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Beyond nudges: Tools of a choice architecture

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Abstract The way a choice is presented influences what a decision-maker chooses. This paper outlines the tools available to choice architects, that is anyone who present people with choices. We divide these tools into two categories: those used in structuring the choice task and those used in describing the choice options. Tools for structuring the choice task address the idea of what to present to decision-makers,

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and tools for describing the choice options address the idea of how to present it. We discuss implementation issues in using choice architecture tools, including individual differences and errors in evaluation of choice outcomes. Finally, this paper presents a few applications that illustrate the positive effect choice architecture can have on real-world decisions.

Keywords Choice architecture · Decision support · Options and alternatives · Describing attributes

Choice architecture, a term coined by Thaler and Sunstein (2008), reflects the fact that there are many ways to present a choice to the decision-maker, and that what is chosen often depends upon how the choice is presented. Choice architects have significant, if perhaps underappreciated, influence, much like the architect of a building who affects the behaviors of the building's inhabitants through the placement of doors, hallways, staircases, and bathrooms. Similarly, choice architects can influence choice in many ways: by varying the presentation order of choice alternatives, the order attributes and their ease of use, and the selection of defaults, to name just a few of the design options available. While it is tempting to think that choices can be presented in a "neutral" way ("Just the facts, Ma'am"), the reality is that there is no neutral architecture—any way a choice is presented will influence how the decision-maker chooses. Consider, perhaps, the best-known example. All choice presentations have a (usually implicit) default, even if the default is no choice is made, preserving the status quo. The default option will be chosen more often than if another option is designated the default. Thus, everyone, from a parent presenting bedtime options to a child to a government providing pension options to its citizens, influences choices and is a choice architect.

In this brief paper, we provide examples of the tools available to a choice architect. We do not provide a theoretical account of why these tools affect choice, nor suggest a normative analysis of how a choice architecture ought to be designed or when to use which tool. Our goals are modest: to provide an initial roadmap and to identify, describe, and categorize many of the tools of a choice architecture with a few brief illustrative applications. We divide our list of tools into two broad categories, those used in structuring the choice task and those used in describing the choice options. These two categories correspond, roughly, to the idea of what to present to decision-makers and how to present it. We then turn to the challenges and opportunities these tools raise in implementation and provide some examples of effective application of choice architecture tools. Table 1 provides a summary of the tools and some relevant examples that are discussed throughout this paper.

1 Structuring the choice task

1.1 Number of alternatives

One of the starkest decisions facing a choice architect is the question of how many alternatives (choice options) to present to the decision maker. Should the

Table 1 Summary of the tools

Problem	Choice architecture tools	Examples
Setting up the task		
Alternative overload	Reduce number of alternatives	Medicare drug plans (Kling et al. 2011), investments (Cronqvist and Thaler 2004)
	Technology and decision aids	Sorting on attributes (Lynch and Ariely 2000), mobile devices and applications (Cook and Song 2009), smart energy grids
Decision inertia	Use defaults	Investments (Cronqvist and Thaler 2004; Madrian and Shea, 2001), insurance (Johnson et al. 1993), organ donation (Johnson and Goldstein 2003)
Myopic procrastination	Focus on satisficing	Planning errors (Koehler 1991; Weber et al. 2007; Shu 2008), job search (Iyengar et al. 2006)
	Limited time windows	Gift certificates (Shu and Gneezy 2010), retirement planning (O'Donoghue and Rabin 1999), tax credits
Long search process	Decision staging	Automobile customization (Levav et al. 2010), product evaluation (Häubl et al. 2010)
Describing the options		
Naïve allocation	Partitioning of options	Investments (Langer and Fox 2005; Bardolet et al. 2009), food menus (Fox 2005), automobile attributes (Martin and Norton 2009)
Attribute overload	Attribute parsimony and labeling	Good/bad labels for numeric information (Peters et al. 2009)
Non-linear attributes	Translate and rescale for better evaluability	Credit card repayments (Soll et al. 2011), gas mileage ratings (Larrick and Soll 2008)
Implementation issues		
Individual differences	Customized information	Politics and energy conservation (Hardisty et al. 2010), numeracy and decision making (Peters et al. 2006; Sagara 2009)
Outcome valuation	Focus on experience	Focusing and satisfaction (Schkade and Kahneman 1998), cooling off periods

