological perspective on success conditions). Setting aside those situations in which choice architecture is not the most promising approach, it is clear that where it works, it likely provides a less costly way to change behavior than alternative measures. If we have a clearly defined target behavior and understand how cognitive biases or constraints affect the behavioral target-actual gap, then the proposed framework can contribute to designing promising testable choice architecture interventions.

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Table 1

Choice architecture categories and techniques

Category		Technique	
D.	Decision information	A 1	Translate information *Includes: reframe, simplify*
		A 2	Make information visible *Includes: make own behavior visible (feedback), make external information visible*
		A 3	Provide social reference point *Includes: refer to descriptive norm, refer to opinion leader*
E.	Decision structure	B 1	Change choice defaults *Includes: set no-action default, use prompted choice*
		B 2	Change option-related effort *Includes: increase/decrease physical/financial effort*
		B 3	Change range or composition of options *Includes: change categories, change grouping of options*
		B 4	Change option consequences *Includes: connect decision to benefit/cost, change social consequences of the decision*
F.	Decision assistance	C 1	Provide reminders
		C 2	Facilitate commitment *Includes: support self-/public commitment*

8 Paper 2: Nudge me if you can

how defaults and attitude strength interact to change behavior

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Nudge me if you can -

how defaults and attitude strength interact to change behavior

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Abstract

Defaults (i.e., preselected options that become effective without active choice) are becoming increasingly popular as the idea of nudging enters the political arena. Their interplay with individual attitudes is largely unknown. In two preregistered and highly powered experimental studies, we examined how defaults and attitudes interact to influence decision-making. In both studies, we manipulated the default electricity provider (gray versus green electricity sources) and measured environmental attitudes and attitude strength. The default manipulation and measures of attitude strength independently predicted people's choices. Yet, we found no compelling evidence for an attenuated default effect for participants with strong preexisting attitudes. Implications for the concept of libertarian paternalism and the use of green defaults as a means for policymakers to foster pro-environmental choices are discussed.

Keywords: defaults, attitude strength, choice architecture, nudge, ecological behavior

Nudge me if you can - How defaults and attitude strength interact to change behavior

After the initial publication of the status quo bias and its consequences on choices (Samuelson & Zeckhauser, 1988), defaults have become a prominent concept in the discussion about how to apply behavioral insights to policy making and directed behavior change (Dolan et al., 2012; Shafir, 2012). Selecting a default, i.e., an option that becomes effective when no active choice is made, can be applied to various contexts, such as medical decision making (Ansher et al., 2014; Halpern et al., 2013), consumer choices (Brown & Krishna, 2004), or online privacy (Johnson, Bellman, & Lohse, 2002). Among the most frequently cited effects are the influence of defaults on organ donation (Johnson & Goldstein, 2003) and on contributions to retirement saving plans (Madrian & Shea, 2001). Another prominent field of application for choice architectures influencing behavior and decision making is environmental policy (Sunstein & Reisch, 2014) where defaults were used to explain the differences in adoption rates of renewable energy in German cities (Pichert & Katsikopoulos, 2008).

Several processes have been suggested to cause default effects. All have received some empirical support without one explanation having emerged as the dominant yet. Decision inertia and the avoidance of cognitive or physical effort provide an explanation as to why people avoid making an active decision and stick to a default even if they do not actively endorse this default. Others have demonstrated the informational function of defaults as "implied endorsements" (McKenzie, Liersch, & Finkelstein, 2006). In several studies, defaults were perceived as indicators of the recommended action, for example, concerning organ donation and enrollment in saving plans (McKenzie et al., 2006). Defaults might also function due to reference dependence when they are perceived as endowments (Park, Jun, & MacInnis, 2000) and every attempt to depart from this endowment makes the resulting "losses loom larger than gains" (Tversky & Kahneman, 1981). This mechanism has been explained with query theory predicting that defaults influence the number, position and valence of queries concerning the default and non-default options (Dinner, Johnson, Goldstein, & Liu, 2011).

Much of the research on default effects is conducted as natural field experiments or macro-level case studies demonstrating how the situational setup can influence choices. This approach has clear advantages in explaining existing phenomena like differences in organ donation rates between similar countries (Abadie & Gay, 2006; Johnson & Goldstein, 2003) or changes in the use of green energy over time (Pichert

& Katsikopoulos, 2008). Other field studies report default effects on financial decisions (Choi, Laibson, Madrian, & Metrick, 2003; Madrian & Shea, 2001), end-of-life treatment preferences (Kressel, Chapman, & Leventhal, 2007), and online privacy (Johnson et al., 2002). Yet, this approach also bears disadvantages. Default effects are only sporadically tested, replicated and explained (see also Ölander & Thøgersen, 2014). Causality is also difficult to demonstrate in macro-level comparisons. For these reasons, the straightforward recommendations for policymakers presented in many articles are somewhat surprising and may be premature (as, e.g., in Keller, Harlam, Loewenstein, & Volpp, 2011, p. 376; Smith, Goldstein, & Johnson, 2013). Indeed, policy makers in the United Kingdom have recommended not changing the default policy for organ donation in 2008 and maintaining the explicit consent policy (House of Lords, 2008, p. 60). Thus, to avoid possible downsides like reactance (Brown & Krishna, 2004) or regret (Brown, Farrell, & Weisbenner) and to underscore recommendations for the effectiveness of defaults with reliable data, more experimental demonstrations are warranted.

That being said, default effects have been demonstrated in controlled experiments, most of them using hypothetical choices and self-reports as dependent variables. These studies cover domains such as organ donation decisions (Johnson & Goldstein, 2003), choices of light bulbs (Dinner et al., 2011) and electricity providers (Pichert & Katsikopoulos, 2008), decisions about advance directives (Halpern et al., 2013), consumer goods (Lu & Xie, 2014), and recruitment rates for patients in medical research (Junghans, Feder, Hemingway, Timmis, & Jones, 2005).

Moderators of default effects

Policy makers and the general public have criticized the use of defaults in policies as undue manipulation by working non-transparently (Hansen & Jespersen, 2013). If valid for default manipulations, defaults would have to make use of cognitive weaknesses and be able to overrule pre-existing preferences. Indeed, the idea that defaults would be accepted despite being counter-attitudinal seems difficult to reconcile with the liberty-preserving promise inherent in the use of defaults (Thaler & Sunstein, 2003). In defense, proponents argue that interventions from the choice architecture toolbox are "asymmetrically paternalistic" (Camerer, Issacharoff, Loewenstein, O'Donoghue, & Rabin, 2003) because they influence choices differently depending on the decision maker's preferences. Support for this notion comes from Fox, Ratner, and Lieb (2005) who demonstrated that partition dependence (i.e., the tendency to diversify ones

choices dependent on the categories offered) is moderated by experience (Study 5) and salience of preferences (Study 6). The same moderation has been discussed for default effects, e.g., by Johnson and Goldstein (2003, p. 1339) who claim: "If preferences […] are strong, we would expect defaults to have little or no effect". Yet, the interplay of default manipulations and individual attitudes lacks clear experimental evidence.

Results from research on moderating factors that might differentially influence whether a default leads to behavior change or not are mixed. Socio-demographic variables and experience did not moderate the influence of a participation vs. non-participation default in an online study (Johnson et al., 2002). However, high social intelligence (Brown & Krishna, 2004) and the social role of being an advisor rather than a decision maker reduced default effects (Lu & Xie, 2014). Similarly, when people had specific plans on how to spend tax refunds, default refund allocations did not influence their spending decisions (Bronchetti, Dee, Huffman, & Magenheim, 2011). A high level of experience concerning environmental issues is also assumed to attenuate the influence of defaults on pro-environmental decisions (Löfgren, Martinsson, Hennlock, & Sterner, 2012), but experience was neither measured directly nor manipulated thus impeding causal interpretations. In an experiment on the interplay of financial literacy and investment decisions, high literacy attenuated the propensity to stay with the default investment (Agnew & Szykman, 2005).

These findings suggest that interindividual differences like knowledge or experience influence whether people stick to a default or not. This fits with the claim that strong attitudes attenuate the influence of defaults. The amount of experience and time spent with an issue are important aspects of the attitude strength concept. Thus explaining the absence of default effects by claiming strong pre-existing attitudes seems reasonable (Sunstein & Reisch, 2014). Yet, the role of strong attitudes as, for example, reflected by high subjective importance and centrality of an issue has not been directly investigated. Instead, several indirect proxies for attitude strength (experience, financial literacy, specific plans) have been used to demonstrate moderators of default effects. The conceptual overlap between these proxies and attitude strength suggests that the latter may play a role in understanding the influence of defaults on behavior and choices. Before examining a possible influence on default effects, we will shed some more light on the broader concept of attitude strength.

Default effects and attitude strength

According to Krosnick and Petty (1995), strong attitudes are persistent, resistant, and exert influence on cognition and behavior. As such, external cues such as defaults should become less influential (Chaiken & Baldwin, 1981) and strong attitudes towards the decision for which a default option exists might override the default and moderate its effect on behavior. Attitude strength has been found to moderate the influence of salient behavioral information on self-perceptions (Chaiken & Baldwin, 1981). People with weak attitudes were more influenced by salient past pro-environmental or past anti-environmental behaviors than people holding strong attitudes.

Attitude strength has been conceptualized as a multi-facetted construct consisting of several different dimensions (Krosnick, Boninger, Chuang, Berent, & Carnot, 1993). We focus on importance, certainty, personal relevance, elaboration, subjective knowledge, and ambivalence to assess attitude strength comprehensively and explore the individual influence of each dimension. Importance depicts the degree of caring for the attitude. Certainty reflects the amount of confidence with which a person holds an attitude and is closely linked to personal relevance which refers to the extent that a topic "holds significant consequences" (Wegener, Downing, Krosnick, & Petty, 1995, p. 470). The amount of thought devoted to a topic is depicted in the elaboration dimension (see Petty, Haugtvedt, & Smith, 1995). The fifth dimension discussed here, subjective knowledge, refers to the belief about one's own information on the topic. This might differ from actual, objective knowledge as measured in a test. Finally, ambivalence is the amount of mixed positive and negative evaluations of a topic (for a detailed review of strength dimensions, see Petty & Krosnick, 1995). Some of the discussed proxies for attitude strength used in research on default effects map directly onto these dimensions and suggest the same direction of effects, e.g., financial literacy (knowledge) or experience (knowledge, elaboration). Other dimensions have not been tested but have been discussed as attenuating default effects (e.g., importance and personal relevance, see Sunstein & Reisch, 2014, p. 128). For these reasons, we assume the same direction for the individual dimensions' influence on default effects.

Our hypothesis is that defaults predict behavior particularly in the absence of strong attitudes. This hypothesis can be derived separately for the different causal mechanisms of default effects sketched before. *Implied endorsement* should be less important in the face of strong a priori attitudes especially when confidence and certainty are high.

Holding a more pronounced attitude for an alternative should also lead to a higher willingness to invest *effort* to change the default especially when attitude importance is high. Strong attitudes should attenuate *endowment effects* caused by defaults and thus departing from the default should be viewed less as a loss the stronger an attitude is. This implies that defaults can be understood as endowments and evoke loss aversion only when they are either in line with existing attitudes or are applied in the absence of strong attitudes. Finally, strong attitudes towards an action should render the action a starting point for deliberation as is the case for highly accessible attitudes, counteracting the effects of the default option on the sequence of *queries*.

