43

COGNITIVE AND AFFECTIVE CONSEQUENCES OF INFORMATION AND CHOICE OVERLOAD

Elena Reutskaja, Sheena Iyengar, Barbara Fasolo, and Raffaella Misuraca

Introduction

When interviewed in 1992 in Pittsburgh, Pennsylvania, the Nobel laureate Herbert Simon described a paradox at the heart of living in an economy that made every effort to design and produce ever more "choice alternatives" but that simultaneously allocated very little energy to encouraging people to devote the attention and time actually required to choose. He gave the example of a decision to buy a new house, commenting: "Before you even start the choice process, somebody has presented you with this, and this, and this house" (UBS, 1992).

The overabundance of alternatives was lamented by Simon in 1992, when computing power was slower. It is all the more alarming in the modern and constantly connected world, which now has the internet, smartphones, apps, and tablets—all used to make a plethora of decisions every day.

Nowadays, people receive information from ever-increasing and often simultaneous sources. The average US resident consumer views about 3,000 advertisements every day (Kardes, Cline, & Cronley, 2011) and while in the 1970s to the 1990s grocery stores in the United States carried around 7,000–8,000 items, the variety has increased to 40,000–50,000 items nowadays (Jacoby et al., 1974a; Malito, 2017), including around 285 varieties of cookies and 275 types of cereal (Schwartz & Ward, 2004). The explosion of choice is not limited to retail either and has begun to permeate even people's personal lives. A speed-dating event organized by China's Communist Youth League in 2017 was attended by about 5,000 young single people (Shim, 2017). And in a world where the internet increases an individual's access to information, it seems being surrounded by an overwhelming amount of information every day has become the new norm.

The aim of this chapter is to examine this state of affairs. What is information and choice overload, and what are the cognitive and emotional consequences of this overload?

Classical economics and psychology have argued that increased information and choice are often desirable and lead to better outcomes (Steiner, 1970; Zuckerman, Porac, Lathin & Deci, 1978; Walton & Berkowitz, 1979; Rolls et al., 1981; Deci & Ryan, 1985; Loewenstein, 1999; Ryan & Deci, 2000; Kahn & Wansink, 2004). However, theories of bounded and adaptive

rationality posit the opposite (Simon, 1957 1991;Gigerenzer & Selten, 2002) and have been supported by a large body of research. Extensive information and choice can be costly, demotivating, and unsatisfying (Miller, 1956; Newell & Simon, 1972; Jacoby, 1974; Malhotra, 1982; Iyengar & Lepper, 2000; Schwartz, 2004; Reutskaja & Hogarth, 2009; Grant & Schwartz, 2011; Reutskaja, Nagel, Camerer, Rangel, 2018). They can result in what Schwartz (2000) has called a "tyranny of freedom." However, using less information and making decisions based on less information can lead to higher-quality outcomes. (For a review, see Gigerenzer & Gaissmaier, 2011.)

Information and choice overload: a theoretical background

Definition of information and choice overload

Information load is closely connected to Herbert Simon's behavioral model of rational choice, or "a kind of rational behavior that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man, in the kinds of environments in which such organisms exist" (Simon, 1955, p. 99). In line with Simon, later research has sought to differentiate information "load" from "overload." The result has been a long-standing debate in the relevant literature about how "information load" and "information overload" can and should be measured. Jacoby (1977, p. 569) provides the following definitions:

> Information load refers to the variety of stimuli (in type and number) to which the receiver must attend. Information *over*load refers to the fact that there are finite limits to the ability of human beings to assimilate and process information during any given unit of time. Once these limits are surpassed, the system is said to be "overloaded" and human performance (including decision making) becomes confused, less accurate, and less effective.

Many researchers use these definitions and manipulate information load by varying both the number of items and the number of attributes describing those items (Jacoby, Speller & Berning, 1974; Jacoby, Speller & Kohn, 1974, Lee & Lee, 2004). Others argue that information load cannot be measured using the product of the number of items and number of attributes (Malhotra, Jain & Lagakos, 1982). As yet, there is no consensus on how to appropriately measure information load and, as a result, any effects driven by the number of choice alternatives and choice attributes remain controversial.

In addition to information overload, it is necessary to define a closely related concept, that of *choice overload*. Choice overload occurs when an increase in the number of options to choose from has detrimental consequences. For example, choice overload may manifest itself as lower intrinsic motivation to choose, decreased satisfaction with the option finally chosen, decreased satisfaction with the process of choosing, stress, anxiety and choice paralysis (Iyengar & Lepper, 2000; Schwartz, 2004; Shah & Wolford, 2007; Reutskaja & Hogarth, 2009; Grant & Schwartz, 2011; Chernev, Böckenholt, & Goodman, 2015; Nagar & Gandotra, 2016; Reutskaja et al., 2018).

Both information and choice overload can arise for both cognitive and affective reasons but they differ in one important way: choice overload occurs only when there is a need to choose an item from a set of alternatives. In contrast, information overload may occur regardless of whether there is a need to make a choice or not. In the latter case, information overload is driven not by choice per se but by the overwhelming amount of information to process.