decision maker be presented with one option at time, or two options, three options, or even 10, 20, or 100 or more options simultaneously? There are times when a person has too few options, such as when the original Ford Model T were available in any color—as long as it was black. At other times, there can be the danger of too many options, what others have called the tyranny of choice (Schwartz 2004) or choice overload (Iyengar and Lepper 2000; Jacoby 1984). For example, the number of Medicare drug benefit plans available to US seniors now exceeds 100 in some states, possibly overwhelming the processing capacity of many elderly decision makers (Kling et al. 2011), and investors can often face hundreds of options for retirement funds (Cronqvist and Thaler 2004). The trend in the marketplace is for more, not fewer options to be presented to the consumer, and additional options can also complicate choice in unexpected ways. In cafeterias, for example, additional foods can be "trigger foods," resulting in seemingly unrelated additions that would otherwise have not been made (Hanks et al. 2012). In studies of high school cafeterias, the presence bananas and green beans decreased sales of ice cream while the presence of sugary sides, such as fruit cocktail and applesauce, increased sales of cake and chips.

To answer the question of how many options to present, the choice architect needs to balance two criteria: first that more options increase the chances of offering a preference match to the consumer, and second that more options places a greater cognitive burden on consumers because of the additional need to evaluate options. Thus, to answer this question of balance, we should be concerned about the willingness of the decision-maker to engage in the choice process, the decision-maker's satisfaction with the decision process, and more generally the nature of the processes that will be used to make the decision. Finally, as discussed later, the answer is contingent upon characteristics of the individual decision-maker. Older adults, for instance, with less processing capacity seem to prefer less choice than younger adults (Reed et al. 2008).

Despite the vast amount of research examining the effects of a number of alternatives on decision behavior (see Payne et al. 1993; Scheibehenne et al. 2010), the issue of balancing different objectives makes it hard to identify a simple recommendation for the optimal number of alternatives to present. However, some general guidelines apply. One wants the fewest number of options that will encourage a reasoned consideration of tradeoffs among conflicting values and yet not seem too overwhelming to the decision maker. Yet too few options may generate context-specific preferences, a well-known phenomenon in choice, where the presence or absence of one option influences what is chosen. One recommendation that balances these considerations is that four or five non-dominating options may represent reasonable initial values for the choice architect given these tradeoffs. One could also proceed by starting with this limited choice set, but also provide the decision-maker with the option of considering more options, if desired.

1.2 Technology and decision aids

More and more of the choices we make involve the use of some form of information technology (Murray et al. 2010). This technology may be introduced to assist in the choice task. For instance, we increasingly choose what to buy, what activities to participate in, or what to attend to via some form of desktop or mobile computer interface. Moreover, we may use technology-based tools such as search engines or product recommendation systems to help us identify attractive choice alternatives that we were not aware of, and to filter out ones that are not of interest to us (Bodapati 2008; Häubl and Murray 2006; Xiao and Benbasat 2007). We can also enlist the assistance of interactive decision aids that help us compare choice alternatives in terms of their attractiveness on various feature dimensions (Häubl and Trifts 2000; Lynch and Ariely 2000). Yet another way in which the choices we make are increasingly facilitated by technology is the automatic personalization of user interfaces to reflect our preferences (Hauser et al. 2009; Price et al. 2006). This interaction with decision technology is likely to increase in future years as computing devices become more unobtrusively integrated into our daily environment (see, e.g., Cook and Song 2009; Streitz et al. 2007).

Research has demonstrated that decision aids such as product recommendation systems can be highly beneficial to consumers, enabling them to find products that better match their preferences while at the same time reducing search effort (Häubl and Trifts 2000). However, these tools can also predictably influence consumers' choices through very subtle architectural features such as the set of other products that are presented alongside a recommended alternative (Cooke et al. 2002) or which product attributes are made more salient by the system (Häubl and Murray 2003). Thus, technology-based decision aids could be designed to steer consumers towards choosing products, services, or activities that are individually and/or socially desirable—i.e., healthy, environmentally friendly, etc.—without restricting their freedom to choose. Given that consumers appear to show little resistance to such influence when it benefits profit-seeking sellers (Häubl and Murray 2006), they should be even more willing to accept these interventions when these are in their own and/or society's interest.