To test the moderating effect of attitude strength on default effects, we propose two consecutive studies in the realm of environmental decision making. Our target behavior is the choice of an electricity provider. People are usually customers of a local provider by default but may change to any other provider. The environmentally relevant choice is between electricity from either renewable energy sources such as wind, solar power, and water (labelled "green electricity") or non-renewable sources such as nuclear power and fossil fuels (labelled "gray electricity"). At the time the study took place, renewable energy and green electricity had been on the political agenda in Germany for almost five years. In Experiment 1, we replicate an existing experiment to examine the robustness of the default-effect and add measures of attitude strength. In Experiment 2, we manipulate rather than measure attitude strength to examine its moderating effect on default effects.

Experiment 1

Experiment 1 investigated choices between a green and a gray electricity provider. Although this was not a direct replication of the study by Pichert and Katsikopoulos (2008), due to a different sample and sampling method as well as further questions, we tried to stick to the original experiment as closely as possible by using the material from the original experiment.

Methods

Power analysis

The required sample size for a planned power of 80% (two-tailed, $\alpha = .05$, $Pr(Y = 1 | X = 1)$ H0 = .6) was calculated with G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) using odds ratios (OR). Pichert and Katsikopoulos (2008) reported an effect size of $\Phi =$

.26 for the main effect of default condition. This translates into an odds ratio of 2.9. For sample size calculations we conservatively assumed a lower effect size of OR = 2 which results in a minimum overall sample size of 308 to detect a main effect of default condition. It can further be assumed that the effect of environmental attitude on choices is at least medium sized. Thus, it is reasonable to assume an odds ratio of at least 1.5, which results in a necessary sample size of 215 to detect the main effect of attitude. Because no prior studies on the attitude strength by default interaction exist, we conducted a sensitivity analysis with $N = 308$ which revealed an odds ratio of 1.4 for the interaction. To allow for potential participant exclusions, we planned a sample size of 350 to test for the hypothesized main effects and the interaction.

Participants

Data was collected via the German online panel Social Science Survey (Leiner, 2014) which sends out a link to the study based on previous response rates and the planned sample size. Because panelists are free to fill out the survey any time within a two-week period stopping data collection after reaching the planned sample size was not possible. An unexpectedly high response rate lead to a sample size of $N = 600$ participants despite the planned sample size of only 350. The Poisson distribution of participation time stamps lends credence to the fact that data was collected in a single experimental wave. To account for this deviation from the preregistered sample size but simultaneously make use of the larger sample, we also included calculations for the planned sample size in Appendix C. Mean age of the sample was 36.1 years ($SD = 13.7$), 61% were female, 36% male, and 3% did not indicate gender. Among all participants, 25 vouchers worth 25 Euros each were raffled.

Procedure

The procedure was followed exactly as preregistered. Participants were confronted with the choice between two electricity providers equal to the scenario used by Pichert and Katsikopoulos (2008, see Appendix A for material). They were told to imagine that they had moved to another town and that, per default, they had become customers of an electricity provider. About this provider, they received the name and information about monthly costs. The default electricity provider was varied between participants to be either a green electricity provider, exclusively relying on renewable energy sources, or a gray, low cost electricity provider, providing electricity from an unidentified mix of

energy sources. In the original experiment, a neutral condition was also included and yielded almost identical results as the green default. Likewise, in other studies, the neutral condition was very similar to one of the default conditions rather than being located between them (Toft, Schuitema, & Thøgersen, 2014). Because we were mainly interested in the default effect and less in the "genuine" preferences for electricity providers in the absence of defaults, we dropped this condition and focused exclusively on the two default conditions.

After having chosen one option, participants were probed whether they remembered the default electricity supplier correctly and had read the text. They were then asked to rate the two providers on 7-point scales (very negative to very positive) for their environmental impact and pricing policy. Following the original experiment, participants also ranked five attributes (company reputation, environmental impact, location of provider, quality of service, price) according to their relevance for choosing an electricity provider. Participants then filled out the environmental attitude and attitude strength measures. Before being debriefed and thanked for participation we asked participants whether they would be willing to participate in a follow-up study several weeks after the first data collection. This follow up enabled us to measure attitude stability over time. Matching was based on a code to guarantee anonymity.

Measures

To assess the influence of attitudes and attitude strength on default effects and choices, we separately measured attitude position and attitude strength. The following measures were assessed as preregistered. Scale characteristics are displayed in Table 1.

Environmental attitude. For attitude position, participants filled out a German version of the New Ecological Paradigm scale (NEP, Dunlap, van Liere, Mertig, & Jones, 2000) measuring environmental attitude with 15 items answered on a fully labeled 5-point scale. Evidence for the dimensionality of the NEP is mixed (see Dunlap et al., 2000). Despite the modest amount of variance explained by one factor (25.9 %), the scree plot and internal consistency justified a one-factorial solution in this experiment.

Attitude towards renewable energy. Because specific attitudes towards renewable energy might be more predictive than general environmental attitudes for our dependent variable "choice between green and gray electricity provider" (evaluative consistency, see Ajzen & Fishbein, 2005), we also assessed the specific attitude towards renewable energy with four items (see Appendix A). We did so, to be able to compare

possible effects between specific and general attitudes. Yet, in contrast to the NEP, the specific measure is novel and untested and related analysis will thus serve exploratory purposes. These four items formed a strong, one-dimensional measure (see Table 1).

We did not assume changes in environmental attitudes or attitudes towards electricity providers to be caused by the default manipulation, which allowed measuring it after all replication relevant parts of the experiment. This assumption was checked (see randomization checks).

Attitude strength. Attitude strength was assessed with self-report measures for six dimensions of attitude strength used in previous research (Brannon, Tagler, & Eagly, 2007; Wegener et al., 1995). Participants indicated on 7-point scales the levels of *importance* (How important is the topic how humans should deal with the environment for you personally? How important is the topic to you compared with other issues?), *certainty* (How sure are you that your opinion on how humans should deal with the environment is correct? How likely are you to change your opinions about the topic? How certain do you feel about your attitude towards the topic?), *personal relevance* (How relevant is the topic how humans should deal with the environment for you personally?), *elaboration* (How much have you thought about the topic before?), and *subjective knowledge* about the environment and ecology (How well informed are you about the topic?). The latter two most closely correspond to the amount of experience and knowledge previously found to moderate default effects. Finally, s*ubjective ambivalence* was measured similar to Priester and Petty (1996) with the following three sentences: "Concerning the topic how humans should deal with the environment, I feel… no conflict at all / feel no indecision at all / have completely one-sided reactions vs. maximal conflict / maximal indecision / completely mixed reactions".

Krosnick and colleagues (1993) argue that different dimensions of attitude strength should be treated as distinct rather than as a combined measure of attitude strength. Others have successfully combined dimensions to form an attitude strength index (e.g., Brannon et al., 2007). Although an individual interpretation of dimensions of attitude strength becomes impossible for a combined index, this approach avoids over-fitting caused by too many predictors and high inter-correlations. Thus, we planned to conduct our analyses twice: with individual dimensions as separate predictors and with a one-dimensional index of attitude strength by combining the different self-report measures.

To construct the attitude strength index, we performed a principal component analysis and combined those items clearly loading on the same factor as indicated by one large eigenvalue and a drop in eigenvalues thereafter visible in the scree-plot. The eleven attitude strength items measuring different dimensions clearly loaded on one reliable factor despite the negative item-test correlation of one item (ambivalence item measuring internal conflict, r_{it} = -.18). Eliminating this item leads to an alpha increase to .87.[5]

We also included a measure of specific attitude strength towards the choice of an electricity provider (see Appendix A), using the same strength items but relating to the choice of an electricity provider. Equivalent to the general environmental attitude strength measure described above, the specific measure can be conceived of as one factorial. The same item as in the general attitude strength measure possessed an item-test correlation close to zero[6] (r_{it} = .06).

------ insert Table 1 about here ------

Demographics. Demographic data including age, gender, profession, and mother tongue was gathered at the end. Information about participants' electricity provider was also assessed. All of these measures were used for exploratory purposes only.

Hypotheses

H1: Replicating the experiment by Pichert and Katsikopoulos (2008), we assume a main effect of the default on the choice of the electricity provider. More people should choose green electricity in the green-default group than in the grey-default group. Similarly, more people should choose a gray electricity provider in the gray-default group than in the green-default group.

H2: People with more pro-environmental attitudes should be more likely to choose green electricity than people with less pro-environmental attitudes (main effect of attitude).

H3: The critical moderation should be visible in a decreasing impact of the default manipulation as attitude strength increases. This translates into an interaction of the

[5] Because the pre-registered criterion for item deletion was a drop in Alpha below .70 instead of low item-test-correlations, the item was retained for all following analyses. Excluding the item does not change any of the results. We recommend replacing it in future research.

[6] See footnote 1

default condition and attitude strength. Specifically, in the green electricity default condition, we expect a decreasing rate of green choices with increasing attitude strength. Analogously, in the gray electricity default condition we expect a decreasing rate of gray choices with increasing attitude strength.

Results

Manipulation checks and randomization checks

As outlined in the preregistered analyses, we checked whether participants remembered the name of the default electricity provider correctly. Forty participants (6.7%) did not remember the default electricity provider correctly in the attentiveness check and were excluded from all analyses as preregistered[7].

Separate *t*-tests indicated no significant differences between the two conditions in our core predictors environmental attitude strength (M_{gray} = 4.81, SD = .74 vs. M_{green} = 4.76, *SD* = .70, $t(558) = .91$, $p = .36$), specific attitude towards renewable energy (M_{gray} = 3.96, *SD* = .69 vs. M_{green} = 3.89, *SD* = .64, $t(558) = 1.17$, $p = .24$), and specific attitude strength (M_{gray} = 3.90, SD = 1.00 vs. M_{green} = 3.95, *SD* = .91, $t(558) = -.58$, $p = .57$). Mean environmental attitude in the gray condition (*M* = 3.84, *SD* = .47) was slightly but not significantly larger than in the green condition (*M* = 3.78, *SD* = .41, $t(558) = 1.71$, p_{NEP} = .09), and thus randomization was successful. This also removes concerns that the manipulation could have influenced the measures collected after the dependent variable and used as predictors. Environmental impact of the green provider (*M* = 5.06, *SD* = 1.24) was rated higher than impact of the gray provider (*M* = 3.12, *SD* = 1.13), $t(559) = 27.23$, $p < .001$, 95% CI [1.80, 2.08], Hedges' g_{av} = 1.63. The price of the gray provider (*M* = 2.91, *SD* = 1.09) was rated lower than the green provider's price (*M* = 4.46, *SD* = 1.06), $t(559) = 31.08$, $p < .001$, 95% CI [1.45, 1.65], Hedges' g_{av} = 1.44. This pattern equals the pattern found by Pichert and Katsikopoulos (2008) and indicates a successful manipulation and understanding of the scenario as intended.

Across both conditions, there is no evidence that either of the providers was chosen more frequently, 47.7% green vs. 52.3% gray, $\chi^2(1, 560) = 1.21$, $p = .27$.

[7] Including these forty participants neither changed the significance levels nor the overall results.

Does general attitude strength moderate default effects? (Model 1)

As preregistered, we used a logistic regression model to test the influence of default condition, environmental attitude, attitude strength, and the two-way interaction of default by strength on the probability to choose green electricity. The analysis was carried out twice: in Model 1, we used general attitude and attitude strength as predictors; in Model 2, we used the specific attitude and specific attitude strength measures as predictors. All predictors were mean-centered prior to analyses and entered into the regression simultaneously.

