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When do defaults stick and when are they ethical? - taxonomy, systematic review and design recommendations

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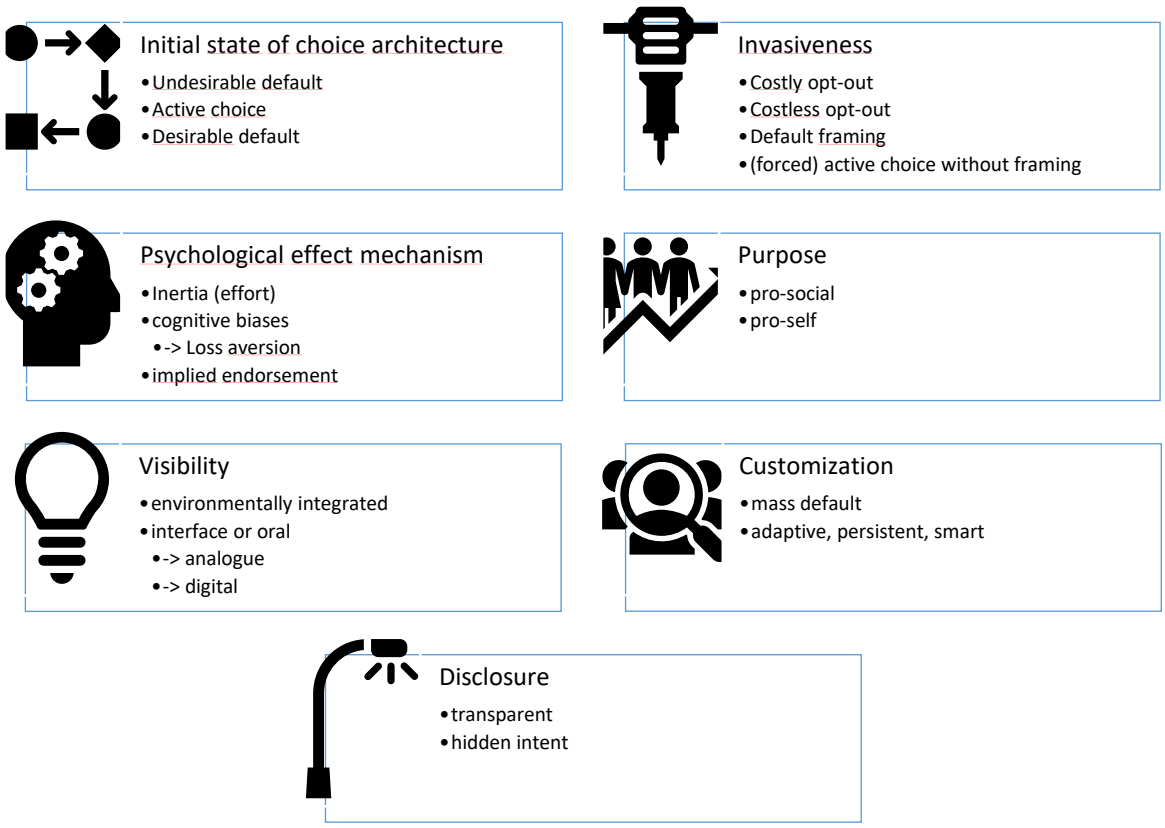
Graphical Abstract: Taxonomic features of default nudge interventions



Highlights:

- Universal Design recommendations
- Elaboration of the issue of undesirable defaults in daily lives
- Several research gaps in designing default nudges

Abstract: In many instances, default nudges are proven to be strong drivers of behavior. However, a number of ethical concerns have been raised. Both, nudge success and ethical concerns, depend heavily on the features of the default nudge, with some of them being shared by defaults in all settings. We systematically review the scientific literature on default nudges from various disciplines and investigate nudge success and ethical concerns with respect to seven main features: (1) the initial state of the choice architecture, (2) the invasiveness, (3) the psychological effect mechanism, (4) the purpose, (5) the visibility, (6) the customization, and (7) the disclosure of the default. When designing a default, as researcher or practitioner, a full consideration of these features is advised. Often enough, choice architects are not aware of the design options. In a nutshell, the welfare losses suffered through the initial choice architecture are often overlooked. Customizations and disclosures of defaults are scarcely used despite easing ethical concerns without negatively affecting nudge success. The psychological effect mechanism, with several ethical implications, remains a theoretical relict that is not empirically researched. Default framing in combination with a choice structuring default can lead to greater nudge success.

Content

1. Introduction:

Default nudges have been singled out as probably the most effective nudging tool in the box. A meta-review by Hummel and Maedche (2019) of 100 nudging studies finds default nudges to influence behavior more strongly than other nudging techniques. The literature discusses various noteworthy field experiments (Sunstein and Reisch 2014; Schubert 2017; Löfgren and Nordblom 2020). For example, (1) Rutgers University changed the default settings of printers to print on two sides, which resulted in a 44% reduction in paper consumption. (2) In a region in southern Germany, the local energy provider offers a green energy mix as the default and two alternatives, a less green option at an 8% cost advantage and an even greener option at a higher price. 94% stick with the default and 4.3% opt into the cheaper contract. This finding has to be understood in the context of less than 1% of German households opting for any green energy mix by that time (Sunstein and Reisch 2014).

The choice for (1) printer settings and for (2) energy contracts are examples of decisions subject to default options. The printer setting menu preselects default options that can, but must not necessarily, be altered. The offered default energy contract can either be signed or a contract for a different procurement option can be requested. The nudge success of such defaults is known, but the behavioral disciplines still lack a systematic understanding of what makes a default stick: (1) Was paper consumption reduced due to a low involvement with the printing decision, weak preferences for a one-sided print, or a printer setting menu difficult to navigate? Additionally, a default nudge may not be the only element of the choice architecture that altered the behavior. (2) In the green energy example, a third, even greener option was offered, which in the marketing literature is described as a compromise effect (Kivetz, Netzer, and Srinivasan 2004), i.e. the tendency to stick to a medium option due to a strong reference dependency. The growing literature on default nudges (90% of the reviewed articles are published between 2015 and 2020) provides an opportunity to better understand such design features and their relevance for nudge success.

However, nudge success is not the only dimension of defaults that allows to formulate policy applications. The nature of defaults themselves has labeled them as “hidden persuaders” (Smith, Goldstein, and Johnson 2013). This label comes with ethical concerns related to consumer autonomy. Two main ethical objections have been expressed: (a) consumer welfare losses and (b) the erosion of consumer autonomy (Sunstein 2013; Sunstein and Reisch 2014; Smith, Goldstein, and Johnson 2013). (a) Firstly, the implementation of a default can, but must not, lead to an overall welfare gain for consumers. This precondition has coined the term “benign default” (Goldstein et al. 2008). An ex-ante cost-benefit analysis is advised (Sunstein and Reisch 2014). Secondly, the heterogeneity of preferences leads to winners and losers of a policy change. For example, the default activation of airbags in 90s vehicles was beneficial for most, but can adversely affect smaller women and children (Smith, Goldstein, and Johnson 2013). A default may negatively affect particularly vulnerable groups or cause supply chain issues as supplier surplus is reduced. Depending on the design features of the default, welfare concerns can be eased. (b) Consumer autonomy is an essential safeguard against non-benign defaults and promotes decision making competences. Although nudging theory explicitly preserves the freedom of choices, i.e. nudging should not be confused with stricter forms of paternalism (Sunstein 2013), a default will reduce the number of considered options, particularly for consumers with a low involvement in the decision. A nudged simplification of choices may eventually reduce decision making competencies. Similar to the welfare critique, the design features of nudges can fuel or dowse autonomy concerns.

To improve the design of default interventions, we systematically review the growing default nudge literature. We present taxonomic features of defaults, all of which hold ethical implications, and evaluate their contribution to nudge success. The taxonomic features can guide choice architects in

designing more successful and ethically acceptable default nudge interventions. This is the first study of its kind. Although many empirical reviews have addressed nudging interventions, to the best of our knowledge, due to their research scope, all of them ignore default specific features.

The following chapters explain (2) the methodology of the systematic review, followed by (3) the results and discussion chapter on the taxonomic features of defaults. Each subchapter of (3) explains the classification of the taxonomic feature, the empirical findings, and derives implications for nudge success and the legitimacy of each default feature.

2. Method

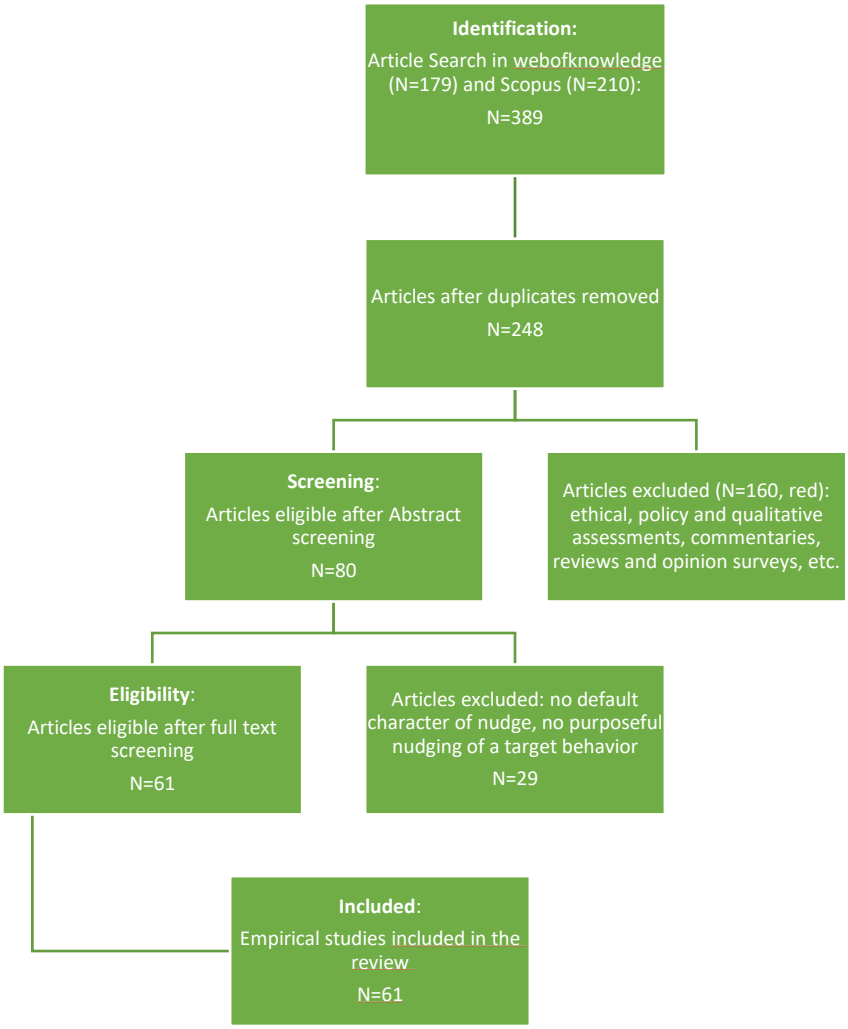
2.1 The systematic literature review

Initially, we tried to register the review with Joanna Briggs Institute and Prospero, but were refused due to increased demand during the Corona pandemic. The following response was given: "PROSPERO does not currently accept registrations for scoping reviews, literature reviews or mapping reviews". While the research objective of the review was not altered during the data collection stage, the taxonomic features of defaults were not refined during data collection.