1.3 Defaults

One of the most powerful and popular tools available to the choice architect is the use of defaults. Defaults are settings or choices that apply to individuals who do not take active steps to change them (Brown and Krishna 2004). Collections of default settings or "default configurations" determine the way consumers initially encounter products, services, or policies, while "reuse defaults" come into play with subsequent uses of a product. At the finest level, a single question can have a "choice option default", which on electronic forms can take the shape of a pre-checked box (Johnson et al. 2002).

Defaults have been shown to have strong effects on real-world choices in domains including investment (Cronqvist and Thaler 2004; Madrian and Shea 2001), insurance (Johnson et al. 1993), organ donation (Johnson and Goldstein 2003), and marketing and beyond (Goldstein et al. 2008). They appeal to a wide audience in their ability to guide choice, while at the same time preserving freedom to choose, and are often regarded as prototypical instruments of libertarian paternalism (Sunstein and Thaler 2003).

Through default-setting policies, choice architects can exert influence over resulting choices (Goldstein et al. 2008). The palette of policies includes simple defaults (choosing one default for all), random defaults (assigning a configuration at random, for instance, as an experiment), forced choice (withholding the product or service by default, and releasing it to the recipient only after an active choice is made), and sensory defaults (those which change according to what can be inferred about the user, for example, web sites that change language dependent on country of origin of the visitor). Products and services that are frequently purchased can use either of persistent defaults (where past choices are remembered) or reverting defaults (which forget the last changes made to the default configuration). They also can use predictive defaults (which intelligently alter reuse defaults based on observation of the user).

Choice architects should be mindful of the ethical risks involved in setting defaults (Smith et al. 2010). The ethical acceptability of using a default to guide choice has much to do with the reason why the default is having an effect (see Dinner et al. 2011 for a discussion of those reasons). When consumers are aware that defaults may be set as recommendations in some cases, or manipulation attempts in other cases (Brown and Krishna 2004), they exhibit a level of "marketplace metacognition" that suggests they successfully retain autonomy and freedom of choice. However, if defaults have an effect because consumers are not aware that they have choices, or because the transaction costs of changing from the default are too high, defaults impinge upon liberty. An often-prudent policy, though not a cure-all, is to set the default to the alternative most people prefer when making an active choice, without time pressure, in the absence of any default. Running an experiment on a sample of the population can determine these preferences, and can be done in little time and at low cost in this age of Internet experimentation.

1.4 Choice over time

The intertemporal structure of a task has important implications for both the decision-maker and the choice architect. Many of the choices individuals face involve outcomes that unfold over long periods of time, which affects choice tasks in three specific ways. First, individuals tend to be myopic and prefer to receive positive outcomes early, leading them to yield to immediate temptations and heavily discounting future outcomes (Ainslie 2001; Loewenstein and Elster 1992). Second, uncertainty about the future can cause individuals' preferences for future outcomes to be unclear, such that certain types of outcomes are systematically over- or under-weighted. For example, uncertainties in life expectancy (Payne et al. 2012) can affect decisions about financial products with future payouts such as savings, annuities, and reverse mortgages (Brown 2007; Börsch-Supan 2003; Davidoff et al. 2005). Similarly, uncertainties about the likelihood and extent of global climate change seem to reduce the political will for mitigation (Hansen 2009). In dealing with this uncertainty, the decision maker can become overly focused on certain highly salient or desirable future outcomes and fail to consider satisfactory second-best alternatives (Koehler 1991; Shu 2008). Third, individuals are often overly optimistic about the future and assume that they can accomplish more than they actually will. They expect to have both more time and money in the future than they do today and overestimate the probability that desired outcomes will occur as planned (Kahneman and Lovallo 1993; Zauberman and Lynch 2005).