The full model predicted electricity provider choices significantly better than the intercept-only model, $\chi^2(4, 560) = 83.73$, $p < .001$. Nagelkerke's pseudo-R^2 as a measure of determination was .19 (Nagelkerke, 1991). Table 2 contains regression coefficients, *p*-values, odds ratios, and 95% confidence intervals for odds ratios of all predictors. Similar to the results from Pichert and Katsikopoulos (2008), a green default significantly increased the odds of choosing green electricity by 4.05, $b = 1.40$, $p < .001$. Environmental attitude measured with the NEP did not significantly increase the prediction. However, an increase in attitude strength by one unit significantly increased the odds of choosing green electricity by 2.44. The critical interaction of default condition and attitude strength was insignificant indicating that the influence of the default manipulation was independent of people's attitude strength, $b = -.49$, $p = .08$, OR = 0.61. Although intended to be uncorrelated, attitude strength and environmental attitude overlapped, $r = .40$, $p < .001$.

------ insert Table 2 about here ------

To illustrate the influence of default condition and attitude strength on choices, we divided attitude strength into quartiles. Figure 1 (upper left) shows both the main effects of the default and attitude strength. Although the difference in percentage of green energy choices between the two default conditions is larger in the first (lowest) quartile of attitude strength (53.5% vs. 11.7%) than in the fourth (highest) quartile of attitude strength (74.0% vs. 49.4%), default condition remains a significant predictor in all four quartiles as indicated by the interaction of $p = .08$.

------ insert Figure 1 about here ------

As preregistered, we calculated diagnostic statistics to assess model fit which turned out to be good: 98.57% of standardized residuals lie within a range of $-1.96 < z < 1.96$, and 99.46% lie within a range of $-2.58 < z < 2.58$. Cook's distances as indicators for the

overall influence of a single case on the model are small [.00, .16] and far from the critical threshold of one. 98.9% of all leverage values are below the recommended threshold of three times the average leverage (Stevens, 2002, in this case 3 × 0.00893 = 0.0268). According to these statistics, the model parameters are not biased by the undue influence of single cases.

Dimensions of general attitude strength as individual predictors

High internal consistency, item inter-correlations, and principal component analysis of the attitude strength items provide strong support for a one-dimensional solution (see Table 1). Moreover, individual dimensions were measured with very few or single items and were thus less reliably assessed than the compound strength measure. We checked for the differential impact of each facet in separate regression models where we replaced the compound measure of attitude strength with individual facets. Whereas importance (p = .004), certainty (p = .03), and elaboration (p = .024) moderated the influence of the default manipulation, defaults did not interact with the strength dimensions relevance (p = .098), knowledge (p = .132), and ambivalence (p = .229). This mixed pattern mirrors the marginally significant interaction for the compound measure (p = .08).

Does specific attitude strength moderate default effects? (Model 2)

We conducted the same analysis with mean centered condition, specific attitudes (towards green electricity), specific attitude strength, and the condition by strength interaction as predictors. The full model predicted electricity provider choices significantly better than the intercept-only model, $\chi^2(4, N = 560) = 110.45$, $p < .001$, $R^2 = .24$ (Nagelkerke). Table 3 provides an overview of the predictors and reveals a similar pattern: Again, a green default significantly raised the odds to choose green electricity (by the factor four). Unlike the *general* environmental attitude, the *specific* attitude towards renewable energy also predicted provider choices and so did stronger attitudes. Again, specific attitudes and attitude strength were correlated although to a smaller degree, $\rho = .186$, $p < .001$. In contrast to Model 1, the condition by strength interaction was significant. Simple slope analysis using the Johnson-Neyman technique shows that the interaction is driven by the upper 7% of participants with very high attitude strength (specific attitude strength > 1.56 *SDs* above the mean, see Figure 1 upper right).

For these participants, default condition did not predict choices, whereas for the remaining 93% choices were influenced by the default condition.

------ insert Table 3 about here ------

Dimensions of specific attitude strength as individual predictors

As in Model 1, we checked for the differential impact of each facet in separate regression models where we replaced the compound measure of attitude strength with individual facets. Similar to Model 1, importance ($p < .001$) and elaboration ($p < .001$) moderated the influence of the default manipulation. Defaults did only marginally interact with knowledge ($p = .07$), and there was no interaction with ambivalence ($p = .14$). In contrast to Model 1, certainty ($p = .23$) did not interact with the default condition whereas relevance ($p < .001$) did.

Because the preregistered sample size was 350, we additionally conducted both regression analyses for the first 350 participants only. Twenty-two participants were excluded due to the failed attentiveness check. The results for the reduced sample mirror the presented pattern except for the default by specific attitude strength interaction which remains insignificant ($p = .09$). All coefficients are displayed in Table C1 and Table C2 in Appendix C.

Relevance ratings

The relevance rank order of the five attributes for electricity provider choice was equal to the order reported in Pichert and Katsikopoulos (2008). Price was ranked highest ($M = 1.97$, $SD = 1.11$) followed by environmental impact ($M = 2.50$, $SD = 1.25$), service quality ($M = 2.73$, $SD = 1.07$), reputation ($M = 3.45$, $SD = 1.18$), and location of the provider ($M = 4.34$, $SD = 1.13$).

Stability over time

To assess the stability over time of the measures used, we invited all participants to take part in a second study eight weeks after the first study. We assessed environmental attitude, general attitude strength, and specific attitudes towards green energy in the follow-up. In total, 307 people (51%) participated in the follow-up ($M_{age} = 37.6$, $SD = 13.6$, 62% female, 38% male). Participants in the follow-up did not differ from people who did not participate in the follow-up on any measure. Test-retest correlations of the measures and the same correlations corrected for measurement error are depicted in Table 4 and all reveal a large stability of the measures over time.

------ insert Table 4 about here ------

Discussion

We found a strong effect of the default manipulation on choices replicating the findings from previous studies on default effects (Johnson & Goldstein, 2003; Pichert & Katsikopoulos, 2008) and supporting Hypothesis 1. Further, *general* environmental attitudes as assessed by the NEP did not predict choices while general attitude strength did. This dissociation might be due to the fact that we did not succeed in separating attitude position and strength. At the same time, holding more positive *specific* attitudes towards renewable energy and holding them more strongly did lead to a higher propensity to choose the green electricity provider. Overall, this partial support of Hypothesis 2 lends credence to the validity of the scenario as a whole.

Despite this systematic pattern, we did not find support for a relevant moderating influence of attitude strength on defaults (H3). The corresponding interaction was only marginally significant in Model 1 and only significant at $p < .05$ for the strength of specific attitudes towards renewable energy. A simple slope analysis revealed this interaction to be driven by a small fraction of participants holding extremely strong attitudes.

To illustrate the moderation in Model 1, assuming that it exists, consider that a person with average attitude strength (centered at 0, $SD = .72$) is 4 times more likely to choose green energy after a receiving green default compared to the same person receiving a gray default (OR for default condition). Yet, even a person with the most extreme attitude strength in the sample (strength = 1.67) is still 1.79 times more likely to choose green energy given a green default compared to a gray default[8]. Thus, even extremely strong attitudes in our sample did not render the default influence meaningless.

In sum, Experiment 1 was set up to investigate whether the strength of preexisting environmental attitudes, general or specific, moderates the influence of a default manipulation for an environmentally relevant choice. We conclude that there is at best a weak influence.

One might argue that Experiment 1 has two weaknesses: First, the default manipulation might have influenced attitudes which were assessed afterwards. Even though there was no evidence for such an influence, in Experiment 2 we measured

[8] b(default) + attitude strength × b(interaction) = 1.4 + 1.67 × (-.49) = 0.58, exp(0.58) = OR = 1.79

attitudes before the manipulation. Second, we measured rather than manipulated attitude strength and hence cannot make causal claims. We address both issues in Experiment 2.

Experiment 2

In Experiment 2, we seek to experimentally manipulate attitude strength. This entails assessing environmental attitudes before rather than after the choice task. Thus, as an extended replication, in Experiment 2, we a) first assess attitudes and b), for half of the participants, increase attitude strength. We chose to do so by instigating deeper elaboration.

Methods

Power analysis

As preregistered, we based power calculations for Experiment 2 on observed effect sizes in Experiment 1. Experiment 1 yielded a (non-significant) odds ratio of 1.67[9]. We conservatively assumed a somewhat smaller effect size of 1.4 for the critical interaction. To achieve 90% power (two-tailed, $\alpha = .05$, Pr(Y = 1 | X = 1) H0 = .6, R^2 other X = .2), a sample size of $N = 506$ is necessary. This sample size is sufficient to demonstrate the default main effect (assumed OR = 4) with even larger power of over 99%.

Participants

Equal to Experiment 1, data was collected via the German online panel Social Science Survey (Leiner, 2014) over a period of two weeks. We assured that no participant had already taken part in Experiment 1 by excluding these participants' serial numbers. Complete surveys were received from 572 participants. Deviations from planned sample size were again due to the sampling procedure of the panel outlined in Experiment 1. After excluding 37 participants who did not remember the default electricity provider correctly in the attentiveness check[10], the resulting sample's mean age was 37.5 years ($SD = 14$), 62.8% were female, 34.6% male, and 2.6% did not indicate gender. Among all participants, 25 vouchers worth 25 Euros each were raffled.

[9] We transformed the .6 odds ratio using 1/OR.
[10] Including these participants neither changed the significance levels nor the overall results.

Procedure

The procedure was followed exactly as preregistered. At the beginning of the experiment, all participants filled out the new ecological paradigm scale (NEP, Dunlap et al., 2000). Upon completion, participants were randomly allocated to either the enhanced strength condition or the control condition. In the enhanced strength condition participants received all 15 NEP-items again and were asked to pick four items which they felt most certain about, knew most about, or which were most important to them (see Appendix B for instructions). For these items, participants were asked to give a short reason for their answer. This should increase attitude strength by making participants elaborate on subjectively important aspects of their attitude. Participants in the control condition did not receive the NEP items again and did not provide reasons.

Participants were then confronted with the electricity provider scenario used in Experiment 1. Again, half of the participants received a gray electricity default, the other half received a green electricity default. As in Experiment 1, participants were then asked to make a choice between the two providers by either following the default or opting for another electricity provider. After this, participants answered several control questions to check whether they understood the text correctly. As a manipulation check, we also included all self-report items for attitude strength from Experiment 1. Before asking participants to provide socio-demographic data, they were asked to list all thoughts that were relevant for their choice of an electricity provider ("Please list all aspects that influenced your decision for or against the two electricity providers." See Dinner et al., 2011 for a similar procedure). A debriefing followed this.

Measures

Dimensionality, item-test correlations and internal consistency of all multi-item measures used in Experiment 2 are depicted in Table 1 and mirror the findings from Experiment 1.

Environmental attitude. As in Experiment 1, we assessed environmental attitude using the NEP scale (Dunlap et al., 2000).

Attitude strength. Now serving as a manipulation check, attitude strength was assessed with the same self-report measures as in Experiment 1 relating to the dimensions importance, certainty, relevance, elaboration, knowledge, and ambivalence (see Appendix A for the translated items).

Demographics. We gathered demographic data including age, gender, profession, and mother tongue at the end. Participants' electricity provider was also assessed.

Hypotheses

H1: Equivalent to Experiment 1, we predict a main effect of the between-participant factor default condition. More people should choose green electricity in the green-default group than in the gray-default group. Vice versa, more people should choose gray electricity in the gray-default group than in the green-default group.

H2: We also predict a main effect of environmental attitude such that participants with more pro-environmental attitudes are more likely to choose green electricity than participants with less pro-environmental attitudes.

H3: We also predict an interaction of the default condition and the manipulation of attitude strength. This should correspond to a smaller difference in choice proportions between the green and the gray default condition given participants are in the enhanced strength rather than in the control strength condition.