The data collection stage adhered as closely as possible to the PRISMA Statement. We started a keyword search in two databases; the "Webofknowledge" and "Scopus". The keyword search was refined by the wordings of previously identified default nudge articles. Articles were considered if they use an expression for default and for nudging within the Abstract, Title, or Keywords. This includes studies that identify with the nudging literature and excludes a bulk of irrelevant studies that only use a default expression. The search string applies operators to account for different cases of relevant expressions: [("choice* architecture") OR (nudg*)] AND [(default*) OR (status quo) OR (opt* out) OR (opt* in)]. The search was limited to peer-reviewed research articles, published in English after 2008, i.e. after Thaler and Sunstein coined the term nudging. The eligible studies are empirical case studies of default nudge interventions that purposefully influence a target behavior.

After removing duplicates, we started to screen abstracts (N=248). A bulk of studies were excluded because they dealt with defaults from an ethical or policy perspective or were commentaries but did not actually test an intervention. A few studies were qualitative or nudging reviews without primary data of a tested intervention. In the Scopus search process, review articles were not automatically excluded but were manually removed during the screening process. 80 articles were fully read by the research team. A few more articles were excluded after discussion among the research team, although fully reviewed. Reasons for exclusion were: (a) the default nudge was essentially a ban of some options, depriving it of the nudge character, (b) the default was not intended to purposefully influence a behavior, (c) only the opinion on a default was evaluated, but not the nudge effect, or (d) the implemented nudge represents a different nudging category as defined by Wilson et al (2016) rather than a default. The screening process is summarized in the following (Figure 1).

Figure 1: Literature Screening - Flow Diagram



Data collection frame between 01/2008 and 04/2020

The included articles were reviewed by collecting study specifics within a PICO framework: population, intervention, control group and outcome (behavioral change). The framework allows us to track outcomes back to specifics of the population, intervention, or control group. The result and discussion section will elaborate in detail on the reviewed information, particularly on the taxonomic features this review proposes. We added entries on the timing of the study and quality characteristics following a checklist (Downs and Black 1998).

2.2 Publication bias

We intentionally drew a random sample from the two literature databases. Due to biases in the publication process or the journal selection within the databases, we advise for a careful interpretation. However, we do not assume publication bias to vary systematically between the analyzed taxonomic features of the studies. For example, a comparison between defaults with a pro-social vs. a pro-self-agenda should be on equal footing with respect to publication bias. A minimum quality of the included studies is secured through preselecting “webofknowledge” and “Scopus” as databases, as opposed to using Google Scholar, and a qualitative assessment of reporting features, selection bias, and the internal- and external validity of the studies (Downs and Black 1998).

2.3 How to define default success

The habit of reporting the relative and absolute effect sizes, e.g. (Hummel and Maedche 2019), is not adequate to synthesize default effects. Imagine two scenarios: (1) a status quo where 0.1 % of the

research population exhibit the desired behavior, and (2) a status quo where 50% exhibit the desired behavior. In scenario (1) a default may raise this share to 5%, resulting in a 5000% relative increase in the desired behavior and an absolute increase of 4.9%. A default in scenario (2) can only exhibit a maximum relative effect size of 100%. The drawback of absolute effect sizes is the complete disregard of the current rate of adoption. An increase of absolute adoption rates in scenario (2) is simpler than in scenario (1). The main reasons are the challenges for early adopters involved in the uptake of a behavior as opposed to a behavior already observable in half the population. Similar reasoning applies to a status quo where 95% exhibit the desired behavior and the default aims at influencing the laggards. Conclusively, we define the default success as a two by one matrix: a. Status quo (control) (share of target behavior under control condition), b. Default (share of target behavior under default condition) and present both conditions whenever possible. The significance tests between default and status quo depends on the study at hand.

3. Results and Discussion

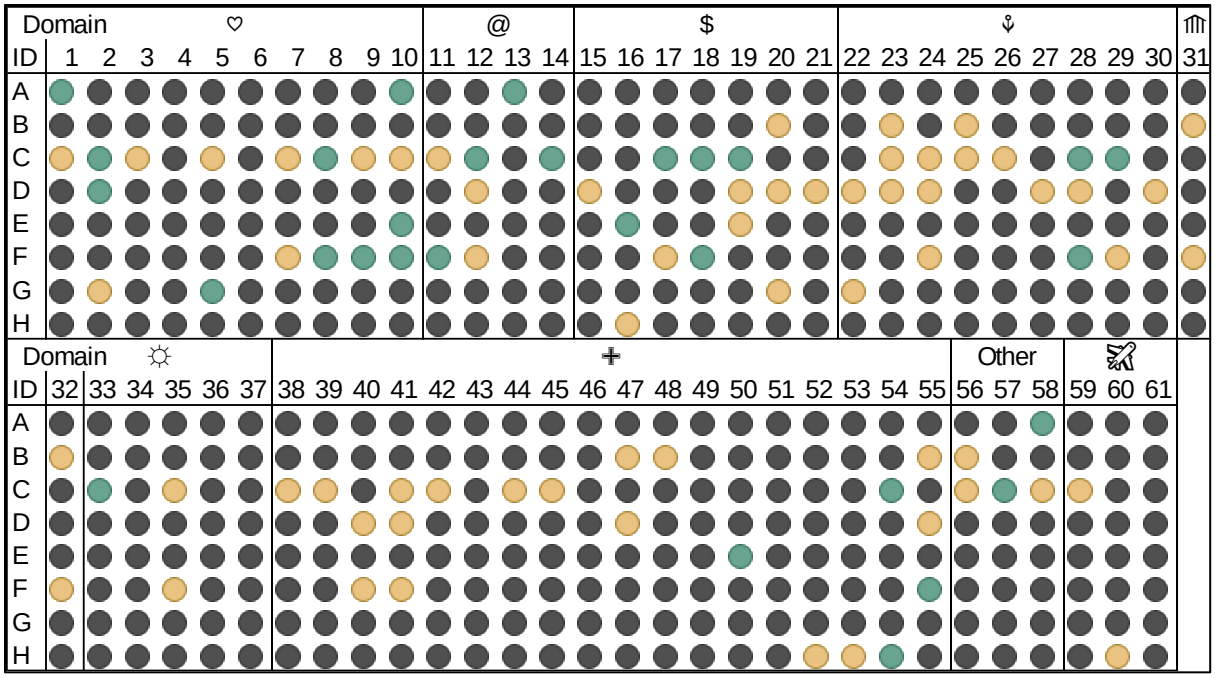
3.1 Taxonomic features of defaults

To understand when defaults stick and when are they ethical we review key taxonomic features of defaults: (1) the initial state of the choice architecture, (2) the invasiveness, (3) the psychological effect mechanism, (4) the purpose, (5) the visibility, (6) the customization, and (7) the disclosure of the default. The following sections will (i) explain the meaning of each feature, (ii) empirically compare the nudge success of different feature levels whenever the levels differ within a study, and (iii) outline the ethical implications of a feature level change. The feature levels are best understood through each section.

The reviewed studies stem from different strings of scientific literature that we group into: Charity, Digitalization and Privacy Concerns, Finance, Food, Green Architecture, Green Electricity, Health, Travel and Others. In general, the use of defaults in the scientific literature is rather restricted to these specific research domains. The Defaults in “Finance” nudge consumers towards tax compliance, increased retirement savings or socially responsible investments. “Charity” involves donations to designated organizations dedicated to social and environmental causes but also direct donations in public goods or coastal conservation. Studies in the “Travel” category default consumers into CO2 offset programs in a variation of travel settings. Some deal with means of transport, e.g. an electric rental car, while others consider choices as a hotel guest with respect to room cleaning and towel reuse. “Health” is a diverse research domain. It addresses physical activity, the selection of medical treatments or medical diagnostics, or the participation in an organ donor program. Here, not only patients but often enough medical practitioners are the target population of defaults. An ecological or green agenda can be found in all research domains but not for all studies. An overview on the studies and the addressed target behaviors has been attached (Table A1).

When it comes to the taxonomic features, we will show how all variations (levels) of the features have been tested, but several research domains neglect to experiment with some feature levels (Figure 2). For example, studies on the household procurement of green energy (☼) present a choice characterized by a grey energy default for many consumers. Often consumers are not uncomfortable enough to actively opt-out and the choice does not occur unless changing residence. A forced active choice and a default frame are interesting options to bring consumers to a reflected decision, but are rarely applied (Figure 2). Also, the studies have so far not tested customized defaults, e.g. where different consumers could be subject to different shares of green energy (Figure 2). Not all feature levels are advisable for all types of defaults. We will conclude with universal design recommendations across all research domains.