Tools are available to the choice architect to address each type of intertemporal bias. One option seems to be order of consideration. Drawing attention to the delayed options can refocus the decision-maker, generating more patient choices (Weber et al. 2007). One can also refocus the decision-maker toward "satisficing" by considering second-best outcomes, which can lead to less choice deferral and higher choice satisfaction (Shu 2008; Iyengar et al. 2006). Placing limited windows for opportunities can overcome the tendency to think that the future holds more resources. For example, big city residents who procrastinate visiting local landmarks due to an assumption they can do it later may benefit by assuming the role of being tourists whose limited window for sightseeing motivates them to action (Shu and Gneezy 2010). Other examples include putting expiration dates on policy initiatives like home energy efficiency improvement tax credits (http://www.irs.gov/newsroom/article/0,,id=206871,00.html) or offering only limited windows for making changes to retirement savings plans (O'Donoghue and Rabin 1999). In general, tools that translate aspects of the choice into immediate salient outcomes are more successful than those that attempt to manipulate heavily discounted future costs and benefits (Soman et al. 2005).

1.5 How task structure affects the search process

The structuring of the decision task not only affects the way in which consumers decide between choice options, it also has implications for how decision-makers successively explore the option space, both in choosing what information to examine and what information to ignore as they narrow down their choice set. As an example, consider the differences in search when making a single choice versus making a series of configuration decisions. This distinction has received relatively little attention in the literature, but has implications for the way in which information is searched, choices are made, and how they are justified. In a typical choice context, a consumer needs to decide between a relatively small set of alternatives and typically is asked to choose only one product (e.g., buying grocery products, buying clothing, choosing a certain service provider, etc.). Alternately, consumers are confronted with configurators (that is software systems for selecting the options for highly customizable products, such as for cars) and may use different strategies to deal with the complexity of multiple decisions that need to be made than in the simpler classical choice context. These strategies affect consumer choice outcomes differently and therefore suggest different tools of choice architecture. Levav et al. (2010) found that consumers are more likely to choose default levels of attributes when they begin with attributes that offer a greater number of configuration options than when they begin with attributes that offer a smaller number of options.

Another way that consumers' definition of the task affects choice is the common finding that they first screen alternatives on the basis of a subset of attributes and only then make alternative-based comparisons for the remaining set of alternatives after screening (Hauser and Wernerfelt 1990; Payne 1975). In this context, formatting the screening stage by facilitating comparisons on one attribute but not others will lead to a stronger preference for options favored by the focal attribute (Diehl et al. 2003).

One way of understanding how consumers search information is to analyze the role of search costs. Normatively, consumers should consider the total distribution of alternatives in the market and the cost for inspecting each alternative, and then compare the (most attractive) alternatives they encounter to a reservation value to determine when to stop searching (Weitzman 1979). Recent research shows that consumers are prone to make sub-optimal decisions in these search decisions (Häubl et al. 2010; Shu 2008; Zwick et al. 2003). Formatting the decision task can help the decision-maker do better; for example, sorting alternatives in order of expected attractiveness can be an effective way to improve search outcomes (Dellaert and Häubl 2012; Häubl and Trifts 2000). Providing easier upfront information about the distribution of product values in the marketplace, such as informing buyers about the range of possible prices they may encounter, is also helpful to consumers who are not familiar with the market (Rosenfield et al. 1983; Shu 2008).

2 Describing choice options

2.1 Partitioning options and attributes

One important facet of choice architecture is the way in which the set of options, attributes, or events are partitioned into groups or categories. This seemingly innocuous feature of a choice environment can have a dramatic impact on choice behavior. Prior research in diverse domains has shown that partitioning creates vivid categories that can influence allocations involving simultaneous choices (Fox et al. 2005). For instance, employees tend to allocate their retirement investments evenly over various categorical options such as stocks, bonds, and real estate when they are separated into categories than when they are listed together (Thaler and Sunstein 2008). Similar effects have been documented in lab-based investments (Langer and Fox 2005) and in charitable donation decisions (Fox et al. 2005). Recent studies have also shown that the physical partitioning of a shopping cart and on-line order forms can alter the mix of products a person purchases. For instance, studies with grocers have shown that altering the amount of a shopping cart reserved for fruits and vegetables ended up altering how much was purchased (Wansink et al. 2012).