Results

Manipulation checks and randomization checks

We planned to check whether the manipulation affected attitude strength by calculating an attitude strength index as described in Experiment 1 and comparing mean attitude strength between the two strength conditions. This manipulation check revealed that the enhanced strength condition and the control condition did neither differ in overall attitude strength as measured by the 11-items, M_{control} = 5.02 (SD = .69) vs. $M_{\text{enhanced strength}}$ = 4.95 (SD = .77), $t(533) = 1.11$, p = .27, 95 % CI [-0.05; 0.19], nor were there significant differences on any of the dimensions except for knowledge, M_{control} = 5.17 (SD = 1.04) vs. $M_{\text{enhanced strength}}$ = 4.94 (SD = 1.22), $t(533) = 2.35$, p = .02, 95 % CI [0.04, 0.42], Hedges' g_s = 0.20. This small difference is not further interpreted. Thus, we have to assume that the intended manipulation of attitude strength by instigating deeper elaboration was not successful. Originally, we had planned to exclude participants in the enhanced strength condition if their attitude strength levels were lower than 99% of all participants this condition. Analogously, we had planned to exclude participants in the control group whose attitude strength exceeded 99% of their fellow participants. Since the strength manipulation failed, the planned exclusion of

participants who were unaffected by the manipulation becomes arbitrary. Thus, we did not exclude participants based on strength scores.

There was no evidence for failed randomization with similar environmental attitude levels across the different conditions (p = .63). The differences between the two providers in price and environmental impact were perceived by participants as intended: Environmental impact of the green provider (M = 5.51, SD = 1.13) was rated higher than the impact of the gray provider (M = 2.89, SD = 1.16), $t(534) = 33.62$, $p <$ .001, 95% CI [2.47, 2.77], Hedges' g_{av} = 2.29. The price of the gray provider (M = 3.11, SD = 1.25) was rated lower than the green (M = 4.54, SD = 1.19) provider's price, $t(534) =$ 20.98, $p <$ .001, 95% CI [1.20, 1.47], Hedges' g_{av} = 1.10 . Overall, significantly more people chose green electricity (68%) than gray electricity (32%), $\chi^2(1, 535) = 72.54$, $p <$ .001. Environmental attitude and attitude strength were again correlated, r = .39, $p <$ .001.

Choices

Despite the failed manipulation of the factor strength, we analyzed the 2 (default: gray vs. green) by 2 (strength: weak vs. strong) design with environmental attitude as a random factor as preregistered using logistic regression analysis. The electricity provider choice (1 = green, 0 = gray) was predicted from mean-centered variables for the default condition, the attitude strength condition, environmental attitude, and the two-way interaction between the default condition and the attitude strength condition. These predictors were entered into the model simultaneously.

The analysis revealed the following results: A test of the full model against a constant-only model was statistically significant, $\chi^2(4, 535) = 73.98$, $p < .001$, R^2 = .18 (Nagelkerke) indicating that the predictors distinguished between choices of gray and green electricity. As Table 5 shows, a green default and a more pro-environmental attitude were the only significant predictors of green choices in this model. Participants confronted with a green default were 4.35 times more likely to choose green electricity than participants in the gray default condition. Likewise, a one-point increase in environmental attitude scores raised the probability to choose green electricity by 2.39. Participants in the enhanced strength and the control conditions were equally likely to choose green electricity and the strength by default interaction remained insignificant.

------ insert Table 5 about here ------

Exploratory analyses

As we could not find any effects of the strength manipulation on the manipulation check, it is not surprising that it did not affect choices either. To check whether *measured* attitude strength instead of *manipulated* strength produced similar results and to replicate the analyses from Experiment 1, we tested a model with default condition, environmental attitude, measured attitude strength, and both two-way interactions of default by strength and default by environmental attitude. This analysis was not preregistered but seems useful due to the failed manipulation of attitude strength.

The full model was again significant $\chi^2(4, 535) = 99.99$, $p < .001$, $R^2 = .24$ (Nagelkerke). A model including the interactions was not significantly different from a model with only main effects. This means, a green default, a stronger attitude, and, marginally so, a more pro-environmental attitude raised the probability to choose green electricity independent of each other (see Table 6). Conditioning choices on strength percentiles confirmed that the default condition remained a significant predictor of choice at the 10th, 25th, 50th, 75th, and 90th percentile. In other words, defaults influenced choices regardless of whether people held strong or weak attitudes and regardless of whether people held pro-environmental attitudes or not.

------ insert Table 6 about here ------

To illustrate the independence of default effects from attitude strength, we divided attitude strength into quartiles and examined the influence of defaults on choices separately for each quartile of attitude strength (see Figure 1 lower left). Across all quartiles, participants in the green default condition chose significantly more green electricity than participants in the gray default condition, all $p < .01$, $.22 < \Phi < .39$. The differences for quartiles one to four were: 39.7%, 25.7%, 29%, and 15.8%.

Women were significantly more likely to choose green electricity than men, 72% vs. 62%, χ^2 (521) = 5.38, $p = .02$. Not surprisingly, of the 163 actual customers of green electricity providers 85% chose green electricity, compared to only 51% of the 229 customers of gray providers. Controlling for these two factors did not change the overall pattern.

Facets of general attitude strength as individual predictors

As in Experiment 1, we also checked whether the individual facets of attitude strength moderated the impact of the default manipulation. Knowledge ($p = .02$) was the only significant moderator. All other facets did not interact with the default condition.

Thought listing

Two research assistants independently coded each reason participants gave for their choice. As guiding categories we used the most frequently mentioned reasons also used by Pichert and Katsikopoulos (2008, see also Table 7) and added "regional provider". Reasons that did not fit into these six categories were coded as "other". Participants could list as many reasons as they wished resulting in 1171 reasons provided overall. Cohen's kappa as an index for interrater reliability was high, $\kappa = .79$. To analyze which reasons were mentioned most frequently (preregistered), first, disagreements were resolved by discussion. Table 7 shows the reasons given and their frequencies. We also exploratory examined systematic associations between the default people received, the choice they made, and the reasons they mentioned to support their choice. First, environmental considerations were mentioned by 68% of the people in the green default condition but only by 49% in the gray condition, $\chi^2(535) = 21.15$, $p < .001$. A reverse pattern emerged for price considerations which were mentioned in the gray default condition more frequently than in the green default condition, 53% vs. 38%, $\chi^2(535) = 12.35$, $p < .001$. For none of the other categories did similar associations emerge. Second, when people chose green electricity, environmental considerations were mentioned similarly often, no matter whether the green choice resulted from a default or an opt-out, 77.7% vs. 79.6%, $\Delta = 1.9\%$, $\chi^2(366) = 1.85$, $p = .17$. In contrast, when people chose gray electricity, price considerations were mentioned much more frequently after opting out of green electricity as compared to sticking with a gray default, 77.3% vs. 68%, $\Delta = 9.3\%$, $\chi^2(169) = 13.43$, $p < .001$. Apparently, changing from green to gray lead to more pressure to justify the change than changing from gray to green did. The anticipated effort of switching from a default (a proxy for general effort explanations of default effects) was mentioned by 16% of all participants.

------ insert Table 7 about here ------

Discussion

In Experiment 2, we find a similarly strong effect of the default manipulation as compared to Experiment 1 and the original demonstration. Different from Experiment 1, we now also find predictive power of general environmental attitudes on choices. The NEP predicts electricity provider choices only when attitude strength is not included. Future research should consider environmental attitude measures stronger than the NEP to predict actual choices or behavior. Both effects further validate the scenario.

Judging by the manipulation check, we did not succeed in experimentally manipulating attitude strength levels. This seems less surprising given that we found very high stability of attitude strength over time. The absence of an interaction between manipulated attitude strength and the default manipulation thus cannot be interpreted as evidence against the existence of such a moderating influence. Yet, the analysis of measured attitude strength again supports such a conclusion. Including measured strength as a potential moderator, as in Experiment 1, we did not find evidence that stronger preexisting environmental attitudes reduce the effect of a default manipulation. Even for the 25% of participants with the strongest attitudes in our sample, the default manipulation was effective.

The selective mentioning of reasons suggests that different defaults trigger different queries (Dinner et al., 2011). More specifically, defaults triggered congruent reasons, such that the environment was mentioned after a green default and the price was mentioned after a (cheaper) gray default. Additionally, people also perceived the effort associated with switching as one reason for their choices, irrespective of which default they received. This finding supports present effort explanations for default effects.

Combined analysis of both experiments (exploratory)

We conducted a (non-preregistered) small meta-analysis including all 1095 participants from Experiments 1 and 2 to assess the overall reliability and strength of the interaction between attitude strength and the default manipulation. Analogous to previous analyses, we used a logistic regression analysis to predict choices by the centered NEP and attitude strength measures and the default manipulation only including the interaction between the latter two. We used a multilevel model implemented in the R package lme4 to account for the fact that the interaction was assessed under three different conditions (i.e., Experiment 1 and the two experimental conditions of Experiment 2). This allowed for variation of the effect estimates between the three groups. The overall results are shown in Table 8. Confirming the previous analyses, default manipulation and attitude strength predicted choices, while the NEP by itself had only a marginally significant influence. Crucially, the interaction between the default manipulation and attitude strength did not reach the level of statistical significance.

------ insert Table 8 about here ------

General Discussion and conclusion

Across two studies with more than 1000 participants taken from a heterogeneous sample of the German population, we could show that defaults and attitudes both play a powerful yet largely independent role in environmental decision making. Our studies and previous (online, lab, and field) experiments on green electricity defaults (Ebeling & Lotz, 2015; Pichert & Katsikopoulos, 2008) provide strong support for the conclusion that the choice of an electricity provider is significantly influenced by the pre-selected default option with comparably large effect sizes (OR > 4).

The picture for preexisting environmental attitudes is somewhat more mixed. While environmental attitude strength consistently predicted choices, the NEP as our environmental attitude measure was less predictive. Given the sample-independent, high correlations of attitude strength and environmental attitude ($.37 < r < .40$), a clear separation of attitude position and attitude strength seems impossible for this measure of general environmental attitudes: Stronger environmental attitudes imply more positive environmental attitudes and as such, environmental attitude strength is asymmetric. At least in the samples used in our studies, strong anti-environmental attitudes were not represented. This could be different for topics such as abortion where people are strongly opposed, indifferent, or strongly in favor.

While replicating default effects, the expectation that "if preferences […] are strong, we would expect defaults to have little or no effect" (Johnson & Goldstein, 2003, p. 1339) was not supported. The presented data does not suggest that "well-formed preferences (…) trump default rules" (Sunstein & Thaler, 2003, p. 1198). Defaults influenced people's choices across the whole range of how strong attitudes can be and the effects were additive rather than interactive (see Kaiser, Arnold, & Otto, 2014). Attitude strength only trumped the default effect for the most extreme 7% of participants and only for a specific measure of attitudes towards renewable energy in Experiment 1.

The results do not allow for a theoretically and empirically convincing interpretation of the individual facets of attitude strengths: First, the compound attitude strength measure is internally consistent and all facets load on one latent factor speaking for the more reliable 11-item measure. Second, no facet moderated the impact of the default manipulation consistently in both experiments.

One might still argue that there were no well-formed preferences in our samples. However, the heterogeneous distribution of attitude strength levels and their predictive

power speaks against this argument. In sum, the findings suggest that the context or "choice architecture", though powerful, works additively with pre-existing attitudes to determine choice propensities. However, our findings and conclusions are limited to environmental attitudes and the strength with which they are held and their interplay with sustainable default options. Generalization to nudges and attitudes beyond green defaults and environmental attitudes, warrants conceptual replications of similar patterns in other areas, with different target behaviors and different nudges, e.g., organ donation defaults and pro-social attitudes.