Figure 2 Appearance of feature levels in reviewed studies



Feature levels:

● = feature level not included, ● =feature level exclusively applied, ● =multiple feature levels applied, A= transparency: intent disclosed (vs. not disclosed), =visibility: environmentally integrated (vs. visible on an interface, C= initial state of choice architecture: active choice (vs. undesirable default), D=purpose: pro-self (vs. pro-social agenda), E=customization: customized (vs. mass default), F=invasiveness: default framing (vs. costless opt-out), G=invasiveness: costly opt-out (vs. costless opt-out), H=invasiveness: forced active choice without framing (vs. costless opt-out), Research domains: ♡=Charity, @=Digitalization and Privacy Concerns, $=Finance, ⚘=Food Choices, 🏛= Green Architecture, ☼=Green Energy, ✚=Health Care, 🚀=Travel

3.2 The initial state of the choice architecture: Undesirable defaults, active choosing and desirable defaults

Classification: Each decision is subject to one of three states with respect to defaults: Undesirable defaults (UDC) -> active choice (ACC) -> desirable defaults condition (DDC). Although an undesirable and a desirable default are similar in nature, they promote conflicting target behaviors and thereby differ substantially with respect to nudge success. A desirable default promotes a behavioral change desired by the choice architect. Vice versa, an undesirable default nudges towards a behavior that the choice architect opposes. Active choosing is characterized by a presentation of all options on an equal footing, i.e. neutral presentation of the choice options. An initial state with an undesirable default gives a choice architect, that holds the legitimacy to act, two options: (1) a shift from undesirable default to active choosing and (2) a shift from undesirable to desirable default. Option (2) introduces two defaults, one from undesirable to active choosing and another from active choosing to desirable default. Both defaults contribute to nudge success.

Empirical findings

In the empirical literature, the most common control group is a UDC rather than an ACC. 40 out of 61 studies control for an UDC. The surplus of UDC control groups is more pronounced in Field Experiments (23 out of 31) than in lab and online experiments. Lab and Online Experiments might be better equipped to implement an ACC, which may not be intuitive to a field setting. Note, however, that most ethical evaluations rather focus on the trade-offs between ACC and DDC.

The difference between UDC, ACC and DDC are well illustrated in studies that evaluate all three of them. For example, Bergeron et al. (2019) analyzed the choice of a desert in a restaurant setting (#28, Table A1, A2). In this particular restaurant, the desert is selected on a paper form, but the options could also be conveyed by waiters. In the ACC scenario the paper sheet asks consumers to check one of two boxes with one option being a lighter desert and the second a heavier desert of the same type (38% chose the lighter option). The ordering process is only completed if a decision on the deserts has been reached (forced active choice). In the UDC scenario, assuming the lighter version to be the desirable option, the paper sheet informs consumers that a desert (the heavier one) is served with the menu, but they can check a box if they want to receive a lighter version (31%). The DDC is the vice versa scenario (79%).

The findings of studies with all 3 states hint at smaller differences between UDC and ACC than ACC and DDC (Table A2). A shift from ACC to DDC is more likely to break habits and initiate a behavioral change. One reason might be the long-term effect of frequent exposure to an undesirable default. A few studies show how a desirable default effect lasts (long term effect) even if the initial conditions have been restored (Venema, Kroese, and De Ridder 2018; Fosgaard and Piovesan 2015). These studies show how even short-term intervention effects can persist. Therefore, the defaults influence not only the choice at hand but also the underlying preference structure. Taste preferences, such as for a thicker desert, depend on the exposure to the taste and the habit of post rationalizing a particular option. Here, we put forward an additional objection for ethical consideration. It is argued that, among other characteristics, the legitimacy of a default depends on the majority endorsing the intervention (Engelen 2019). As we can assume preferences to be biased by the initial choice architecture, researchers are challenged with an unbiased measurement of endorsement. In theory, a desirable default can grow more legitimate through long term exposure of consumers.

Generally, a choice architect can prefer an ACC over an UDC. A clear empirical exception is a charity study in the Gili Tarwangan region in Indonesia (Nelson, Partelow, and Schlueter 2019) (Table A2, #8). Tourists were asked whether they would contribute to an NGO with eco-conservation purposes in the region they visit. The active choice was a blank space where participants could enter the amount they were willing to contribute. The default conditions were structured such that the default was the proposal of a typical donation amount (10000 Rupees). UDC and DDC only differed in the phrasing of the question, i.e. a DDC asked whether they agree to donate the proposed amount, while the UDC asked whether they do not agree. Here, the effect of defaulting an amount provides guidance to consumers. In a different treatment, the investigators framed the decision by simply suggesting 3 typical donation amounts which also resulted in more tourists willing to contribute than in the ACC scenario. The defaulting of an amount appears more relevant than the phrasing of the ask. Unfortunately, such details of the treatment and control condition complicate a comparison across studies.

The studies that evaluate all 3 states show the transition from UDC to ACC and ACC to DDC, but their study context may systematically differ from studies that evaluate just 2 states, some of which do not permit an ACC. We hypothesize that a DDC is more effective if consumers are typically exposed to an UDC in their daily life rather than an ACC. When consumers make active choices on a matter, they start post-rationalizing the decision and are less likely to revisit. A full meta-analysis might be able to address the latter across studies because ACC and UDC are common control groups and the control groups are often chosen in consideration of a status quo in real life settings. However, the research domains and the target behaviors in this review differ widely. If we ignore all the shortcomings of a bivariate analysis, of relative effect sizes, and of the different study contexts, then a Wilcoxon ranksum-test suggests a significantly stronger effect ($p=0.0014$) of DDC if the control group was an UDC.

Ethical implications

Scholars have addressed the ethical implications of active choosing and a default choice architecture (Schubert 2017; Sunstein and Reisch 2014; Sunstein 2013; Smith, Goldstein, and Johnson 2013). Active choosing holds ethical advantages over defaults such as promoting reflective decision making, safeguarding against uncertainty and ill-informed defaults (Sunstein and Reisch 2014). The goal of active choosing is to make people better off. But if the area is unfamiliar, highly technical, or confusing, active choosing might have the opposite effect (Sunstein and Reisch 2014). Active choice vs. defaults are a vibrant part of the debate on whether policy makers should, in any circumstances, consider defaults.

The presence of a UDC in real-world choice architectures can impose significant consumer welfare losses. A choice architect that attempts to replace a UDC with an ACC will strengthen consumer autonomy. Ethical evaluations of defaults often neglect the distinction between undesirable and desirable defaults, overlooking the potential of replacing a UDC with an ACC. While welfare losses through UDC cannot always justify a governmental intervention, they definitely change the set of options a choice architect holds. It will be much harder for defendants of the status quo to oppose the implementation of active choosing. The same arguments that have been used to defend the status quo, can now be applied in favor of an intervention. For example, objections on consumer autonomy and how defaults may degrade consumer's ability to cope with decision tasks in the long run (Schubert 2017; Smith, Goldstein, and Johnson 2013; Sunstein 2013), are reversed. A governmental intervention still interferes with a company's perceived right to choose a choice architecture, which has to be weighted when faced with welfare losses induced by the very choice architecture. This shall not imply that a desirable default can never be justified but it has to be evaluated more critically than an active choice intervention. In a brief sentence Smith et al. (2013) argued that the legitimacy of a (desirable) default increases when policy nudges compete with contradictory nudges from private marketers. Governmental interventions to prevent commercial firms from exploiting the effects of nudges seem more justified, but other taxonomic features, some of which we present in the following sections, can further dampen or strengthen the legitimacy.

3.3 Invasiveness of defaults

Classification*:* The invasiveness of a default nudge can be categorized in four basic default categories: (1) defaults with costly opt-out, (2) defaults with a costless opt-out, and (3) active choosing with default framing, (4) active choosing without framing (Sunstein and Reisch 2014). Defaults were registered as "costly opt-out" if the execution (not the decision making process) to opt out exceeds one minute, the equivalent of 1 € or was not feasible for some. In case the opting out was not costly, the default is registered as "costless opt out". Default framing refers to active choosing while a frame highlights one option to be the status quo or usual option. In contrast to defaults, default framing does not structure the choice task but describes it. Defaults and default frames are not mutually exclusive but can be used in a combination to strengthen nudge success. Active choosing without framing presents an additional treatment to an undesirable default with no default character. The ethical implications of an ACC have been discussed in the previous section. In theory, the invasiveness declines from 1 to 4.

Empirical findings

Costless opt-outs (2) are what behavioral researchers commonly understand as a default. A particular choice is preset which makes it the easiest option but opting out is only a matter of decision making action. The majority of empirical literature reflects this default (48 out of 61). This is the baseline that we compare other invasiveness levels to. In the following we refer to a costless opt-out as regular default.

Costly opt-outs (1) are limited to four studies in this review (Ghesla, Grieder, and Schmitz 2019; Loeb et al. 2018; Briscese 2019; Brune et al. 2017). In field experiments, consumers had to call to deselect a lunch menu for their kids (Loeb et al. 2018) or had to log in to a web-account to find and change a financial decision (Briscese 2019). Under an ACC 5% of consumers would donate leftover credits, while 78% did so when defaulted to donate with a costly opt-out (Briscese 2019). No parents opted out to a healthier lunch for their kids under an UDC with costly opt-out, while 98% did also stick to a healthier lunch default in the vice versa scenario (Loeb et al. 2018). Only one lab experiment allows for a 1 to 1 comparison between a default that is costly in one treatment and costless in a different one (Ghesla, Grieder, and Schmitz 2019). Individuals had to solve small puzzles to deselect a default donation amount. In this case, 59% of consumers accepted the default and donated their maximum endowment, while only 34% did so when a costless opt-out was offered. A costly opt-out will clearly be a stickier default than a costless opt-out.

(Forced) Active choice without framing (4) is usually a forced choice in experiments. The forced character holds a number of nudging characteristics. The choice is overly salient to consumers and consumers cannot ignore it and continue a habit without explicit decision making. The nudging properties add to the general effect of replacing an UDC with an ACC. Defaults and forced ACC can easily be confused. For example, a food choice study claimed to default kids into fast food menus with either apple slices or French fries as a side-dish (Wansink and Just 2016). The kids received a menu with a defaulted side dish, but after ten minutes they had to walk up and actively confirm or reject the side dish with the experimenter, thereby forcing an active choice and diluting the default character, so inertia can no longer drive decision making.

A couple of studies have treated a UDC with a forced active choice without considering a DDC (Hoffmann, Cam, and Camilleri 2019; Kesternich, Roemer, and Flues 2019; Patel et al. 2017; 2016), although a DDC is generally feasible if a UDC exists. An example is the voluntary contribution to a carbon offset program when purchasing a bus ticket (Kesternich, Roemer, and Flues 2019). The price for offsetting carbon emissions was set to 8 Euro-Cents per kilometer. In the UDC, consumers can ignore the box for participation in the program, which is initially deselected. The forced ACC obliges consumers to make this decision, thereby requiring a conscious decision for or against the contribution, which is intended to trigger guilt if opting out. The share of consumers willing to contribute increased from 17.7 to 26.5%. The other studies with forced active choice treatments report similar effect sizes, all of which are significantly different from the control group.