When people allocate a limited resource (e.g., money, attention, probabilistic belief, importance weights) over a fixed set of possibilities (e.g., investment opportunities, consumption options or time periods, events or attributes), they are typically biased toward even allocation over each group or category that has been identified. Thus, in personal investment, people tend toward allocating $1/n$ of their savings to each of the n options that are singled out in a 401(k) plan (Benartzi and Thaler 2001); in consumer choice, people thus tend to seek variety when choosing multiple goods for future consumption (Read and Loewenstein 1995; Simonson 1990), and they tend to favor spreading out consumption over different time periods (Loewenstein and Prelec 1993); in distributive justice, people tend to favor equal allocation of benefits and burdens among individuals unless there is a compelling alternative criterion (Messick 1993); in decision analysis, people are biased toward assigning equal probabilities to each event that could occur (Fox and Clemen 2005; Fox and Rottenstreich 2003) and equal importance weights to each attribute that is explicitly identified (Weber et al. 1988).

This pervasive tendency toward even allocation provides a powerful tool to choice architects: judgments and choices can be strongly influenced by the particular groups or categories into which the set of possibilities is partitioned. Thus, by assigning favored investment options to separate superordinate categories (e.g., domestic and international stock index funds to choice sets A and B) and disfavored investment options to a single superordinate category (e.g., several high-load exotic mutual funds to choice set C), one can nudge greater investment into the favored options (see Bardolet et al. 2009; Langer and Fox 2005). By segregating healthy food menu options into separate menu categories (e.g., "fruits", "vegetables") and integrating unhealthy options into a single menu category (e.g., "cookies and candies"), one can nudge participants to choose a greater number of healthy options and smaller number of unhealthy options; likewise, by segregating later time periods into separate categories and integrating earlier time periods into a single category, one can induce greater patience in consumption (Fox et al. 2005). By splitting more important attributes (e.g., "practicality" of an automobile) into a greater number of subcategories (e.g., "safety", "gas mileage", "warranty") and combining less important attributes into a single category (e.g., "Stylishness—design, stereo, horsepower"), one can increase the importance given to the more important attributes when consumers choose among product offerings (Martin and Norton 2009).

A unique virtue of using partitioning to nudge decision-makers toward desired behaviors is that the impact of this intervention will tend to be strongest among decision-makers with weaker intrinsic preferences or beliefs and diminish or disappear among those with stronger intrinsic preferences or beliefs (Fox et al. 2005). For instance, in one study wine novices asked to choose among several different varieties of white wine were more likely to diversify over grape if wines were grouped by grape type, and they were more likely to diversify over country of origin when wines were grouped in that manner; this effect was greatly attenuated among wine experts (Fox et al. 2005). Thus, partitioning will tend to exert the strongest paternalistic influence on those who need the greatest guidance and will have the weakest effect on those who require the least guidance.

2.2 Designing attributes

People choose between alternatives by weighing their pros and cons on different attributes, and choice architects influence behavior when particular attributes are made more or less salient. For example, car buyers will consider attributes such as style, cost, safety, reliability, capacity, and fuel economy. These attributes may be important in their own right or because they help decision-makers achieve more fundamental objectives (Keeney 1996). An ideal decision incorporates all of the relevant attributes and weighs them to the degree that allows decision-makers to achieve their objectives. The choice architect can help people attend to and use attributes accurately by adhering to the principles of parsimony, linearity, comparability, and evaluability. In addition, decision architects may choose to make some attributes, such as those with externalities that might otherwise be neglected, more salient by using the tools of attribute translation and attribute expansion, all described in the remainder of this section.

Decision-makers often must make choices by using attribute information to predict their satisfaction with different alternatives. Here the choice architect's first available tool is parsimony. Just as individuals may be overwhelmed by too much choice, they may also be overwhelmed by too many attributes and simplify their decision by focusing on only one. Decision-makers can understand more information and weigh important information better in choices that require less cognitive effort, especially for less numerate consumers (Peters et al. 2007). As in choosing the number of alternatives, reducing cognitive effort can be achieved by using smaller sets of attributes and highlighting the meaning of only the most important attributes. This must be balanced by the need of including all attributes. Of course attributes may differ across decision-makers, but while the choice of attributes can be based on a "typical consumer," technology allows tailoring by letting consumers choose attributes from a menu.