Keeping the aforementioned limitation in mind, our findings have several implications for libertarian or soft paternalism which claims that, "if an individual's preferences are incoherent, her choices can be influenced by interventions which, although paternalistic in intent, do not contravene the principles to which anti-paternalists are committed" (Sugden, 2008, p. 227). As we have shown, even in the presence of defaults, environmental attitudes are not necessarily "unclear and ill-formed" (Sunstein & Thaler, 2003, p. 1159) and their influence (if measured correctly) is stable and predictive over and above the influence of choice architectures such as defaults. Yet, systematic differences in who is affected by a nudge (i.e., who chooses the default) and who is not (i.e., who opts out) could provide a way to combine paternalistic measures with libertarian values or an approach "to have one's cake and eat it too" as Camerer et al. (2003, p. 1212) suggest. Extending the concept of "asymmetric paternalism" to defaults (Camerer et al., 2003), i.e., paternalistic measures that influence different people differently, individual attitudes should be one such source of asymmetry. The asymmetry would arise because the indifferent should profit from a default, while it should leave those with strong attitudes unaffected. However, at least for electricity provider defaults, we found no support for asymmetric effects; the paternalistic influence of green and gray defaults was rather symmetric and not systematically influenced by individual attitudes in the presented studies. On the other hand, one could also interpret the independent influence of attitudes and defaults as support for the libertarian (attitude-based) and paternalistic (context-driven) nature of a nudge. The opposing conclusions drawn from the same results highlight that libertarian paternalism still lacks conceptual clarity.

On a more applied side, the presented studies support confidence in defaults as tools to influence environmental decision-making. We do not answer the question whether

green electricity is better than gray electricity, nor do we claim that other measures to increase the adoption of green electricity such as education or subsidies are less effective (as criticized by Gigerenzer, 2015). Rather, we complement existing knowledge about the effectiveness of defaults in environmental policymaking.

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Appendix A. Instructions and material used in both studies (translated from German)

Adapted from Pichert and Katsikopoulos (2008)

Gray condition: "Imagine you have to relocate to another town. After you move into your new flat, you receive a letter from the electric power supplier, *Acon*. You are told that by moving into your new flat you became an *Acon* customer: '*Acon* is pleased to welcome you as a new customer. We are responsible for the basic electricity supply in this residential area. *We offer low-priced electricity tariffs—you cannot beat our prices. Save money with Acon*! Your monthly premium is 26 € per person'. You are kindly asked to fill in some personal data on an attached document, which you do. A couple of days later a contract is sent to you.

Some weeks later you find a flyer in your mailbox, advertising offers from the electric power supplier *EcoEnergy*: 'Switch to *EcoEnergy*! Did you know that you can easily switch your electricity supplier? *EcoEnergy sells clean electricity, generated from renewable energy sources. Contribute to climate protection and environmental protection!* Your monthly premium will be 33 € per person'."

What do you do? ☐ Stay with *Acon* ☐ Switch to *Ecoenergy*

Green condition: The vignette describes the reverse situation; that is, the default company offers 'green' power and the advertisement is for cheaper electricity (see text). Although premiums for electricity vary according to individual consumption, participants are told to accept the premiums as given for the sake of simplicity.

What is the name of the default electricity supplier in the situation just described? (Acon, EcoEnergy, none of the two, don't know) How do you judge the environmental impact of Acon / Ecoenergy? How do you judge the price of Acon / Ecoenergy? (7-point scale from very negative to very positive)

Please arrange the following attributes according to their relevance for your choice of an electricity supplier starting with the most important, followed by the second most important and so forth.
company reputation, environmental impact, location of provider, quality of service, price

Environmental attitude (NEP)

Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree with it.

Do you agree or disagree that:

1. We are approaching the limit of the number of people the earth can support
2. Humans have the right to modify the natural environment to suit their needs
3. When humans interfere with nature it often produces disastrous consequences
4. Human ingenuity will insure that we do NOT make the earth unlivable
5. Humans are severely abusing the environment
6. The earth has plenty of natural resources if we just learn how to develop them
7. Plants and animals have as much right as humans to exist
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations
9. Despite our special abilities humans are still subject to the laws of nature
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated
11. The earth is like a spaceship with very limited room and resources
12. Humans were meant to rule over the rest of nature
13. The balance of nature is very delicate and easily upset
14. Humans will eventually learn enough about how nature works to be able to control it
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

Attitude strength items (environmental attitude strength)

Participants indicate on 7-point scales the level of

1. importance:

"How important is the topic how humans should deal with the environment for you?"

"How important is this topic for you compared with other issues?"

2. certainty:

"How sure are you that your opinion on how humans should deal with the environment is correct?"

"How likely are you to change your opinion?"

"How certain are you about your opinion concerning this topic?"

3. personal relevance:

"How relevant is the topic how humans should deal with the environment for you personally?"

4. Elaboration:

"How much have you thought about the topic before?"

5. knowledge about the environment and ecology:

"How knowledgeable are you about the topic?"

6. Subjective ambivalence:

Concerning the topic how humans should deal with the environment (labeled ends of 5-point scales)…

I feel no inner conflict / maximal inner conflict

I have a clear opinion / I have no clear opinion

I have mixed feelings / I have clear feelings

Attitude towards renewable energy (used in Experiment 1 only)

Participants indicate on 5-point scales the level of agreement.

Electricity from renewable energy sources…

1. Contributes a great deal to environmental protection.
2. Is worth paying a higher price.
3. Should be supported in my view.
4. Does not have a positive effect on the environment.

Electricity provider attitude strength (used in Experiment 1 only)

Participants indicate on 7-point scales the level of

1. importance:

"How important is the choice of an electricity provider for you?"

"How important is this topic for you compared with other issues?"

2. certainty:

   "How sure are you that your opinion on the choice of an electricity provider is correct?"

   "How likely are you to change your opinion?"

   "How certain are you about your opinion concerning this topic?"

3. personal relevance:

   "How relevant is the choice of an electricity provider for you personally?"

4. Elaboration:

   "How much have you thought about the topic before?"

5. knowledge about the environment and ecology:

   "How knowledgeable are you about different electricity providers?"

6. Subjective ambivalence:

Concerning the choice of an electricity provider (labeled ends of 5-point scales)…

I feel no inner conflict / maximal inner conflict

I have a clear opinion / I have no clear opinion

I have mixed feelings / I have clear feelings

Appendix B. Additional instructions for Experiment 2

Instructions for the enhanced strength condition after filling out the NEP

You just gave your opinion on how humans should deal with the environment. We are now interested in some of your reasons for answering the way you did.

Please choose four statements for which you are especially certain, or which are especially important for you, or on which you have a very clear opinion. Maybe there are also statements you have a lot of knowledge on, or you have thought about much before.

Please give reasons for four of the statements depicted below now.

Instructions for thought listing

Please list all aspects that influenced your decisions for or against the two electricity providers. You can list as many aspects as you wish.

Appendix C. Results of Experiment 1 for *N* = 350

Table C1

Logistic regression Model 1 of Experiment 1 with originally planned sample size

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	-1.13 (.20)	<.001	0.32	--
Default	1.63 (.26)	<.001	5.13	[3.09, 8.51]
Env. attitude (NEP)	.02 (.31)	.95	1.02	[0.56, 1.87]
General attitude strength	1.07 (.31)	<.001	2.92	[1.60, 5.32]
Default × strength	-.55 (.38)	.15	0.58	[0.27, 1.22]

Note. $\chi^2(4, 328) = 59.00$, $p < .001$, $R^2 = .22$ (Nagelkerke)

Table C2

Logistic regression Model 2 of Experiment 1 with originally planned sample size

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	-1.06 (.19)	< .001	0.35	--
Default	1.55 (.26)	< .001	4.71	[2.86, 7.76]
Specific attitude	.84 (.21)	< .001	2.32	[1.54, 3.50]
Specific attitude strength	.55 (.21)	.01	1.74	[1.14, 2.64]
Default × strength	-.49 (.28)	.09	0.61	[0.35, 1.07]

Note. $\chi^2(4, 328) = 68.19$, $p < .001$, $R^2 = .25$ (Nagelkerke)

Table 1

Scale characteristics of the measures used in Experiments 1 and 2

	M (*SD*)	α	eigenvalues > 1	explained variance (%)	r_{it} (range)
Experiment 1 (*N* = 560)					
NEP	3.81 (.44)	.79	3.89, 1.46, 1.17, 1.06	25.9	[.25, .50]
General attitude strength	4.78 (.72)	.84	4.76, 1.62	43.3	[-.18, .68]
Specific attitude	3.92 (.67)	.75	2.38	59.6	[.37, .66]
Specific attitude strength	3.93 (.96)	.88	5.11, 1.89	46.4	[.06, .73]
Experiment 2 (*N* = 535)					
NEP	3.76 (.44)	.78	3.87, 1.43, 1.26, 1.07	25.8	[.26, .54]
General attitude strength	4.98 (.73)	.86	5.02, 1.53	45.6	[-.07, .68]

Note. Explained variance refers to the amount of variance explained by the first factor.

Table 2

Logistic regression Model 1 with default condition, NEP, and general attitude strength (Experiment 1)

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	-.86 (.14)	<.001		
Default condition	1.40 (.19)	< .001	4.05	[2.80, 5.87]
Environmental attitude (NEP)	.23 (.23)	.32	1.26	[0.80, 1.96]
General attitude strength	.89 (.22)	< .001	2.44	[1.59, 3.73]
Default × strength	-.49 (.28)	.08	0.61	[0.36, 1.05]

Table 3

Logistic regression Model 2 with default condition, specific attitude, and specific attitude strength (Experiment 1)

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	-.88 (.14)	<.001		
Default condition	1.44 (.19)	<.001	4.22	[2.89, 6.16]
Specific attitude	.86 (.16)	<.001	2.36	[1.74, 3.22]
Specific attitude strength	.53 (.15)	<.001	1.70	[1.27, 2.27]
Default × strength	-.50 (.20)	.01	0.61	[0.41, 0.90]

Table 4

Internal consistency and test-retest correlations for the follow-up measures of Experiment 1

Scale	*α*	r_{tt}	r_{tt} corrected for attenuation
Environmental attitude (NEP)	.78	.79***	1
Environmental attitude strength	.86	.75***	.88
Specific attitude	.68	.66***	.92

Note. *** $p < .001$. r_{tt} = test-retest correlation

Table 5

Logistic regression Model with default condition, manipulated attitude strength, and NEP (Experiment 2)

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	.16 (.17)	.35		
Default condition	1.47 (.28)	< .001	4.35	[2.49, 7.58]
Environmental attitude (NEP)	.87 (.23)	<.001	2.39	[1.53, 3.75]
Attitude strength condition	-.02 (.25)	.93	0.98	[0.60, 1.60]
Default × strength	.09 (.42)	.83	1.1	[0.48, 2.49]

Table 6

Logistic regression Model with default condition, NEP, and measured attitude strength (Experiment 2)

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	.21 (.13)	.11		
Default condition	1.47 (.22)	< .001	4.34	[2.84, 6.64]
Environmental attitude (NEP)	.45 (.25)	.07	1.56	[0.96, 2.55]
Measured attitude strength	.86 (.20)	< .001	2.37	[1.60, 3.50]
Default × strength	-.26 (.30)	.39	0.77	[0.43, 1.39]

Table 7

Frequencies of reasons mentioned for provider choices (Experiment 2)

Reasons	Mentioned by ... %
Environmental considerations	59
Price considerations	45
Anticipated effort caused by switching/laziness	16
Distrust/skepticism of a provider	11
Insufficient information about energy sources or conditions	11
Regional provider	5
Other	21
None	9

Note. Because participants could give more than one reason, percentages do not add up to 100%.