Default framing (3) often addresses how a specific option is recommended or expected. A suitable application of a default frame is the manipulation of a software tool for green engineering designs (Shealy and Klotz 2015). The software assigns green design points while being drafted. Instructions on the standard version read: “You are starting at the industry norm benchmark with 0 points. Every decision you make above industry norm will earn you points.” Instructions on the endowed version read “Decisions made below the conserving level will lose you points. Decisions made above the conserving level will earn you points.” Other than that, the versions were identical. The endowed frame communicates a more ambitious expectation to users, which resulted in an average score of 79% of the total available design points as opposed to 56% for the users of the standard version.

A number of studies implement default frames, either exclusively, in one of the treatment conditions, or in combination with regular defaults. A few studies apply defaults and default frames in separate treatments and can compare it to the same control group (Nelson, Partelow, and Schlueter 2019; d’Adda, Capraro, and Tavoni 2017; O’Reilly-Shah et al. 2018; Schneider et al. 2019). The results point to similar nudge success of regular defaults and their frames. Firstly, an active choice on a donation amount was framed with: “about 50% of the (previous) participants gave 10c (50% of endowment) or

more. What amount will you give …" (d'Adda, Capraro, and Tavoni 2017). The regular default presets the amount to donate 50% of the endowment. Both nudges did not significantly change donation behavior in this online experiment.

Secondly, in a medical setting, the compliance with updated recommendations for mechanical ventilator settings was researched (O'Reilly-Shah et al. 2018). The regular default changed the default settings of the ventilator machines, so that physicians had to actively reset them. The default frame was a quarterly email remainder showing each physicians ventilator compliance compared to the average compliance rate of the entire clinic. These treatments were compared to an UDC where no emails were sent out and the default settings of the ventilator machines defaulted a non-optimal setting. Here, only the default frame significantly changed the outcome, raising the compliance rate from 59.3 % to 75.5 %. A combination of both nudges led to a compliance rate of 87.8%.

Thirdly, the framing of a donation task with 3 typical donation amounts raises the share of tourists that contribute to eco-conservation in the region from 20 to 35% (Nelson, Partelow, and Schlueter 2019). Here, the regular default leads to even 75% of tourists willing to contribute. However, the regular default, as previously explained, phrases the ask in a way that consumers have to actively state that they are not willing to contribute and frames the decision by suggesting a typical donation amount. Therefore, tourists are treated with both, a default frame and a regular default.

Fourthly, an experiment on the selection of an electronic identification card on a mock governmental webpage (Schneider et al. 2019) shows the combination of framing and regular defaults well. The preselection and a default frame stating that "77% opted for an eID" convinced 87%, while 46% selected the eID in an ACC. 74 and 76 % selected an eID if only 1 of the treatments was used.

Although these empirical findings are too premature to compare nudge success, the findings suggest that a default frame, in some instances, can be as effective or even more effective than a regular one. Scenarios that are highly suited to involve reflective decision making can particularly benefit from frames and forced active choices. This is highly context dependent and may persuade different types of consumers. From a perspective of nudge success, frames and regular defaults can complement each other. The frame describes the choice and the default structures it, thereby addressing the automatic and cognitive elements of decision making. In fact, a number of researchers have complemented their default by a default frame, usually referring to the whole intervention as one default (Momsen and Stoerk 2014; Dogruel, Joeckel, and Vitak 2017; Fonseca and Grimshaw 2017; Arvanitis, Kalliris, and Kaminiotis 2019; Schneider et al. 2019; van Kleef et al. 2018). Such studies combine the nudges in one treatment, so that a separate analysis of nudge success is not possible. All of these combined interventions significantly influence behavior as intended by the choice architect.

Ethical Implications

Defaults with costless opt-out (2) are essentially system 1 nudges. The structuring of the choice task intends to influence the automated decision-making component. Priming or salience nudges are system 2 nudges, because they describe the choice task without structuring it, thereby inevitably involving the reflective components of decision making. Since system 1 nudges entail the risk of bypassing the reflective system, they are often perceived as paternalistic (Heilmann 2014; Schubert 2017). Consistent with such reservations, citizens perceive system 1 nudges as more autonomy threatening than other nudges (Jung and Mellers 2016). As default frames are essentially system 2 nudges, they will be viewed as less autonomy threatening than regular defaults. However, regular defaults can potentially also respect the reflective system which depends on several design characteristics.

D*efault framing* (3) reduces a default nudge to a system 2 nudge. Default frames can raise the salience of an option, but respect the reflective system. From a theoretical point of view, the active choice and default framing, in the form of an endorsement of the preferred option by the choice architect, preserves consumer autonomy while increasing welfare (Smith, Goldstein, and Johnson 2013). The active choice demands consumers to take their well-being in their own hand and decide what is good for them. The default frame, if truthfully specified, informs their decision making.

However, in many instances a default frame is not applicable. Firstly, the sheer number of choice task and limited cognitive capacity hinders the full comprehension of all choice tasks in daily lives. For example, consumers face over 200 food choices each day (Wansink and Sobal 2007). Understandably, consumers have developed heuristics to deal with the bulk of decisions in order to deal with the information overload. Often enough, the stakes are not high in singular decisions but quickly sum up to meaningful health effects. Secondly, some real-life settings do not allow for an active choice, so that choice architects are constrained to design defaults. In many choices the number of options is overwhelming and complex for non-experts. An ACC would require all options to be presented on equal footing. For example, when medical staff defaults patients into a vaccination treatment, they can either propose the treatment (DDC) or not (UDC) (Lehmann et al. 2016). An unbiased presentation of all possible treatments will likely cause information overload and mischaracterize the role of medical staff in guiding consumers to better health care.

Defaults with a costly opt-out (1) are not common in the scientific literature, but this may not hold for the real world. Such defaults should not be labelled as nudges. They violate nudging theory and can hold properties similar to a ban. In some instances, consumers may not have the resources to opt-out. Nudging theorists are advised to refrain from proposing them to ensure that ethical assessments of default nudges are judged solely on nudging properties. Nevertheless, costly opt-outs are less welfare threatening than a ban and are therefore easier to legitimize than such extreme measures.

On the contrary, the low legitimacy of costly opt-out does also apply for costly UDC. The example where parents need to call to deselect an unhealthy lunch menu for their kids shows how 100% of parents followed the costly opt-out, while 98% followed the reversed default for a healthy menu (Loeb et al. 2018). Neither the UDC nor the DDC with costly opt-out is likely to reflect the underlying preferences. The UDC choice architecture causes preventable welfare losses. Such welfare losses help to legitimize an intervention. However, a costly UDC does usually not legitimize a full reversal.

3.4 The psychological effect mechanism of defaults

Classification: Although the naming of concepts differs between researchers, there are three main psychological mechanisms theorized of how a default influences behavior: (1) inertia, (2) implied endorsement, and (3) cognitive biases (Schubert 2017; Sunstein and Reisch 2014; Smith, Goldstein, and Johnson 2013; Paunov, Wänke, and Vogel 2019; Ghesla 2017). (1) Decision making requires cognitive effort. The rejection of a default requires active steps to opt-out. Depending on preferences, consumers might be reluctant to make the effort or invest the thought (cognitive cost) (Ghesla 2017; Smith, Goldstein, and Johnson 2013). (2) The preselection of an option can signal a recommendation by the choice architect (McKenzie, Liersch, and Finkelstein 2006). Some consumers might even interpret the default as the option the majority endorses (Smith, Goldstein, and Johnson 2013) which adds a social norm nudge trait nested in the default. (3) Consumers may also use biased decision making strategies, such as an emotional preference for the status quo (Momsen and Stoerk 2014; Paunov, Wänke, and Vogel 2019). They may perceive the default option as an endowment and act according to loss aversion biases.

Empirical findings

The review identified a literature gap, because no study controls for the effect mechanism of the default nudges. One exception is a study that investigates how loss aversion interacts with a default (Stryja and Satzger 2019). In the study, a set of investment decisions is applied to identify loss aversion. Then, consumers select a rental car for a business trip. In the first round only one electric and one diesel car are offered. In the second round, the choice set consists of 3 diesel and 3 electric cars. In the second round one experimental variation introduces a default that preselects consumers to choose the electric car with medium price and medium power. Under an ACC 3.3 % switch to an electric car after previously selecting a diesel. The DDC causes 11% to switch to an electric model. Consumers with a higher loss aversion are less often swayed by the default, though no significant relationship is observed (Stryja and Satzger 2019). The case study therefore does not confirm default theory (Sunstein 2013; Smith, Goldstein, and Johnson 2013; Sunstein and Reisch 2014) of how defaults are effective by exploiting loss aversion. More empirical evidence is lacking on the explicit psychological mechanism. Although we attempted to, we could not make a confident decision on the psychological mechanism employed by the different default studies. All three mechanism are entangled and can weigh differently in each scenario.

Ethical Implications

The identification of the psychological mechanism may explain what makes defaults such a powerful force in shaping people's behavior (Schubert 2017) and whether that force is ethical from a consumer autonomy and welfare perspective.

When *Inertia (1)* drives consumers' preferences for a default and consumers recognize the choices and understand that they can reject the default, then consumer autonomy is maintained (Smith, Goldstein, and Johnson 2013). A nudge purely relying on inertia will be rejected if consumers hold strong preferences against it, which makes such a default less welfare threatening. Perhaps the difference between the willingness to accept an outcome and the willingness to choose an outcome explains the effect of inertia. Consumers shy away from the effort to switch because they are willing to accept an outcome over actively choosing a slightly better one. Here the effort is not the cost of executing the opt out (see costly opt-out), but rather the cognitive cost to make up one's mind, because the default is perceived as sufficiently uncomfortable.

The inertia feature points to a flaw common to studies in our sample. In lab experiments, and sometimes in field experiments, the default is characterized by the preselection of an option, but consumers face a decision task with all options readily available. In a real-life setting, consumers have to take the first step, overcome inertia and decide to deal with a decision task, possibly starting with an evaluation of the alternatives available. Imagine the decision for a green energy provider. A household has an ongoing contract with a grey energy provider and has to decide to reevaluate the matter. Most studies confront consumers with the readily available choice set and thereby dilute the possible effect of inertia. Only a few studies are designed in a way that consumers can ignore a decision and do not need to actively confirm a default. For example, attaching a sticker (easily removable according to the authors) on the mailbox to avoid junk mail (Liebig and Rommel 2014). Here, the sticker can be ignored, i.e. individuals can decide not to care despite not being in favor of it because it is not sufficiently uncomfortable. Such defaults fully employ inertia for nudge success, while most empirical defaults do not.