Linearity is also an important tool for improving accuracy. A decision attribute may have a non-linear relationship to a more fundamental objective. For example, people expect that monthly credit payments have a roughly linear relationship to payback period; in reality, payback period increases sharply when monthly payments barely cover interest (Soll et al. 2011). To correct this misperception, new credit card statements must now list the monthly payment needed to eliminate a balance in 3 years. Similarly, several measures of energy efficiency, such as miles per gallon (MPG) ratings for cars and SEER ratings for air conditioners, have a reciprocal (i.e., non-linear) relationship to energy consumption. However, people use differences in these numbers to estimate energy savings. As a result, they undervalue the energy savings from improving inefficient cars (Larrick and Soll 2008). This misperception can be fixed by converting MPG to an energy consumption measure such as "gallons per 100 miles" (GPM) that is linear in energy savings.

The final two tools for improving accuracy are ways of increasing comparability and evaluability. For decisions where the same attribute (e.g., cost) is expressed in two different ways (e.g., for different time periods) across different contexts (e.g., annual newspaper subscriptions, monthly cable bills, and per use music downloads), placing the activities or products on the same scale allows decision-makers to compare their relative value more accurately. For highly quantitative information that can be difficult for people to process because the numbers are challenging or the domain is unfamiliar, numbers become more easily evaluated if they are broken into categories, such as grades, or if they have endpoints clearly labeled as good or bad. Peters et al. (2007) found that decision-makers could integrate more information into judgments when numbers were supplemented with evaluative labels and showed that the labels facilitated information processing by allowing affective reactions to be accessed more quickly. As an example, newly proposed EPA labels contain information about carbon dioxide emissions, but no one is familiar with what is a "good" or bad" level of CO_2. The labels try to remedy this problem by rating a given car on a 1 to 10 scale that is linear in CO_2 reduction.

For situations where the choice architect wishes to increase the impact of certain attributes, the tools of attribute translation and attribute expansion can be helpful. Research by Bond et al. (2008) showed that people bring to mind only half the objectives they care about in a decision. Thus, there is a benefit in explicitly mapping an attribute to its consequences for other objectives. For example, a car's gas consumption is directly related to the cost of driving the car and to the CO_2 emissions from the car. However, people may fail to translate gas consumption to either scale because the math is challenging or they do not recognize the consequence on that objective without a reminder. The newly proposed EPA labels translate gas consumption to both driving costs and CO_2 emissions to draw more attention to these objectives. A second factor that increases the use of an attribute is changing the scale on which it is expressed. For example, a car's gas consumption can be expressed over short distances (100 miles) or long distances (10,000 miles). Expanding the denominator makes the numerators larger and makes the differences between alternatives appear larger, leading these expanded attributes to receive more weight in choice (Burson et al. 2009).

3 Issues in implementing choice architectures

3.1 Individual differences

Choice architecture at its best promises better decisions, healthier lives, and improved finances. But some early "nudges" have gone wrong simply because a nudge can have multiple effects that may depend on characteristics of the decision-maker. For example, informing households about their relative energy use led to an average 2 % decrease in energy usage, but the change depended on the household's political affiliation. Liberal households reduced their consumption, while Republicans increased theirs, presumably due to differences in environmental concerns (Costa and Kahn 2010).

Individual differences can influence how choice architectures play out in the market. As the eminent learning theorist Hobart Mowrer once said, "To understand or predict what a rat will learn to do in a maze, one has to know both the rat and the maze" (Mowrer 1960, p. 10). In similar fashion, choice architects will have to design decision environments faced by decision-makers in light of knowledge about the decision environment (this is already being done) but also with knowledge about the characteristics of targeted decision-makers and how they will process and draw meaning from information, or what their goals are. In some cases, the right choice architecture may differ by these individual characteristics. Policy makers insensitive to this possibility may find that their best efforts at choice architecture leave some individuals without intended assistance and produce unintended consequences in other cases. Further complicating the policy maker's efforts is a "curse of knowledge" under which choice architects may anchor first on what they themselves know or want, and then insufficiently adjust for other people's knowledge levels or preferences (Nickerson 1999, 2001).