Table 8

Regression table of the combined data of Experiments 1 and 2 including all 1095 participants

	B (SE)	*p*	Exp(B)	95% CI for Exp(B)
Constant	.55 (.28)	.05		
Default condition	1.44 (.16)	<.001	4.23	[3.09, 5.79]
NEP	.36 (.19)	.06	1.44	[0.99, 2.10]
General attitude strength	.71 (.12)	<.001	2.03	[1.61, 2.56]
Default × strength	-.33 (.23)	.15	0.72	[0.46, 1.12]

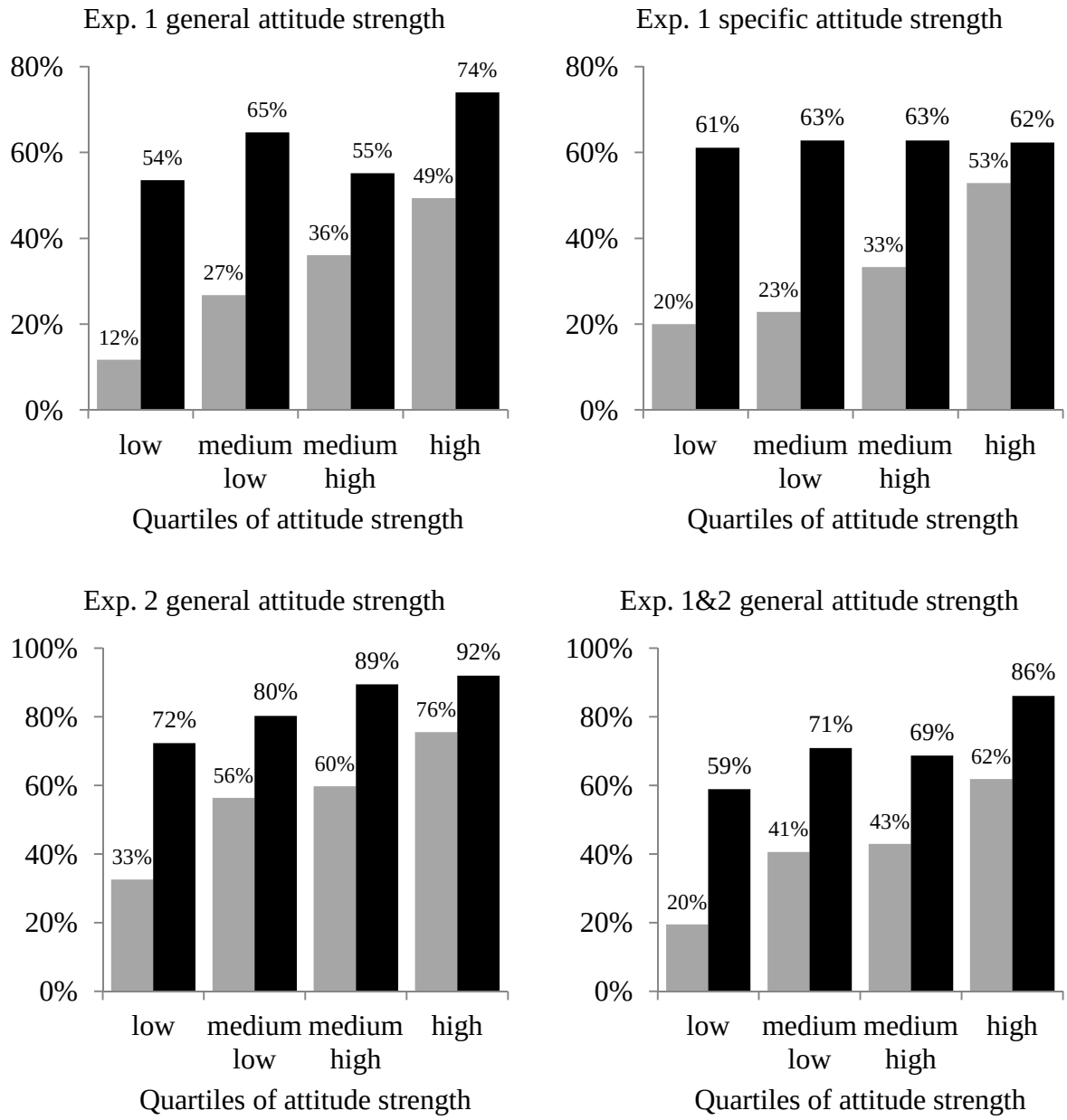

Figure 1. The amount of green energy choices (y-axis) in quartiles of attitude strength (x-axis) ranging from low strength to high attitude strength. Black bars = green default condition, gray bars = gray default condition.

9 Paper 3: How defaults and environmental attitudes influence ecological choices

Testing an additive model against a conditional model

How defaults and environmental attitudes influence ecological choices: Testing an additive model against a conditional model

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Abstract

Although being discussed as powerful tools to influence decision making, defaults are expected to only be behavior relevant when attitudes are weak. This conditional model of the interplay of defaults and attitudes stands in contrast to a compensatory model based on the Campbell paradigm which predicts additive but not interactive effects of defaults and attitudes on decision making. We tested both models in an online shopping scenario presenting green or conventional default products to 242 participants and measuring environmental attitudes. Our results support a compensatory model. First, environmentally-friendly choices were found to be an additive function of defaults and environmental attitudes. Second, the passive acceptance of defaults was predicted by a default by attitude interaction such that attitude-congruent defaults were accepted more frequently. These findings are in line with understanding defaults as behavioral costs that can be overcome by individual attitudes and provide empirical evidence for an additive effect of defaults and attitudes. As such, defaults are also effective in attitude heterogeneous populations but for a more precise prediction of choices, attitudes should be included in the model.

Keywords: defaults, environmental attitudes, nudge, Campbell paradigm, behavior change

Theoretical background

The promise of achieving behavior change with nonfinancial and noncompulsory alterations to choice architecture (for an overview, see Münscher, Vetter, & Scheuerle, 2015) called "nudges" (Thaler & Sunstein, 2008) has sparked the interest of policy makers around the globe and led to a remarkable public interest in behavioral sciences (Shafir, 2012). Defaults, i.e., options that become effective without an active choice, in particular appear as a promising tool to influence decisions in various behavioral domains from medical decision making (Ansher et al., 2014) to consumer behavior (Brown & Krishna, 2004; Herrmann et al., 2011), financial decision making (Agnew, Szykman, Utkus, & Young, 2012; Madrian & Shea, 2001), and moral conduct (Mazar & Hawkins, 2015). Most prominently defaults have been discussed as a reason for the huge differences between organ donation rates in different countries (Johnson & Goldstein, 2003). Environmental protection and the impact of "green defaults" (Pichert & Katsikopoulos, 2008) is another field of application for the use of default effects in policy making. People whose energy provider offered renewable energy by default were more likely to choose green energy than people who received conventional energy by default in controlled experiments as well as in field settings (Ebeling & Lotz, 2015; Pichert & Katsikopoulos, 2008; Vetter & Kutzner, 2015). Switching printers to double-sided printing defaults is another example for the influence of green defaults on individual environmental protection behavior (Egebark & Ekström, 2013).

However, defaults are expected to be behavior relevant only when attitudes are weak (see e.g., Johnson & Goldstein, 2003). In this paper, we challenge this *conditional model* (i.e., attitudes moderating the influence of defaults) with a *compensatory model* in which defaults and attitudes do not interact (i.e., additive main effects of both).

In the following section, we first outline both models in more detail. Secondly, we suggest refining experimental designs of default effects by tracking people's actual choices in case of a default rejection (opt out). Hypotheses for the presented study are then deduced and tested in a well-powered online study on green consumerism before we discuss theoretical and policy implications of the results.

Two models for the interplay of defaults and attitudes

Despite their well explored individual contributions to behavior change, the interplay of defaults and attitudes in decision making remains a constant subject for

speculation. On the one hand, ample evidence on the power of defaults exists especially but not limited to the domain of environmental behavior. On the other hand, research has demonstrates the predictive power of environmental attitudes (e.g., Kaiser & Byrka, 2015; Kaiser, Woelki, & Vllasaliu, 2011) but also pointed out how attitude change can be a difficult and tedious endeavor (Kaiser, Brügger, Hartig, Bogner, & Gutscher, 2014). As such, defaults and other nudges have been well received for their relative inexpensiveness and the promise to achieve behavior change without attitude change. After all, changing a few features of the context in which a decision is taken is less complex than persistently changing the way people think about a topic.

Problematically however, some expect defaults to be behavior relevant only in the absence of strong attitudes. For example, Johnson and Goldstein (2003, p. 1339) suggest that "if preferences […] are strong, we would expect defaults to have little or no effect". Similarly, Sunstein and Thaler (2003, p. 1198) assume that "well-formed preferences (…) trump default rules". Accordingly, green and gray defaults are believed to be less effective for people with high environmental attitude levels (Sunstein & Reisch, 2014). This *conditional model* of the effectiveness of defaults and attitudes is in line with current theorizing in social and environmental psychology (Reis, 2008; Stern, 2000). Statistically speaking, attitudes moderate the influence of defaults in the conditional model such that a default exerts more influence on choices when attitude levels are low than when attitude levels are high. Indeed, absent default effects have been interpreted as evidence for interindividual differences to moderate the success of defaults. In a field study on carbon offsetting conducted with people who were knowledgeable and experienced concerning carbon offsetting, the authors found no effect of a default on the willingness to compensate for one's emissions (Löfgren, Martinsson, Hennlock, & Sterner, 2012). A high level of experience could be a proxy for more pronounced attitudes as it is also discussed as a facet of attitude strength (Krosnick, Boninger, Chuang, Berent, & Carnot, 1993; Wegener, Downing, Krosnick, & Petty, 1995). The absent default effect for experienced people (despite lacking a non-experienced control group) was interpreted to indicate that "the effect of default options attenuate [sic] with experience" (Löfgren et al., 2012, p. 69).

In contrast, the *compensatory model* suggests an additive influence of defaults and attitudes on behavior (Kaiser, Arnold, & Otto, 2014). This model is based on the Campbell paradigm (Kaiser, Byrka, & Hartig, 2010) which describes behavior as an

additive function of two components: a person's attitude and the behavior's costs. Note that behavioral costs are not limited to monetary costs but include all structural factors which influence the difficulty associated with performing a behavior. In line with current explanations of what drives default effects (Dinner, Johnson, Goldstein, & Liu, 2011), defaults can be conceived as behavioral costs due to the additional effort that is necessary to opt out. Furthermore, if a default is perceived as a recommendation (McKenzie, Liersch, & Finkelstein, 2006), deciding against this recommendation is more costly than simply following it.

According to the Campbell paradigm, the higher the behavioral costs, the stronger an attitude needs to be to overcome the costs (hence the term "compensatory" model). Thus, people's attitude levels correspond with the amount of effort, time or money they are willing to invest to achieve their attitudinal goal (e.g., environmental protection). Whether someone chooses green energy is thus determined by the behavioral costs of choosing green energy and by a person's environmental attitude. The costs are lower if green energy is the default than if extra effort is necessary to choose green energy. As such, costs and attitudes are independent of each other: The effort to switch energy providers (e.g., initiating the change by filling out a form) is, for example, equally high for environmentalists and passionate climate change deniers. Thus, costs are assumed to be *behavior*-specific, not *person*-specific, and equal across individuals performing a behavior in the same context (Kaiser et al., 2010). Attitudes are of course person-specific and vary between different people such as environmentalists and climate change deniers. In line with the Campbell paradigm, Kaiser, Arnold, and Otto (2014) suggest that green defaults are behaviorally effective independent of peoples' environmental attitudes. Additionally, higher environmental attitude levels should be reflected in more ecological behavior (e.g., green product choices) irrespective of which default people are confronted with.