Implied endorsement (2) can mislead consumers to believe that the default is carefully chosen for their needs (Smith, Goldstein, and Johnson 2013). This is not the case for generic nudges. The implied endorsement resembles social norm nudges and has to uphold similar ethical considerations. Consumers may reject the social norm, because they are confident about their decision. It can be shown that defaults cannot steer behavior when the nudged consumers are experts in the matter. For

example, defaulting participants of the international conference on environmental economics (EARE) into an CO2-offset payment for their conference travel resulted in a slightly lower share of CO2 compensation compared to an ACC (Löfgren et al. 2012). A knowledgeable consumer, the ideal case for active choosing, is seemingly unaffected by a preselection. Therefore, implied endorsement is unlikely to threaten the knowledgeable consumer, but can cause welfare losses for some consumer clusters, particularly those with insecurity in the choice.

Cognitive biases (3) can be the underlying cause of a default's effectiveness. When implied as a policy instrument, they inevitably degrade consumers' autonomy (Smith, Goldstein, and Johnson 2013). Welfarists' concerns loom larger if the default relies heavily on cognitive biases such as loss aversion (Smith, Goldstein, and Johnson 2013). In contrast to the case of inertia, the choice architect cannot argue that consumers chose the default because they prefer it in the given choice architecture, i.e. they fully understand the options available and have decided not to opt-out or to ignore the decision. The exploitation of a bias comes with a flawed understanding of the available options in the choice set which the choice architect uses to promote an agenda. Hence, the freedom of choice is not preserved. In theory, a nudge can be designed to help consumers to overcome biases that occur even in ACC scenarios and thereby maximize consumer welfare. For example, framed nudges may inform consumers about a commonly observed decision bias in the decision task at hand. Conclusively, a study that is able to show how cognitive biases are not the cause of the default's effect, or are proven to reduce existing cognitive biases, can strengthen the ethical evaluation of the nudge.

3.5 Purpose of defaults

Classification: Choice architects justify a default intervention for behavioral change with at least two types of reasonings: Pro-social and pro-self arguments. (1) Pro-social defaults have led to the emergence of a research field coined "green defaults". A green default implies an external benefit, typically environmental ones, to be promoted through the default (Sunstein and Reisch 2014; Schubert 2017). The agenda of a "green default" is to maximize welfare assuming the internalization of external costs. The pro-social default adds complexity because consumers' welfare depends not only on personal utility but also on the value consumers assign to social and environmental benefits. A pro-social default might align with self-interest but it mustn't. (2) A pro-self default does not foresee a pro-social cause, i.e. no intended positive externality, but intentionally, consumers personally benefit from the default option.

Empirical findings

In 46 out of 61 studies the researchers state externalities as a motivation for the default intervention, i.e. pro-social arguments. In the scientific literature a pro-social default is the most common one, but this must not apply to the real world. The reviewed pro-self defaults address behaviors such as the uptake of federal student loans that entail more formal requirements but offer better rates (Ang and Alexandrov 2017). Other pro-self defaults address investment decisions (Camilleri, Cam, and Hoffmann 2019), payout structures to promote saving vs. spending (Brune et al. 2017), a few health motivated food choices, increasing the use of privacy settings (Dogruel, Joeckel, and Vitak 2017) and the promotion of physical activity (Venema, Kroese, and De Ridder 2018). Pro-social defaults address all kinds of behavior such as CO2 emissions from travel, charitable giving and greener energy contracts. Note that in the health domain several studies nudge medical practitioners to providing better health care which is a pro-social default at the level of the nudge, while promoting a pro-self agenda downstream (e.g. Lehmann et al. 2016; Bourdeaux et al. 2014; Probst, Shaffer, and Chan 2013)

It has been hypothesized that a pro-self default is more sticky because it is aligned with self-interest (Paunov, Wänke, and Vogel 2019). A full meta-analysis might be able to address this hypothesis, but the research domains and the target behaviors in this review are widely different. A target behavior

would need to hold a pro-social component and be comparable to a behavior with only a pro-self component. If we ignore all the shortcomings of a bivariate analysis, of relative effect sizes, and of the different study contexts, then a Wilcoxon rank-sum test suggests a significant tendency of stronger effects (p=0.0051) for pro-self than pro-social defaults.

We want to draw attention to a study combining a pro-social and pro-self agenda in separate treatments (Briscese 2019). The field experiment contacted those registered lenders of an Australian NGO who had extra credit in their accounts from previous lending and had not been active in their account for a year. Emails were sent out to inform them about a default behavior executed with their credit unless they logged into the webpage and changed the settings within a month. In a between design, lenders were then defaulted to either donating or re-lending the extra credit. 4% opted-out of re-lending while 22% opted-out of donating, i.e. 96% and 78% followed the default. Here, re-lending should not been viewed as a purely pro-self default, but rather combines both types of benefits if opportunity costs are ignored. Thus, combining a default with a pro-social and a pro-self agenda strengthens nudge success.

Ethical implications

Externalities have been part of the welfare debate on which grounds nudges are legitimized (Sunstein and Reisch 2014). The theoretical work by Heilmann (2014) has categorized social benefit nudges to conflict with the reflective system (System 2), i.e. a reflective decision maker should opt-out of a pro-social default. This assumption should be relaxed as psychology has shown how altruistic behavior increases personal utility derived from that behavior. The "warm glow of giving" is an example of this research field (Hartmann et al. 2017). The complexity of preference structures allows for rational pro-social behavior despite personal costs and even without personal benefits. This preference structure matters to the ethical evaluation that depends on a nudge being endorsable by the reflective system (Heilmann 2014; Engelen 2019). In the end, welfare objections still depend on whether the default increase or reduces the overall and possibly the individual welfare, but pro-social defaults may also hold value to nudged consumers.

In this context, consumer preferences for nudges have also been researched by placing citizens in the role of policy makers. An endorsement by a representative sample can contribute to legitimacy claims (Engelen 2019). This shall not imply that a representative sample is better suited for policy making than an expert panel, but it is one tool to evaluate whether policy is in the interest of its constituents. Currently, surveys that do both, i.e. analyze support for nudges and distinguish between pro-social and pro-self, are not overly conclusive. For instance, a default to enhance climate compensation payments finds less support in the population than a pro-self-one for smoking discouragement (Hagman et al. 2015), but it is unclear if the pro-self feature is driving this finding. The framing of nudges as pro-self or pro-social was not found to generate systematically different support among US citizens (Jung and Mellers 2016).

3.6 Visibility of defaults

Classification: Here, visibility refers to how easy it is for consumers to notice a default that the choice architect has placed upon them. The degree of visibility can vary substantially. Two types of defaults are distinguished, due to their clear difference in visibility: (1) defaults that appear on some kind of digital or conventional interface and (2) environmentally integrated defaults.

(1) An interface formally presents the choice and explicitly states the preselection made by the choice architect. The choice is displayed on paper, posters, flyers, boards, electronic screens or might be orally communicated. Default rules are generally feasible to implement when consumer choice already occurs, or can easily be made to occur, on some kind of interface (Sunstein and Reisch 2014). For nudge

success, a digital interface may differ from an analogue one (Hummel and Maedche 2019) which does not necessarily lead to a lower or higher visibility.

(2) An environmentally integrated default rule is implemented in the physical environment surrounding a specific behavior. It can be a change to the means to perform a behavior or a change to the procedure of a choice. Such environmentally integrated defaults do not explicitly state the defaulted option to individuals. For example, the default elevation of stand up work desks in the morning to promote standing during working hours (Venema, Kroese, and De Ridder 2018) or a software manipulation on how to display green design points in architectural designs (Shealy and Klotz 2015). Both are changes to the means necessary to execute a behavior. The environmentally integrated default may sway individuals to stand more during work without being aware of the change to their environment.

Empirical findings

The reviewed studies do not compare environmentally integrated defaults with those that are made visible on some kind of interface. A number of studies (9 out of 61) discuss implemented environmentally integrated defaults (Venema, Kroese, and De Ridder 2018; Shealy and Klotz 2015; O'Reilly-Shah et al. 2018; Bourdeaux et al. 2016; Brune et al. 2017; Mikkelsen and Quinto Romani 2017; Friis et al. 2017; Shealy et al. 2018; Liebig and Rommel 2014). Most of these entail changing the means of a behavior. For example, the evaluation of stand up work desks at a governmental facility in the morning led to an average standing time per employee of 13.1 % during working hours as opposed to 1.8 % during the baseline (Table A4, #47). Environmentally integrated defaults in food buffets tend to change the procedure of selecting an option (Friis et al. 2017; Mikkelsen and Quinto Romani 2017). For example, a food buffet that offers butter vs. a food buffet where butter can only be requested through an available staff member. This procedural change led to 0.3 butter packages consumed per person as opposed to 0.7 (Table A4, #25). In general, the effect sizes of environmentally integrated defaults are predominantly significant (Table A4). However, it is not clear whether environmentally integrated defaults are generally more effective than those presented on an interface.

Ethical Implications

Environmentally integrated: Nested in the visibility of a default is the discussion on how involved the reflective system should be in decision making. Similar to default framing vs. regular defaults, it is ethically preferable to involve the reflective system (Heilmann 2014; Engelen 2019), particularly, if the singular decision includes a meaningful trade-off. One prominent example is the case of policies on becoming an organ donor. While opt-out default regulations create welfare for the citizens, as the regulation raises the number of donors, this comes at the costs of citizens becoming a donor without ever consciously agreeing to this. The choice to become a donor is not visible to citizens, but presents a purely environmental change, i.e. a change to the procedure of selecting an option. In this specific case, the environmental change is detached from the daily lives, which differs from the reviewed studies. Becoming a donor is a one-time decision with considerable stakes for family and friends. A default donor may have never been exposed to anything that made him or her aware of being automatically pre-selected as a donor through the default.

Recognizing the disregard of the reflective system, MacKay and Robinson (2016) argued for a mandated (forced) active choice. Such forced active choices have also been analyzed by studies in this review (see also section 3.3). In contrast, Whyte et al. (2012) argued from a perspective of close relatives that a default opt-out with veto options for the family is best suited to the real situations in health care. These debates have caused considerable confusion on defaults and can lead to premature rejections of defaults with a less sensitive taxonomy. Thus, a low visibility is especially problematic, if

the choice does not occur frequently, since this makes it more likely to bypass the reflective system and influence the automated choice. A low visibility must not lead to less respect for the reflective system, but the risk is clearly higher. The reviewed studies tend to introduce frequent choices (Table A4), nevertheless, its legitimacy decreases if shown how the default is not visible and/or not endorsed by the reflective system of a majority. In such cases, an environmentally integrated default is not a very ethical policy solution to offset welfare losses.