The implication is that the intuitions of choice architects will not always be enough and that choice architectures should be tested in diverse populations of interest. However, we already know quite a bit about how individual differences influence decisions and how they interact with situations. An understanding of what individual differences might be important to particular content domains (e.g., cultural cognitions in environmental domains) or types of decision problems (e.g., numeracy in decisions with unfamiliar numeric information) can be brought to bear already on the emerging science of choice architecture.

For example, a series of studies have been conducted examining the interaction of numeracy with how information is presented or framed. We know that requiring less cognitive effort will help decision makers understand more information and weigh important information more in choices, and this is particularly true for less numerate consumers (Peters et al. 2006). Attaching affective meaning to numeric information allows decision makers to integrate more information and, for those who are less numerate, results in reduced reliance on less relevant, emotional sources of information such as mood states (Peters et al. 2007, 2009). However, while the use of an organizing framework helped less numerate consumers to better comprehend information that was summarized in the framework, it hurt their comprehension of other information. On the other hand, highly numerate decision-makers may overuse number comparisons when such information is provided. A one-size-fits-all approach to choice architecture will not always work, particularly in diverse and sometimes highly politicized environments.

3.2 Evaluating outcomes

How can we tell if a choice architecture intervention has helped a decision-maker? One answer is to consider the decision-maker's experience of the selected choice outcomes. Most theories of choice (implicitly) assume that the utility of an outcome estimated ex ante equals its utility when it is experienced ex post. However, a growing body of research has documented numerous ways in which people can fail to accurately predict how they will feel about the outcomes of their choices (Hsee and Hastie 2006; Loewenstein and Schkade 1999). People often overestimate the impact of differences in income on well being (Kahneman et al. 2006) and underestimate the impact of an empty stomach on their grocery shopping decisions (Nisbett and Kanouse 1968). A related problem is the underprediction of adaptation to enduring changes (Schkade and Kahneman 1998). For example, Gilbert et al. (1998) demonstrated that people greatly overestimate the duration of their emotional responses to the denial of academic tenure and the breakup of a romance. But there is evidence that people who have experience in a situation make more accurate predictions about adaptation (Schkade and Kahneman 1998).

Some features of existing policy and choice environments reflect at least a tacit knowledge of these phenomena. For example, many consumer protection laws provide “cooling off” periods, during which a consumer can cancel a choice without penalty. One function that experienced agents and advisors often serve is to encourage a decision-maker to consider not only the features of an option that are salient at the time of choice, but also those that will be more important when the outcomes are experienced. These and other interventions that bear on the decision-maker’s knowledge about their future outcomes should be considered part of the decision architect’s toolkit.

4 Applications of the tools of choice architecture

The concept of choice architecture has already diffused into several economic and public policy domains where individuals regularly experience suboptimal decisions. Choice architecture tools have been applied to issues of consumer savings, organ donation, medical decision-making, consumer health and wellness, and climate change mitigation. Here, we focus on three primary domains: decisions that impact the environment, consumer financial decisions, and eating decisions.

Consider first the domain of decisions that impact our environment. This may include decisions regarding energy consumption (appliances, transportation, heating and cooling), water use (including showers, gardening, swimming pools, rice farming), and land use (deforestation, types of agriculture, urban planning). Some environmental decisions have substantial long-run implications. Potential climate change risks are perhaps the greatest sustainability challenge, and require drastic reductions in greenhouse gas (GHG) emissions through reduced energy consumption and better efficiency and conservation measures. Producing these reductions can offer both financial gains for consumers and societal gains for the environment, seemingly a win–win situation. While purely economic solutions have been attempted, the psychological biases that are a barrier to adoption make this a domain where behavioral change may prove more effective (Weber 2012, in press).

A second application domain is the area of consumer financial decision-making. We have already seen the impact of choice architecture on both innovative product offerings and in public policy. The Save More Tomorrow plan (Benartzi and Thaler

2004) first reframes the decision to save; instead of reducing consumption now, the participant decides how much of a future increase in salary will be allocated to savings. By moving the commitment into the future, the intervention also reduces the impact of impatience. Finally, the plan makes the increased saving the default. Together, these three changes in choice architecture have significantly increased savings behavior and have generated widespread adoption. A change of default in debit and credit cards has also recently produced a significant change in the structure of profits in that industry. The 2009 CARD Act changes the default for over-limit fees on debit and credit cards, requiring an opt-in choice to enable the bank to pay bills over the amount in the consumer's account. These fees, often greater than $30, generated large profits for credit card companies. One firm, Bank of America, took a write-off of greater than $10.4 billion in the value of its credit card unit (Schwartz 2010).