Assessing person-level variables such as attitudes as possible moderators for the effect of experimentally manipulated situational variables is of course a common theme in social psychology. In an example involving environmental attitudes, Kaiser and Byrka (2015) assessed participants' cooperation in a social dilemma. In line with the compensatory model outlined above, claims for the common resource were found to be an additive function of environmental attitudes and the type of the resource (i.e., points vs. energy units). Specifically, cooperation turned out to be higher (i.e., indicating a

lower behavioral difficulty) when the common resource consisted of generic 'points' as compared to 'energy units', irrespective of participants' attitude levels. Conversely, participants with higher environmental attitude levels were more willing to cooperate, irrespective of the type of common resource.

However, such research is conspicuously absent for defaults as a specific case of a situational variable. Specifically, the two conflicting models proposed for the interplay of defaults and attitudes both lack empirical support since the effectiveness of defaults and attitudes has typically not been assessed within the same study (for an exception which lacks reporting of the interaction term, see Campbell-Arvai, Arvai, & Kalof, 2014). Thus, no research has – to our knowledge – tested the popular assumption of conditionally effective defaults, nor has the contrasting (compensatory) model been tested.

Default acceptance and opting-out

What does opting-out of a default mean? In most previous research on defaults the choice is dichotomous, e.g., receiving green or gray energy (Pichert & Katsikopoulos, 2008), donating organs or not (Johnson & Goldstein, 2003), continuing with a task or not (Shevchenko, Helversen, & Scheibehenne, 2014). Participants either follow a default or opt out which is equated with the opposite choice. However, in most daily choices there are more than two opposing alternatives. Someone might for example opt out of a green energy default to choose another green provider. Likewise, in the case of green consumerism rejecting the environmentally-friendly, organically produced apple juice in a glass bottle does not imperatively lead to choosing the least environmentally friendly alternative product instead. Classifying every green default rejection as a non-green choice misclassifies a significant proportion of people's choices. A green default, despite being rejected, might raise the odds of actively choosing a different environmentally friendly alternative. This possibility is not empirically represented in binary choice experiments on default effects although one theoretical explanation for their power claims that defaults are interpreted as recommendations (McKenzie et al., 2006). Therefore, experiments on the behavioral impact of defaults and other nudges should not turn a blind eye to people's alternative choices to increase ecological validity of these experiments.

Because opting out of a default is not always equivalent to choosing the opposite course of action, it is possible to disentangle the *behavior guiding function* of defaults

from the *default acceptance rate*. Equally attractive defaults should be accepted equally often but does this hold independent of a decision maker's attitude? Whereas the compensatory model assumes independence of defaults and attitudes concerning their behavior guidance, a different prediction arises when turning to default acceptance as an outcome criterion. By passively tolerating the offered option and accepting a default, people can avoid behavioral costs that come with searching for and switching to an alternative. The Campbell paradigm in which the compensatory model is grounded suggests that people's attitudes are manifest in their readiness to overcome such costs (Kaiser et al., 2010). Thus, whether or not people accept the extra hassle to reject the default likely depends on their attitudes and whether attitudes and defaults are congruent. Strong attitudes *in*congruent with the default (e.g., environmentalists being offered an un-ecological product) fuel the decision to overcome the behavioral obstacles set by the default, whereas attitude-congruent defaults do not necessitate any action.

The present research

To test the influence of defaults and attitudes on people's choices, we employed an online shopping scenario. In this scenario, we offered either green or conventional default products and assessed participants' environmental attitudes. The core dependent variables were the amount of green product choices and the default acceptance rate. In contrast to previous research on defaults, we tracked people's actual choices when they rejected a default. Therefore, choices and default acceptance did not logically result from each other. We were thus able to examine the influence of defaults and attitudes on these two dependent variables separately.

Hypotheses

Drawing on the compensatory model, we derive the following hypotheses on the influence of each predictor and their interaction: We expect a main effect for the default, such that green defaults should result in a higher amount of green product choices (Hypothesis 1). We also expect a positive linear relationship of environmental attitudes predicting people's ecological behavior (Hypothesis 2). In line with the assumed independence of behavioral costs (defaults) and attitudes, we expect these predictors to work independently and non-interactively (Hypothesis 3). Thus, defaults should predict behavior equally well for low, medium, and high environmental attitudes. Finally, whether a default is accepted or actively rejected should depend on the congruency of

that default and a person's attitude. Accordingly, we assume an attitude by default interaction to predict default acceptance (Hypothesis 4).

Methods

Power analysis

To detect even a small interaction effect of default condition and environmental attitude assuming an effect size of $f^2 = .05$ (equaling partial $R^2 = .048$) with 90 % power ($\alpha = .05$, two-tailed), a sample size of $N = 213$ is necessary as indicated by G*Power (Faul, Erdfelder, Buchner, & Lang, 2009).

Participants

We recruited 242 participants from a German online panel (138 female [57%], 87 male [36%], mean age = 34.54 years, $SD = 13.03$). One participant reported not having worked carefully and was excluded from analyses. Ten participants failed to fill out the environmental attitude scale and were excluded from all related analyses. Upon completion, participants could win products chosen in the study. 202 (87%) participants entered their email addresses for the raffle of which 32 won. The mean value of the product bundles was 10.07 Euro.

Procedure

At the beginning of the study, participants were informed that they would take part in an online shopping task for everyday products. In order to encourage serious choices, participants were informed that one out of six would win the chosen products. Upon providing their informed consent, participants first completed a test trial which explained how choosing products in the online shop worked. To assure that participants were only confronted with products that were relevant to them, each participant chose five products from a list of ten (e.g., jam, apple juice, paper towels) to put on their shopping list.

Participants were randomly allocated to either a green or a conventional default condition. Dependent on condition, the default product offered was always organic respectively eco-friendly (glass bottle, recycled paper towels) or conventional respectively eco-unfriendly (can, bleached paper towels). Product pairs with similar mean prices ($M_{\text{green}} = 2.22$ Euro, $M_{\text{conventional}} = 2.16$ Euro) were presented to prevent the perception that either alternative was more valuable. For each selected product

category, participants were shown a default product (e.g., organic or conventional jam) and could either choose the presented product or an alternative brand of the same category (a different jam) from an online shop. They were free to choose any alternative product as long as it belonged to the same category (e.g., jam) and fell below the price limit set by the more expensive default product. We introduced a maximum price because most real shopping situations are also confined by price considerations. Several green and conventional alternatives were always available. The procedure was repeated for each of the five products on the shopping list.

After the simulated shopping part, participants answered questions concerning their purchasing habits (How frequently do you buy the following products? How often do you change brands for each product? How high is the percentage of green products in your shopping overall?) and completed the environmental attitude measure and the consumer self-confidence scale. Next, participants filled out demographics and rated how conscientiously they had worked on the study as well as how similar their choices were to real-life choices. Finally, participants were thoroughly debriefed.

Measures

Environmental attitude. We assessed environmental attitude based on a Rasch scale of ecological behavior, as suggested by the Campbell paradigm (Kaiser et al., 2010). To do so, we alternately employed two overlapping 26-item versions (45 items overall) adopted from the General Ecological Behavior scale (GEB, Kaiser & Wilson, 2004), a self-report measure that taps mundane ecological behaviors (e.g., "I collect and recycle used paper"). The scale has proven to be a reliable (.71 ≤ Rasch based separation *rel* ≤ .88) and valid measure of environmental attitude (Kaiser & Wilson, 2004). Items that represented unecological activities were reversely coded (e.g. "I kill insects with a chemical insecticide"). Engagement in 15 behaviors could be acknowledged by a *yes/no* statement. For the remaining 30 items, we used a five-point scale (never to always). In line with Kaiser and Wilson (2004), the responses to these polytomous items were recoded into a dichotomous format by collapsing *never*, *seldom*, and *occasionally* as indicators of a low environmental attitude level. *Often* and *always* were combined, indicating a high environmental attitude level. When participants were unable to answer an item (e.g., asking about driving behavior when people did not have a license) they could mark "not applicable", which was treated as a missing value. Two items tapping

green consumerism were excluded from the scale in order to avoid trivial predictions of green product selections in the experimental task.

The dichotomous Rasch model served as the measurement model. Each participant's environmental attitude level was derived based on a maximum likelihood approach (see, e.g., Bond & Fox, 2007), and estimated in logits, which stand for the natural logarithm of the engagement/nonengagement ratio of a person across all items. Higher environmental attitude levels are thus reflected in larger positive logit values. Environmental attitude had a separation reliability of *rel* = .60. Because we alternately employed two overlapping 26-item versions, 42% of the data were missing by design. Using the obtained environmental attitude levels and item difficulties, we simulated these missing data resulting in an expected reliability of *rel* = .84 with a complete data set (cf. Curtis, 2004). Joint calibration of the two item sets is feasible due to the uniform item discrimination inherent in Rasch Models. Fit statistics indicated that the 43 items represent a Rasch-homogenous (unidimensional) scale ($0.85 \leq MS_{\text{items}} \leq 1.19$). The estimated environmental attitude levels were sufficient for accurately anticipating participants' responses to the items ($t \geq 1.96$ for 3.9% of participants; see e.g., Bond & Fox, 2007).

Consumer self-confidence. We further assessed consumer self-confidence using the information acquisition (α = .77), consideration-set formation (α = .75), and personal outcomes subscales (α = .72) of the consumer self-confidence scale each containing five items (Bearden, Hardesty, & Rose, 2001). Participants expressed their (dis)agreement to the 15 items on a 5-point scale. Consumer self-confidence is used as a trait measure for marketplace metacognition (Brown & Krishna, 2004), i.e., metacognitive processing of situations in market contexts like reactance towards a perceived manipulation.

Dependent variables: Amount of green products and default acceptance rate

Participants in the two conditions did not differ significantly (i.e., at a Bonferroni corrected level of α = .005) concerning their pre-selection of the ten products (χ^2-tests, $.047 \leq p \leq .913$). We therefore aggregated choices over all products to achieve a more reliable measure of product choices. When an alternative product was chosen instead of the default, these choices were independently coded as green or conventional by two research assistants blind to the hypotheses. The resulting Kappa of κ = .98 indicates almost perfect agreement (Landis & Koch, 1977). For the amount of green product

choices measure, we computed the percentage of green product selections for each participant by dividing the number of green products chosen by the total number of valid choices. For the second dependent variable (default acceptance rate), we divided the number of default products chosen by the number of choices.

Results

We conducted two separate moderated regression analyses using the PROCESS macro for SPSS (Hayes, 2013). Default condition (green vs. conventional, manipulated between participants), environmental attitude, and their interaction served as predictors in both regressions. The percentage of green products chosen was the dependent variable in the first analysis; the default acceptance rate was the dependent variable in the second analysis.

Participants in the two conditions did not differ a priori concerning the percentage of green products usually bought in daily shopping, environmental attitude, age, gender ($.36 \leq p \leq .88$) or household income ($p = .11$) and thus randomization was generally successful.

Green choices as an additive function of default and environmental attitude

In the full model with mean centered default condition, environmental attitude, and the interaction, default condition and environmental attitude independently and significantly predicted the amount of green products chosen, $F(3, 227) = 48.72$, $p < .001$, $R^2 = .32$. Hypothesis 1 is supported by the finding that participants in the green default condition chose more green products than participants in the conventional default condition, $M = .58$ ($SD = .32$) vs. $M = .29$ ($SD = .31$), $t(229) = 7.00$, $p < .001$, $d = 0.92$, 95 % CI [.21, .37]. Environmental attitude and amount of green products chosen correlated significantly, $r = .38$, $p < .001$. Thus, more green products were chosen with increasing environmental attitude levels which supports Hypothesis 2. Importantly, as predicted by Hypothesis 3, attitudes did not moderate the effect of default condition as visible in the non-significant interaction (see Table 1). Figure 1 illustrates the independence of both predictors in the model. As further analysis using the Johnson-Neyman technique revealed, the significant influence of the default condition persisted for participants with environmental attitudes below 2.37 logits (i.e., 2.77 *SD* above the mean) which pertains to 99 % of all participants.