Interface: Strictly speaking, many choice-sets on an interface do not allow "no active steps", i.e. consumers cannot ignore the choice. The default rule changes the configuration of alternatives or suggests a default option. Then, consumers are required to confirm an option, for example, by signing a contract or through a mouse click. Thereby, defaults on interfaces involve the reflective system of decision making more than the definition by Sunstein and Reisch (2014) of "defaults as settings that apply, or outcomes that stick, when individuals do not take active steps to change them". With interfaces, consumers are rarely automatically assigned to an option and can hardly ignore the choice.

3.7 Customization of defaults

Classification: A categorization of customized defaults was proposed by Goldstein et al. (2008): (1) A "mass default" treats all consumers equally. A mass default can be a benign evaluation of risks, utility and costs, or a random selection because the setting demands a default rule. By definition, mass defaults are uniform between consumers. (2) A "customized default" occurs in three forms. A persistent default preselects an option previously selected by consumers. A smart default considers features of the population to make an educated guess on the preferred option. An adaptive default is dynamic and updates itself based on other (often real-time) choices observed of a consumer.

Empirical evidence

Customization is a niche in experimental studies (4 out of 61). In the context of retirement investments, smart defaults are applied to guide consumers towards better choices (Camilleri, Cam, and Hoffmann 2019; Hoffmann, Cam, and Camilleri 2019). In this context, smart refers to the customization of defaults depending on age. Older consumers (here 51 to 60 years) are defaulted in a less risky conservative investment strategy, while younger ones (18 to 25 years) are encouraged to select high growth and high risk options in line with a life cycle investment model. In the experiment, 60 % follow such a smart default as opposed to 42% that follow a generic (undesirable) default of a balanced option with medium risk and medium growth (a statistically significant difference). The smart default is therefore more likely to stick. In a similar study, the default options for retirement funds are presented in line with the Australian superannuation choices. The smart default is adjusted to the age in line the with the life cycle investment model while the generic default preselects a balanced option. Given the authors' objective to promote socially responsible investment (SRI) funds, the smart default can be counterproductive, because more consumers stick to the smart but non-SRI default. Under the smart default condition, 4.4% select a SRI fund, under a static default 6.5% and under the active choice 12.1% (Hoffmann, Cam, and Camilleri 2019).

A different smart nudge was introduced to the ordering of medical tests (Probst, Shaffer, and Chan 2013). The electronic health record (EHR) system that admits patients to hospitals usually deselects all available laboratory tests (opt-in). In a manipulated opt-out version, the EHR preselects all possible tests related to the diseases stated in the patient record. In the smart version, the EHR only preselects laboratory tests deemed to be most relevant by experts in pediatric medicine. In both cases, the number of relevant tests significantly increased from 6.14 to 7.18, while the number of non-relevant tests significantly increased from 0.74 to 0.89 for the mass default. In contrast, the smart default caused significantly less non-relevant tests, corresponding to a decrease from 0.89 to 0.78. The

investment and medical studies show particularly well, how the nudge success differs between a smart and a comparable mass default.

Lastly, Goswami and Urminsky (2016) applied a persistent default to increase the share of charity donors. In a number of variations, a default was tested that preselects a charity amount sensitive to past donation behavior of each individual within the last 2 years. There is no indication of the persistent default being particularly effective in this study. However, a sub-study introduces a different type of persistent default in the sense that consumers are defaulted to donate to organizations they have previously donated to, rather than donating to a pre-determined NGO. This sub-study finds a particularly high share of people willing to donate to their customized NGO.

An adaptive default, for example Laptop configuration tools that adapt the default option to previous configuration choices, are not identified in this review. The adaptive default should not be confused with a generic preference evaluation to inform the choice set offered to consumers. A few mass nudges build on a priori preference information. They use the information to limit the number of (food) defaulted options in a choice set in order to offer the most appealing ones (van Kleef et al. 2018; Campbell-Arvai, Arvai, and Kalof 2012) or exclude consumers from the sample population that already implement the desired behavior (Liebig and Rommel 2014). In these cases, the default remains uniform for each consumer, i.e. resembles a mass nudge.

Ethical Implications

Mass nudges: It is advisable to make use of a priori information on consumers' preferences. Such information could ensure an overall utility gain for the nudged population. The information would also help choice architects to design stickier default options. It may even help to enhance support for the decision to implement a specific default. A majority should endorse a nudge to improve its ethical implications (Engelen 2019). However, a mass nudge is unable to solve some welfare objections to defaults, as explained below.

Customization: Welfare objections to defaults address the heterogeneity in consumer preferences (Smith, Goldstein, and Johnson 2013; Sunstein and Reisch 2014). While a default will produce winners, others are nudged against their preferences and end up with a utility loss. Likely, a lower education and lower income goes hand in hand with a higher probability to stick to a default independent of utility gains and losses (Sunstein and Reisch 2014; Sunstein 2013). The relatively poor may benefit from defaults by being relieved from cognitive load – consider simplified information or information feedback. With other nudges, however, those facing a higher cognitive load are likely to lose, in the sense of not being able to enjoy the freedom of choice, nudges intentionally grant people (Schubert 2017). After having finalized our data collection, a study was published that explicitly considers income differences when defaulting consumers into green energy contracts (Ghesla, Grieder, and Schubert 2020). A clear understanding of subgroups helps to grasp welfare concerns. Who is opting-out and who is not opting-out, despite opting out being in their best interest.

Such heterogeneity issues can be eased through customizing defaults. The empirical findings imply a reduction in opting-out through customization, but should also reduce the percentage of consumers adversely affected by a default. It still needs to be shown whether a pareto optimum is generally feasible. The reviewed empirical examples, e.g. a default adjusted by age, will not lead to a pareto optimum and thereby leave some heterogeneity concerns on the table. The choice of a customized default, adaptive, smart or persistent, will depend on the availability of customization options. If more than one customization is available, multiple options could be combined to make better guesses on optimal defaults. A powerful framing of customized defaults was put forward by Sunstein and Reisch (2014): A website might know where you like to sit, which airline you prefer, and how you like to pay.

A bit like a close friend, a sibling, or a partner, it defaults you into your preferred choices while allowing you to opt-out. Conclusively, customization of defaults can help consumers to act in their best interest especially if the decision is complex or highly automated. However, if consumer start trusting defaults over their own decision competences, they grow dependent on a benign character of the default.

3.8 Disclosure of the intention to influence

Classification: When it comes to defaults, disclosure means to be transparent about the intention to influence (Bruns et al. 2018). Many defaults are transparent in the sense that they inform about the default option, what happens in the event of no choice, and whether consumers hold alternative options. With "disclosure" we refer to an explicit statement about the intention of the default to unmask why consumers are facing a specific choice architecture, i.e. consumers are made aware of being nudged.

Empirical Findings

Although most studies do not apply a transparent nudge, the topic has grown more salient in recent studies. Researchers that apply transparent defaults seem aware of how they change the choice situation. A number of hypotheses have been put forward. Most importantly, some claim default nudges work "better in the dark" than with transparency, i.e. defaults effectiveness relies on the covert nature (Bruns et al. 2018; Paunov, Wänke, and Vogel 2019). Another reason for reduced nudge success could be that making a nudge transparent states the intention to guide a consumer. Such nudges explicitly claim to know what is best for one which may lead to psychological reactance (Bruns et al. 2018). In contrast, the framing of defaults allows choice architect to describe a choice which can hold persuasion power. The combination of a regular default and framing lead to strong behavioral influence (see also default framing). The means and tools to make a defaults' intention transparent are essentially a framing of the choice. This frame is not only adding a paternalistic angle, but can also strengthen the social norm component, particularly if the target behavior is not conflicting with previously learned social norms, moral mandates or is perceived to serve self-interests of the choice architect (Paunov et al. 2019). Additionally, the disclosure of intent against an otherwise constant background will increase the salience of the defaulted option (Sunstein and Reisch 2014).

Four studies have tested how information on the intent of the default changes the effectiveness of the default itself (Dranseika and Piasecki 2020; Paunov, Wänke, and Vogel 2019; Goswami and Urminsky 2016; Bruns et al. 2018). The findings imply similar effects for transparent defaults compared to non-transparent ones. Participation with personal medical data in a learning health care system was not increased through a default, regardless of whether the default was made transparent or not (Dranseika and Piasecki 2020). A successful default to raise voluntary participation in an up to 2 min longer academic survey was higher if the purpose of the default was stated (Paunov, Wänke, and Vogel 2019). In a charity context, two types of intentions were made transparent (Bruns et al. 2018). The purpose, i.e. how the default is applied to promote donation behavior, and in a separate treatment, a technical information on how defaults are persuaders and influence donation behavior. In this study, a default significantly raised the average donation from 1.82 to 2.95 Euros. However, complementing the default by disclosure, purpose, information framing or other framing, did not substantially change the outcome. Generally, the findings show that transparent defaults are neither less effective, nor necessarily more effective than non-transparent ones. Nudge success will rather depend on carefully framing the disclosure.

Ethical Implication

In contrast to policy measures, such as taxes, non-transparent defaults are rather "hidden persuaders". Nudged consumers may not be aware of the policy, raising consumer autonomy concerns (Bruns et al.

2018; Schubert 2017). Additionally, the covert nature of the default allows for an exploitation of psychological biases which is less feasible with transparent nudges. We have previously explained why the psychological effect mechanism of bias exploitation is particularly unethical, but also that the exploitation of biases must not be the reason for nudge success, since inertia and implied endorsement also play a role.

Transparent defaults can be a safeguard against the exploitation of biases. Nudges do not violate consumer autonomy if each nudge is, in principle, transparent, ensuring that everyone can unmask the manipulation if they wish (Smith, Goldstein, and Johnson 2013). The consumer welfare perspective is less clear. The type of consumers swayed by a default may heavily depend on whether a default is unmasked or not. Even if the same amount of consumers follow a default, the scientific community needs to investigate whether vulnerable groups are better protected with transparent defaults.