Though it may be possible for choice overload to occur without information overload, the two often go hand in hand and, for this reason, this chapter will use the terms interchangeably. Despite the different approaches in methodology, most scholars do not dispute the premises of information or choice overload (with some exceptions, such as Scheibehenne, Greifeneder, & Todd, 2010).

Processes underlying the information-overload phenomenon

Next to be discussed are the underlying mechanisms of choice overload, which are connected to the benefits and costs of choice and information provision.

The benefits of increased access to information are nearly always self-evident. Generally, there is an increased likelihood that people's diverse needs and wants will be satisfied. Full and transparent information should also promote market competition by driving prices down and quality up (Loewenstein, 1999). Moreover, actual variety and perceived variety often have the potential to increase consumption (Kahn & Wansink, 2004; Rolls et al., 1981), while access to more choice offerings can improve consumers' welfare (Brynjolfsson, Hu, & Smith, 2003).

Full information and an abundance of choice can also be beneficial from a psychological point of view. As a thought experiment, contrast the emotional feelings experienced when entering a grocery store offering only a few options with what you might feel when entering a well-stocked competitor. In general, individuals are attracted to larger choice sets (see, for example, Iyengar & Lepper, 2000). This can be explained, at least in part, by research demonstrating the association between more choice alternatives and greater perceived decision freedom (Steiner, 1970; Reibstein, Youngblood, & Fromkin, 1975; Walton & Berkowitz, 1979).

On the other hand, information may also impose costs on an individual. Costs come in the form of extra time spent assimilating new information, the potential for error, the greater cognitive burden, and the potential to create an affectively taxing experience, such as feeling greater regret as the number of forgone options increases (Miller, 1956; Loewenstein, 1999; Botti & Iyengar, 2006; Reutskaja, 2008). Those are discussed in more detail below.

A theoretical model describing how the benefits and costs of choice can be integrated has been proposed in previous research (Reutskaja & Hogarth, 2009). This model suggests that, while choice implies both benefits ("goods") and costs ("bads"), which may both increase with the number of available alternatives (see also Coombs & Avrunin, 1977), the benefits increase more slowly than the costs. This proposition was also supported later by Grant and Schwartz (2011). As a result, their model's first implication is that an intermediate amount of choice leads almost always to a more optimal choice offering than a small or large number of choices. That is, the provision of choice is beneficial up to a certain point, after which it becomes detrimental and choice overload occurs. The net benefit to this outcome varies as a function of the number of alternatives, which can be graphed as an inverted U shape, as shown in Figure 43.1.

Another important consequence of this model is that changes in actual and perceived costs and benefits shift the location of the function's peak. For example, with benefits being held constant, lower costs will shift the peak to the right, allowing people to deal with more choice offerings. The costs and benefits of choice (and therefore, the location of the peak of the resulting function) can be moderated by several significant factors: features of information and the environment (such as perceptual attributes of information, organization of the information set, whether a decision is made with or without time pressure, the presence or absence of brand names) and individual differences between the decision makers (such as gender and age). A discussion of the moderators of choice overload is beyond the scope of this chapter but for

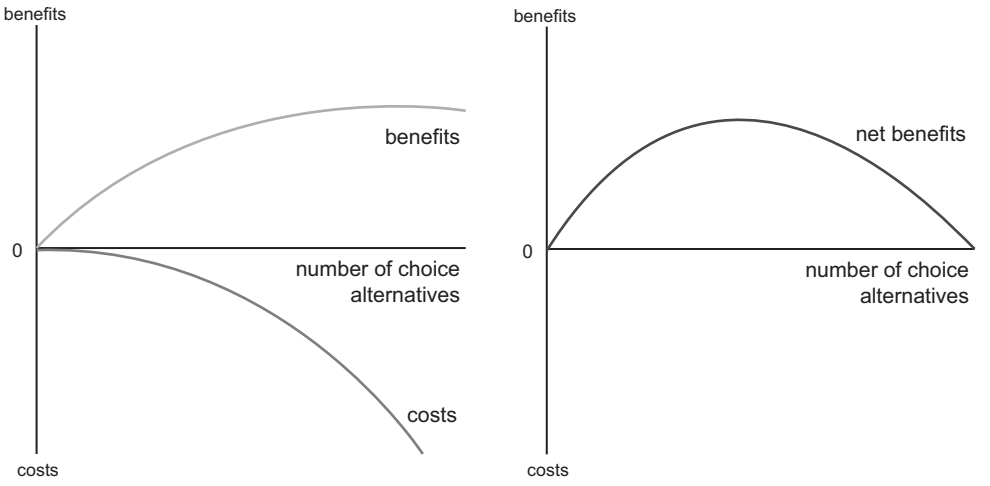

Figure 43.1 Satisfaction as a function of the number of alternatives in the choice set

Source: Adapted from similar figures originally published in Reutskaja and Hogarth (2009).

more on this subject, see Chapter 44 in this volume, "How much choice is 'good enough'? Moderators of information and choice overload."