We additionally controlled for participants' self-reported purchasing habits. When the amount of green products usually bought is entered as a covariate, R^2 rises to .44 leaving the pattern of significance unchanged. By contrast, consumer self-confidence did not predict the amount of green choices and did not moderate the relation of the examined variables.

---------- Insert Table 1 about here ----------

---------- Insert Figure 1 about here ----------

Acceptance of the default as an interactive function of default and environmental attitude.

To test Hypothesis 4 that the likelihood of rejecting an attitude-incongruent default despite the associated behavioral costs increases with ascending attitude levels, we conducted a second moderated regression analysis. Default acceptance rate was predicted from mean-centered default condition, environmental attitude, and the default by attitude interaction. The full model including the interaction was significant, $F(3, 227) = 9.94$, $p < .001$, $R^2 = .10$, but neither the main effects of default condition nor environmental attitude reached significance (see Table 2). However, the interaction between the two predictors significantly predicted default acceptance. The simple slope for the conventional default condition was negative ($b = -0.11$, $p < .001$), and the simple slope for the green default condition was positive ($b = 0.11$, $p < .001$). This supports Hypothesis 4 that default acceptance in the green condition (attitude congruent default) increases with ascending levels of environmental attitudes. The reverse pattern emerged in the conventional condition (attitude incongruent default): Here, default acceptance decreased with ascending levels of environmental attitudes as illustrated in Figure 2. The effect did not change when controlling for purchasing habits (frequency, brand loyalty) and consumer self-confidence.

---------- Insert Table 2 about here ----------

---------- Insert Figure 2 about here ----------

Importantly, default acceptance and the amount of green choices were not redundant. Participants rejecting a green (conventional) default could select an alternative green (conventional) product. By coding alternative choices, we were able to determine the percentage of alternative product choices from the same category as the default, i.e., the amount of green alternative products chosen after rejecting the green

default and the amount of conventional alternative products chosen after rejecting the conventional default. Overall, 38.95 % (*SD* = 37.97 %) of all alternative choices belonged to the same category as the default. This is the amount of choices we would have classified incorrectly, if we had assumed that people always choose the opposite category when they reject a default.

Discussion

The central question of this paper concerned the relation of defaults and individual attitudes in the prediction of people's choices. We found support for the predictions derived from a compensatory model that green defaults and pro-environmental attitudes independently increase the amount of green products people choose. The assumption that attitudes moderate the impact of defaults on people's green product selection as implied by a conditional model was not supported. Furthermore, by separating the question concerning the behavioral effectiveness of a default (do green defaults increase green choices?) from default acceptance (when is a green default accepted or rejected?), we could show that default acceptance depends on the congruency of individual attitudes and pre-selected defaults.

The results support predictions derived from the Campbell paradigm (Kaiser et al., 2010) and indicate that defaults can be conceived as behavioral costs that impede or facilitate a choice independently from the decision maker's attitude (Kaiser, Arnold et al., 2014). Understanding defaults as cost factors corresponds with the processes discussed to drive default effects such as inertia/effort (Dinner et al., 2011) and implied endorsement (McKenzie et al., 2006). Thus, conceptualizing defaults as cost factors provides a parsimonious theoretical umbrella for the individual processes responsible for default effects. Our results do not provide a definite answer to the question which process is dominant in which situation, i.e. which kind of cost a certain default raises or reduces. It may very well be that ambiguous situations involving a lot of uncertainty (like, e.g., organ donation) trigger the recommendation (i.e. implied endorsement) function of defaults whereas the extra effort necessary to reject a default drives default effects in situations where rejecting a default is tedious. Yet, in other situations several processes might work together to produce default effects. Since default effects have also been shown in paradigms without any switching effort (Johnson, Bellman, & Lohse, 2002; Shevchenko et al., 2014), it seems likely that effort alone is not a sufficient

explanation. Additionally, 39 % of all alternative choices in our study belonged to the same category as the default (e.g., green alternative choice after green default) which fits an implied endorsement explanation of default effects. However, the present data can only provide first starting points to deal with these questions.

Our research also strengthens the role of individual attitudes in the prediction of choices. Even for one of the most prototypical nudges, namely defaults, attitudes are not necessarily inconclusive and arbitrary as sometimes suggested (Ariely, Loewenstein, & Prelec, 2003). Although there might be situations in which people *want one thing and do another*, this idiom has somehow overshadowed the equally true proposition that oftentimes people want one thing and do the same. We thus argue not to erase attitudes from choice architecture research or treat them as mere moderators but pay attention to both contextual factors such as defaults and individual factors such as attitudes.

A methodological concern of the presented experiment could be that measuring environmental attitudes after the choice task rather than before made participants derive their attitudes from their choices and thus inflated the predictive value of attitudes. However, despite systematic differences in choices, we found no difference in environmental attitude levels between conditions. Furthermore, as the GEB derives attitudes from very concrete instances of past behavior and not from evaluative statements which are probably more malleable, a reverse influence is less likely. Finally, previous research has demonstrated the stability and robustness of environmental attitudes assessed with the GEB (Kaiser et al., 2014). For these reasons, we are confident that attitudes influenced choices and not vice versa.

Although the shopping scenario remains an experimental situation and is no field experiment, we maximized ecological validity by introducing real choices instead of hypothetical choices and by coding participants' alternative choices. We would have classified 39 % of all alternative choices incorrectly, had we automatically assumed that participants who rejected a green (conventional) default preferred a conventional (green) product. Avoiding this large error rate provides a tremendous validity increase.

From an applied perspective, our findings are good news for policy makers considering the use of defaults as behavior change interventions even for attitude-heterogeneous target populations. In the realm of environmental decision making, our findings add to previous research on green defaults and go one step further by applying green defaults to a novel situation (sustainable consumption) with an enormous

potential for environmentally friendly choices and behavior (see also Demarque, Charalambides, Hilton, & Waroquier, 2015). Notwithstanding, the behavioral *end* towards which defaults might be used as a *means* is a normative decision ideally emerging out of a democratic process (as argued by Kaiser, Midden, & Cervinka, 2008). Whether the promotion of green products provides a suitable end for society is not answered by our research but we can conclude that defaults as a means of behavior change can be useful. Importantly, our research also shows that defaults are not silver bullets. Luckily, one could say – and sooth critics who anticipate choice architecture to sound the bell for an age of subtle manipulation – attitudes remain important predictors for individual behavior.

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Table 1

Regression of amount of green choices on default condition and environmental attitude.

	b (*SE*) [95 % CI]	*t*(227)	*p*
Constant	0.43 (0.02) [0.39, 0.47]	22.17	<.001
Default condition	0.29 (0.04) [0.21, 0.36]	7.40	<.001
Environmental attitude	0.15 (0.02) [0.11, 0.19]	7.09	<.001
Default × attitude interaction	-0.03 (0.04) [-0.12, 0.05]	-0.73	.47

Table 2

Regression of default acceptance on default condition and environmental attitude.

	b (*SE*) [95 % CI]	*t*(227)	*p*
Constant	0.41 (0.02) [0.37, 0.45]	20.73	<.001
Default condition	0.04 (0.04) [-0.04, 0.12]	1.01	.31
Environmental attitude	-0.00 (0.02) [-0.04, 0.04]	-0.18	.86
Default × attitude interaction	0.22 (0.04) [0.14, 0.30]	5.29	<.001

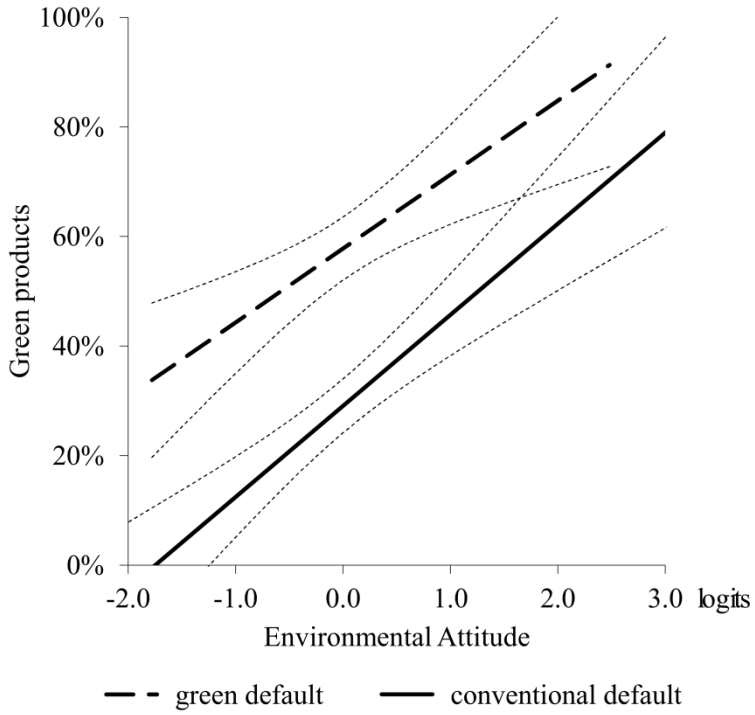

Figure 1. The share of green products as a function of default condition (green vs. conventional) and environmental attitude. Dotted lines indicate the 95 % confidence intervals.

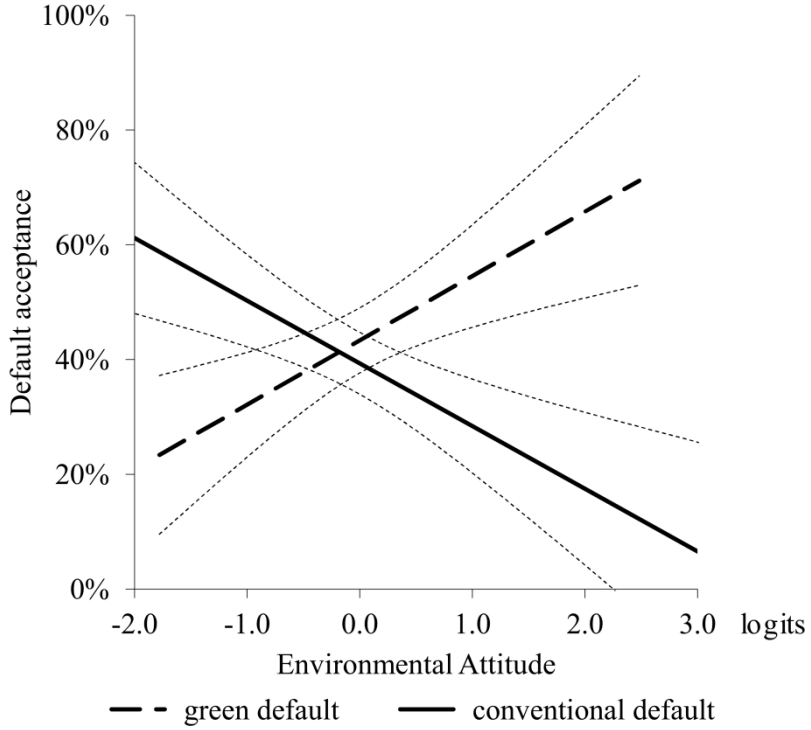

Figure 2. The extent of default acceptance as a function of default condition (green vs. conventional) and environmental attitude. Dotted lines indicate the 95% confidence intervals.

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Doctoral Committee of the Faculty of Behavioural and Cultural Studies, of Heidelberg University

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