3.9 Remarks on nudge success

The primary driver of nudge success is the actual change demanded of consumers. A behavior that opposes one's value system or a behavior routinely executed for decades is unlikely to change with a default. The consumers' involvement and/or experience will detect the default and for better or worse opt-out. A reasonable request will be more likely to stick. A reasonable price premium in one research domain might be unreasonable in a different context. A few studies have varied what is asked. Goswami and Urminsky (2016) for instance investigated the effect of varying the defaulted donation amounts, i.e. how a default grows less sticky, the more is asked for. A similar analysis was done for defaulting consumers into green energy contracts at different price premiums (Ghesla 2017). In a medical context, health care professionals were defaulted to prescribe different opioid quantities (Montoy et al. 2020). From a behavioral change perspective, small steps or subtle changes are advised. Small steps may not repel consumers and allow them to learn and experience the target behavior, setting a path for nudge success.

An essential worry on nudge success is that the behavioral change induced by the default does not last. When tested, nudge success seems to last (Bourdeaux et al. 2016). Though often diminishing over time, some of the nudge success even lasts once the status quo before the default intervention has been restored (Venema, Kroese, and De Ridder 2018; Fosgaard and Piovesan 2015; Kesternich, Roemer, and Flues 2019). In the special case of prescribing generic instead of brand medication, a default in an e-prescribing interface could even be shown to grow stronger over time (Malhotra et al. 2016).

In any case, nudges should not be seen as an isolated policy, but are should be integrated in a policy mix and interact with other policy measures. For example, if we nudge consumers towards public transport and neglect to develop the infrastructure for a convenient use of them, repercussions have to be expected. Two of the reviewed studies analyzed spillover effects, i.e. how a defaulted donation amount influences a subsequent active choice donation (dictator game setting) (Ghesla, Grieder, and Schmitz 2019; d'Adda, Capraro, and Tavoni 2017) or how a default influences spillover contributions in a public good game. In the dictator game settings, no spillover effects could be confirmed, while the public good game indicated a desirable spill-over.

Lastly, there is uncertainty on the nudge success associated with taxonomic features. The degree a psychological effect mechanism contributes to default success has not been researched and presents a literature gap. Other features are scarcely researched, often limited to a few behavioral research domains. More empirical work should reevaluate and refine the assessment of each feature's contribution to nudge success (Table 1).

3.10 Limitations

Nudge success has to be interpreted with care. The studies reflect a broad literature with respect to research domains, hypothetical and non-hypothetical experiments, online, lab and field experiments and different defaulting strategies. Our analysis focusses on within study variations of taxonomic features, leaving a bulk of information untouched, but avoiding potentially biased comparisons. As a result, only a limited number of studies back our interpretation of nudge success for each taxonomic feature. Future reviews will have to improve the estimates of nudge success (Table 1). Ideally, a meta-analysis becomes feasible for each type of target behavior and taxonomic feature. Currently, donation behavior is the best researched behavior with respect to defaults (Table A1).

4. Conclusions and design recommendations

A default nudge can be designed in consideration of consumer autonomy and individual consumer welfare. The analysis of the taxonomic features provides guidance to choice architects in how to design more ethical and potentially more effective default nudges (Table 1). We recommend to design defaults in full consideration of the taxonomic options whenever possible (Table 1).

Table 1 Nudge Success and legitimacy of default by taxonomic feature

Default Feature	Feature expression/level	Nudge Success	Legitimacy
(1) Initial state of choice architecture	Undesirable default (UDC)	0	0
	Active choosing (ACC)	(+)	+
	Desirable default (DDC)	++	0
(2) Invasiveness	Costly opt-out	++	- -
	Costless opt-out	0	0
	Default framing	0	+
	Costless opt-out and framing	++	0
	Forced active choice	0	+
(3) Psychological effect mechanism	Inertia	?	0
	Explicit endorsement	?	-
	Cognitive biases	?	- -
(4) Architect's agenda	Pro-social	0	0
	Pro-self	+	+
	Pro-self and pro social	+	++
(5) Visibility	Interface (digital or analogue)	0	0
	Environmentally integrated (frequent choice)	0	-
(6) Customization	Mass default	0	0
	Smart, Adaptive, Persistent	+	+
(7) Disclosure	Non-transparent	0	0
	Transparent intention	0	+

Reference point for the evaluation is: (1) an initial undesirable default condition, (2) with costless opt-out, (3) without a defined effect mechanism, (4) with a pro-social agenda, (5) nudged through a text on an interface (6) uniform (mass nudge) for all consumers, (7) and non-transparent

(1 and 4) Although no reviewed default was ill-natured, not all defaults promote a behavioral change that we would endorse or that was convincingly argued to optimize welfare. An understanding of the welfare perspective remains an important precondition to recommend a default. The work of a choice architect is especially demanded if considerable welfare losses are associated with an UDC in the status quo setting. Choice architects should identify such UDCs and address the welfare impact. Such welfare losses can be embedded in a social welfare perspective, but a default is probably more effective if it is

motivated by meaningful pro-self arguments for the ones being nudged. In case the status quo is an ACC, which isn't typically the case in real-life settings, the legitimacy of an intervention declines. If an intervention is deemed meaningful, a DDC seems better equipped than an ACC to break undesirable habits and cause behavioral change. (2) However, if consumers have the capacity to reflect on the choice at hand, then a forced active choice or default framing may produce similar behavioral change, while providing greater respect to consumer autonomy. The combination of structuring the choice via default and describing the choice via default framing are promising to produce particularly strong nudge success.

(3) Currently, nudge success is the dominant question of experiments. The psychological effect mechanism, how a default nudge sways consumers, holds strong ethical implications, but has rarely been empirically researched, despite frequent elaborations on the mechanism. Conclusively, there is little indication of how each mechanism contributes to nudge success and limited agreement even on how to measure the psychological concepts involved. (5) An environmentally integrated default might be preferred to influence particularly automatic or routinely executed behavior. However, such defaults can easily bypass the reflected decision making system and if not endorsed, will be perceived as manipulative. (6) Theoretically, a customized default can ensure that most consumers endorse the proposed behavior or are less repelled. The customization can accommodate consumer heterogeneity and thereby provide greater welfare. All types of customization should be considered whenever feasible. (7) To disclose the intent of a default provides greater respect to consumer autonomy. The nudge success of disclosed default does not seem to differ from regular ones. We hypothesize that a disclosed default will sway some consumers previously unaffected and the other way round, which may lead to more consumers implementing their reflected preferences. Because overall nudge success has been at the core of the reviewed experiments, we still know very little about who suffers welfare losses and who wins. A subgroup analysis for poorer consumers is generally advised. From a policy perspective, taxes are known to adversely hurt poorer consumers. Default nudges should, in theory, influence consumers with smaller welfare losses involved in a behavioral change, i.e. low adaptation costs. Consumers with larger adaptation costs should, if ethically nudged, opt-out. It is unclear whether adaptation costs are generally higher for poorer consumers and probably depends on the context.

Altogether, defaults are cost-effective behavioral tools and when optimized with respect to ethics and/or effectiveness enable policy makers, so that governance issues can be the last obstacle public policy has to face.

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Table A1 The reviewed studies by research domain, target behavior, type of control and treatment group, sub-studies, study type and country

ID	Author	Domain	Target behavior	Treatment	Control	Sub	Study-type	Country
1	(Bruns et al. 2018)	♡	charitable giving	DDC	ACC	4	Lab experiment	NL and GER
2	(Briscese 2019)	♡	charitable giving, charitable re-lending	ACC + DDC	UDC	2	Field experiment	AUS
3	(Crow, Mathmann, and Greer 2019)	♡	charitable giving (at checkout counter)	DDC	ACC	1	Online Experiment	USA
4	(Fosgaard and Piovesan 2015)	♡	charitable giving (public good game)	DDC	UDC	1	Lab Experiment	DK
5	(Ghesla, Grieder, and Schubert 2020)	♡	charitable giving	DDC	ACC	2	Lab Experiment	SWI
6	(Zarghamee et al. 2017)	♡	Charitable giving	DDC	UDC	1	framed field experiment	USA
7	(Schulz, Thiemann, and Thoni 2018)	♡	Charitable giving	DDC	ACC	1	Framed Experiment	SWI
8	(Nelson, Partelow, and Schlueter 2019)	♡	Charitable giving (on-site, for coastal and marine conservation)	DDC	ACC	3	Field experiment	IDN
9	(d'Adda, Capraro, and Tavoni 2017)	♡	charitable giving (dictator game and PD)	DDC	ACC	2	Online Experiment	USA
10	(Goswami and Urminsky 2016)	♡	Charitable giving (donating > 0)	DDC	ACC	27	lab, online and field experiment	USA
11	(Schneider et al. 2019)	@	Selecting the eID	DDC	ACC	2	Online Experiment	USA
12	(Dogruel, Joeckel, and Vitak 2017)	@	increase use of privacy settings	ACC + DDC	UDC	2	Online Experiment	USA
13	(Dranseika and Piasecki 2020)	@+✙	increase consent to participate in learning health care system	DDC	UDC	2	Lab experiment	UK
14	(Theotokis and Manganari 2015)	@+🚀	Participation in e-statement service, Participation in e-bills, Increase towel reuse in hotels	ACC + DDC	UDC	4	Lab and Field experiment	?
15	(Ang and Alexandrov 2017)	$	Uptake of federal student loans as opposed to private	DDC	UDC	1	Field experiment	USA
16	(Hoffmann, Cam, and Camilleri 2019)	$	increase socially responsible investment (SRI)	ACC	UDC	2	Online Experiment	AUS
17	(Fonseca and Grimshaw 2017)	$	decrease tax non-compliance	DDC	ACC	3	Online Experiment	UK