Finally, consider the domain of eating decisions. While many individuals spend significant amounts of time, effort, and money in attempts to modify their diet, most eating behavior occurs without much conscious thought. Yet given that people make an average of 200 to 300 decisions regarding food consumption in any given day (Wansink and Sobal 2007), it is no wonder that individuals might make decisions that are out of line with their health goals and desires. In order to reduce the cognitive requirements of so many decisions, individuals may rely on heuristics or decision-rules to guide food choice and consumption decisions (Wansink 2010; Wansink et al. 2009). These habitual behaviors can become rigid and unresponsive to changes in understanding of health and nutrition. For instance, doubling the price of an all-you-can-eat pizza buffet led people to eat more pizza even though the diminishing returns to taste and perceived quality quickly dropped (Just and Wansink 2011). It led them to eat more and enjoy it less. It is these types of dynamics that make eating behavior a prime context for behavioral economic interventions and research.

More generally, standard interventions suggested by classical economic analysis can backfire, if they ignore the factors we have discussed. For example, providing information about a particular issue does increase attention toward that issue, but the intervention can have unintended consequences such as reducing attention about other important issues (Weber 1997) or increasing focus on only a single corrective action to the exclusion of others (Weber 2006). Thus, it may be useful to modify standard utility theory of time and risk preferences, to allow consideration of psychological processes and effects in combination with economic incentives (Just and Wansink 2009).

For each domain, one may wonder whether choice architecture can leverage economic solutions. Prior to the advent of choice architecture, traditional models in economics have suggested three policy levers: altering prices, providing information, and placing restrictions on purchasing and other behavior. However, many of the issues examined in psychology and economics, such as excessive discounting, status quo effects, and information processing limitations can prevent such solutions from being effective. In financial decisions, purely economic incentives are not enough to improve choices; for example, even company matching on 401(k) contributions is not enough to achieve 100 % participation in savings programs. In food consumption, observed behavior also cannot be reconciled with standard economic models: Altering prices and providing information is generally ineffective in altering consumption

(Mytton et al. 2007). For the environment, economic solutions have included regulating behavior (through building codes and CAFE efficiency standards) and raising the price of energy (e.g., a carbon tax in some countries other than the USA), often without substantial effects.

An emerging literature has tried to incorporate some psychology into economic models of environmental choices, financial decisions, and food consumption. While this literature represents a starting point, much remains to be done in terms of incorporating the tools of choice architecture into these domains, and creating and using suitable individual data to calibrate these models for policy purposes. Many of the choice architecture tools described in this paper were designed to change behavior in these three areas. Additional situational changes, such as changing the wallpaper used on a web site (Mandel and Johnson 2002), the social setting of the decision (Milch et al. 2009), the information process or mode used for making the decision (Weber and Lindemann 2007), the framing of the outcomes (Tversky and Kahneman 1981), or even the label of a choice attribute (Hardisty et al. 2010) may all have desirable effects. Such behavioral interventions are not necessarily objectionable to the decision-maker even when they are unaware of the impacts of these interventions on their own behavior (Johnson and Goldstein 2003; Wansink 2012). Rather, the individual may believe they are better off for the intervention if the intervention encourages good behavior while not prohibiting bad behavior. One possible response to the charge that the choice architect is influencing behavior without the decision-maker's awareness is full disclosure of decision design: Choice formats could be accompanied by a description of the potential influences that might accompany the way the choice is posed. Such full disclosure of choice architecture is rarely done today, but its effects deserve further study with the goal of making open disclosure a routine responsibility for choice architects.

The behavioral economics of environmental sustainability, financial decisions, and eating affects us all in multiple ways multiple times a day. The good news is that the same factors that lead us to make a mindless suboptimal or unhealthy choice can often be reversed to help us make a mindless better choice. Behavioral economics offers a means to encourage more optimal behavior without inducing the resistance and reactance often associated with restrictive policies (Just and Wansink 2009).

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