18	(Feltz 2016)	$	Improve surrogate financial decisions (payment partially invested in index fund, annual payment)	DDC	ACC	2	Online Experiment	USA
19	(Camilleri, Cam, and Hoffmann 2019)	$	Better retirement investments choices (by "life cycle model")	ACC + DDC	UDC	1	Online Experiment	AUS
20	(Brune et al. 2017)	$	increase savings and reduce (temptation) spending	DDC	UDC	1	Field experiment	MAL and ZIM
21	(Haan and Linde 2018)	$	Better investment decisions (maximizing payout)	DDC	UDC	1	Lab experiment	NL
22	(Loeb et al. 2018)	⚘	choose healthier lunch menu	DDC	UDC	1	Field experiment	USA
23	(Friis et al. 2017)	⚘	increase vegetable intake (healthier)	DDC	ACC	1	Lab experiment	DK
24	(Broers et al. 2017)	⚘	increase Salsify soup purchase	DDC	ACC	1	Field experiment	BEL
25	(Mikkelsen and Quinto Romani 2017)	⚘	reduce butter consumption	DDC	ACC	1	Field experiment	DK
26	(Campbell-Arvai, Arvai, and Kalof 2012)	⚘	choose meat free meal	DDC	ACC	2	Lab experiment	USA
27	(van Kleef et al. 2018)	⚘	choose whole bread sandwich instead of white bread (healthier)	DDC	UDC	1	Lab Experiment	NL
28	(Bergeron et al. 2019)	⚘	choose lighter dessert (healthier)	DDC	UDC	2	Field experiment	FR
29	(Saulais et al. 2019)	⚘	choose vegetable burger	ACC + DDC	UDC	2	Field experiment	FR
30	(Loeb et al. 2017)	⚘+✚	choose healthier breakfast menu, increase fitness level of child	DDC	UDC	2	Lab experiment	USA
31	(Shealy et al. 2018)	🏛	Increased intended Envision score	DDC	UDC	1	Online Experiment?	USA
32	(Shealy and Klotz 2015)	🏛	Increased intended Envision score	DDC	UDC	1	Framed field experiment	USA
33	(Ghesla 2017)	☼	100% green energy contract	ACC + DDC	UDC	5	Lab Experiment	SWI
34	(Ebeling and Lotz 2015)	☼	100% green energy contract	DDC	UDC	1	Field experiment	GER
35	(Momsen and Stoerk 2014)	☼	50% green energy contract	DDC	ACC	1	Online Experiment	GER

36	(Ölander and Thøgersen 2014)	☼	authorizing smart grid tech	DDC	UDC	1	Experimental study	DK
37	(Vetter and Kutzner 2016)	☼	choosing green electricity provider	DDC	UDC	2	Online Experiment	GER
38	(Ghesla, Grieder, and Schubert 2020)	☼	choose more environmentally friendly electricity contract	DDC	ACC	1	Field experiment and online study	SWI
39	(Chung and Rimal 2015)	✚	increase uptake of HIV testing	DDC	ACC	2	Field experiment	MAL and ZIM
40	(Beshears et al. 2019)	✚	encourage home delivery for long-term prescription medications	DDC	UDC	1	Field experiment	USA
41	(Arvanitis, Kalliris, and Kaminiotis 2019)	✚	Enrollment to a specific Health Insurance plan	DDC	ACC	1	Experimental study	GRE
42	(Montoy et al. 2020)	✚	Reduce Opioids prescriptions	DDC	ACC	5	Field experiment	USA
43	(Lehmann et al. 2016)	✚	increase uptake of influenza vaccination (among health care workers)	DDC	UDC	1	Field experiment	NL
44	(Soon et al. 2019)	✚	Decrease practitioner's choice for low value care options	DDC	ACC	1	Online experiment	AUS
45	(Malhotra et al. 2016)	✚	increase use of generic (non-branded) medication	DDC	ACC	1	Field experiment	USA
46	(Hsu et al. 2019)	✚	Increase clinic transfer rates	DDC	UDC	1	Field experiment	TWN
47	(Venema, Kroese, and De Ridder 2018)	✚	increase standing time at work	DDC	UDC	1	Field experiment	NL
48	(Bourdeaux et al. 2016)	✚	improve medical ventilation settings (low tidal volume (Tve) standard)	DDC	UDC	1	Field experiment	UK
49	(Moseley and Stoker 2015)	✚	increase willingness to donate organs	DDC	UDC	1	online experiment	UK
50	(Probst, Shaffer, and Chan 2013)	✚	Increase number of relevant laboratory tests ordered (decrease irrelevant tests)	DDC	UDC	2	online experiment	USA
51	(Howard-Anderson et al. 2020)	✚	reduce inappropriate (and total) tests for Clostridioides difficile infection	DDC	UDC	2	Field study	USA

52	(Patel et al. 2017)	✚	increase influenza vaccination rate	ACC	UDC	1	Field experiment	USA
53	(Patel et al. 2016)	✚	increase in physician ordering of mammography and colonoscopy	ACC	UDC	2	Field experiment	USA
54	(Bourdeaux et al. 2014)	✚	reduce use of Hydroxyethyl starch, and increase use of chlorhexidine mouthwash	ACC	UDC	2	Field experiment	UK
55	(O'Reilly-Shah et al. 2018)	✚	increase lung-protective ventilation (LPV) strategies during anesthesia	DDC	UDC	2	Field experiment	USA
56	(Liebig and Rommel 2014)	Other	attach a sticker on the mailbox	DDC	ACC	1	Field experiment	GER
57	(Mazar and Hawkins 2015)	Other	reduce systematic cheating	ACC + DDC	UDC	1	Lab Experiment	CAN
58	(Paunov, Wänke, and Vogel 2019)	Other	selecting a longer survey than paid for	DDC	ACC	4	Online Experiment	UK
59	(Stryja and Satzger 2019)	🛩	Switch to an e-car after initially choosing petroleum car	DDC	ACC	1	Online experiment	GER
60	(Kesternich, Roemer, and Flues 2019)	🛩	offset CO2 emissions for travel	ACC	UDC	1	Field experiment	GER
61	(Knezevic Cvelbar, Grün, and Dolnicar 2019)	🛩	reduce requests for room cleaning in hotels	DDC	UDC	1	Field experiment	SVN

♡=Charity, @=Digitalization and Privacy Concerns, $=Finance, ⚘=Food Choices, 🏛= Green Architecture, ☼=Green Energy, ✚=Health Care, 🛩=Travel, DDC=desirable default condition, ACC=active choice condition, UDC=undesirable default condition, Sub= number of sub-studies

Table A2 Nudge success for studies with UDC, ACC and DDC

ID	Target Behavior	UDC	ACC	DDC	DDCs
2	charitable giving [%]	.03	.05	.78	***
2	Charitable re-lending [%]	.24	.2	.96	***
8	Charitable giving (on-site, for coastal and marine conservation) [%]	.55	.2	.75	***
12	Participation in e-statement service [%]	.56	.79	.7	**
12	Participation in e-bills [Likert 1-7]	3.5	5.3	5.5	**
14	increase use of privacy settings [up to 4 priv. settings]	1.89	1.69	2.64	***
14	increase use of privacy settings [up to 4 priv. settings]	1.6	1.69	2.4	***
19	Better retirement investments choices (by "life cycle model") [%]	.3325	.29	.625	***
28	choose lighter dessert (healthier) [%]	.31	.38	.79	**
29	choose vegetable burger [%]	.273	.344	.596	**
33	100% green energy contract [%]	.37	.36	.59	***
33	100% green energy contract [%]	.65	.55	.83	***
33	100% green energy contract [%]	.04	.06	.17	***
33	100% green energy contract [%]	.04	.06	.24	***
33	100% green energy contract [%]	.04	.02	.2	***
57	reduce systematic cheating [%]	.4544	.2386	.0818	**

**=p<0.01, ***=p<0.001, DDCs= significance level DDC vs. UDC, sub-studies may differ with respect to the tested default or target behavior, DDC=desirable default condition, ACC=active choice condition, UDC=undesirable default condition

Table A3 Nudge success for studies with variations in invasiveness

ID	Target behavior	invasiveness	UDC	ACC	DDC	DDCs
5	charitable giving [%]	costless	.	.274	.3426	*
5	charitable giving [%]	costly	.	.274	.59	***
8	Charitable giving (on-site, for coastal and marine conservation) [%]	costless	.48	.	.62	***
8	Charitable giving (on-site, for coastal and marine conservation) [%]	framing	.	.2	.35	***
8	Charitable giving (on-site, for coastal and marine conservation) [%]	costless	.55	.2	.75	***
9	charitable giving (dictator game and PD) [USD-cents]	framing	.	.2669	.3229	*
9	charitable giving (dictator game and PD) [USD-cents]	costless	.	.2669	.2821	n.s.
18	Improve surrogate financial decisions [%]	costless	.	.71	.85	***
18	Improve surrogate financial decisions (choose annual payment) [%]	framing	.69	.	.91	***
28	choose lighter dessert (healthier) [%]	framing	.38	.	.75	***
28	choose lighter dessert (healthier) [%]	costless	.31	.38	.79	**
54	reduce use of Hydroxyethyl starch (can cause renal failure) [%]	Active choice no framing	.541	.031	.	***
54	Increase use of chlorhexidine mouthwash (reduces ventilator associated pneumonia) [%]	costless	.	.553	.904	***
55	increase lung-protective ventilation (LPV) strategies during anesthesia [%]	costless	.593	.	.54	n.s.
55	increase lung-protective ventilation (LPV) strategies during anesthesia [%]	framing	.593	.	.755	***

**=p<0.01, ***=p<0.001, DDCs= significance level DDC vs. UDC, sub-studies may differ with respect to the tested default or target behavior, DDC=desirable default condition, ACC=active choice condition, UDC=undesirable default condition, study #10 neglected for convenient display

Table A4 Nudge success for environmentally integrated defaults

ID	Target behavior	UDC	ACC	DDC	DDCs	Freq
20	increase savings and reduce (temptation) spending [%]	.065	.	.283	***	daily
23	increase vegetable intake (healthier) [Gramm]	.	193.67	238.88	**	daily
25	reduce butter consumption [butter packages p.p.]	.	.7	.3	***	daily
31	Increased intended Envision score [%]	.56	.	.79	***	several times a year
32	Increased intended Envision score [%]	.44	.	.62	***	several times a year
47	increase standing time at work [%]	.018	.	.1313	n.r.	daily
48	improve medical ventilation settings [low tidal volume (TVE) standard]	6.47	.	6.1	n.r.	daily
55	increase lung-protective ventilation (LPV) strategies during anesthesia [%]	.593	.	.54	n.s.	daily/weekly
55	increase lung-protective ventilation (LPV) strategies during anesthesia [%]	.593	.	.755	***	daily/weekly
56	attach a sticker on the mailbox [%]	.	.1598	.2166	**	daily/weekly

**=p<0.01, ***=p<0.001, n.s.= not significant, n.r.=not reported, DDCs= significance level DDC vs. UDC, sub-studies may differ with respect to the tested default or target behavior, DDC=desirable default condition, ACC=active choice condition, UDC=undesirable default condition, Freq= expected frequency of choice