Overall, the underlying mechanism described above can explain many findings from previous research. Empirical evidence indeed suggests that variables such as choice quality, motivation for choice and buying, and satisfaction with both process and outcome exhibit an inverted-U relationship with the number of choice alternatives and/or the complexity of each alternative.

Empirical evidence: effect of the provision of information and choice on the decision-making process and the outcomes

Next, this section considers empirical evidence of the effects of information and choice provision on the various steps of a decision-making process: information processing and usage, decision-making outcomes (quality and accuracy), motivation for choosing, consumption and buying, and subjective perceptions (individuals' subjective and emotional states).

Information processing and usage

The provision of information can impose cognitive costs on individual decision-makers. Cognitive costs include attention costs and the effort required to process information and make trade-offs. In his classic 1956 paper, "The magical number seven, plus or minus two" (Miller, 1956), George A. Miller argued that the amount of input information was not equal to the amount of information transmitted. This is due to a human's limited ability to receive, process, and remember information. In particular, Miller demonstrated that, as the quantity of input information increased, the amount of transmitted information would quickly plateau. The "channel capacity"—or the greatest amount of information that a human can process without error—was shown to be surprisingly low for unidimensional variables (around four for tastes, six for sounds or tones, and from 10 to 15 for visual positions). Miller suggested that the total "channel capacity" could be improved by increasing the number of dimensions in which given objects differed. However, the accuracy of judgment on each particular attribute

would decline. Subsequently, Chase & Simon (1973) and Simon (1974) argued that the brain possessed a "chunk" capacity and that short-term memory was capable of retaining a range of five to seven pieces of information. It was shown that it took time to consciously identify an object—sometimes more than half a second. In addition, the amount of information that the brain can simultaneously maintain in its short-term memory is quite small: the brain is able to remember or monitor only about four objects at once, regardless of how many objects are shown to a person at a time (Marois & Ivanoff, 2005).

In addition, at any given time, the mind normally selects only a subset of relevant information from a scene to process in detail. When full attention is paid to a certain location or item, the attention given to other locations and objects is suppressed (Wedel & Pieters, 2007). This inattentional blindness has been well demonstrated in one of the most famous studies in psychology, known as the Invisible Gorilla Test (Simons & Chabris, 1999). In this experiment, participants were asked to watch a short video in which students, wearing either a black or a white T-shirt, passed a basketball between themselves. The participants' task was to count the number of times that players wearing a white T-shirt passed the ball. During the video a person in a gorilla suit walked through the center of the scene. However, about half of the participants did not actually see the gorilla, which suggests that the relationship between what is in our visual field and what we actually perceive is based mostly on attention.

Attention costs are important costs to consider when dealing with lots of choice or information because attention is limited and selective. However, it is hard to measure many covert processes behind the decisions. Therefore, recent research has used modern tools, including eye tracking and brain imaging to open the black box behind the phenomenon of choice overload. By tracking people's eye movements, previous research has found that attention costs increase when people make choices from large rather than small sets of alternatives under time pressure (Reutskaja et al., 2011). When the number of snacks that people were choosing from increased, the number of eye fixations[1] and the time spent on choosing a snack increased significantly. The increased number of eye fixations likely reflects higher attention and processing costs (or the time necessary to perceive and understand the information), which suggests that a higher number of alternatives in the set imposes higher processing and attention costs on decision makers.

The functional magnetic resonance imaging (fMRI) method, which tracks activity in the brain, was also used to examine the processes behind the choice-overload phenomenon and revealed that choices from large sets of alternatives were associated with a greater cognitive load. Subjects choosing from larger (rather than smaller) choice sets showed increased eye movement and stronger activity in visual and sensorimotor brain areas—areas previously associated with the planning and control of movement such as reaches and saccades, the processing of visual scenes or both (Andersen & Buneo, 2002; Grill-Spector & Malach, 2004; Orban, Van Essen, & Vanduffel, 2004).

The amount of processed information that people use for their decision making (information usage) is also constrained by bounded human processing abilities (Simon, 1976) and imposes cognitive and time costs on decision-makers. Empirical evidence suggests that information usage follows an inverted U-shaped curve with the increase in information load (Miller, 1956; Schroder, Driver & Streufert, 1967; Newell & Simon, 1972; Chewning & Harrell, 1990; Tuttle & Burton, 1999). Research has found that input-cue usage increases initially with the number of cues provided but does not show any further increase after a particular point (Chewning & Harrell, 1990; Stocks & Harrell, 1995). In addition, people consider and process smaller percentages of information when the number of options and amount of relevant information increase (Hauser & Wernerfelt, 1990). For example, a study tracking the eye

movements of decision-makers has shown that, when participants chose a snack to consume out of different-sized sets, the average number of items seen in a larger set was greater compared to the smaller set but the percentage of items seen actually decreased with the set size (Reutskaja at al., 2011). So, when confronted with few items (two or three alternatives), people often process and use all the relevant information (Payne, Bettman, Coupey, & Johnson, 1992) but, in an environment with many alternatives, people shift to simpler choice strategies (Rolls et al., 1981). A more recent and large body of research found that the cognitive costs are not necessarily as high as the classical theory suggested. Research on adaptive decision-making (Payne, Bettman, & Johnson, 1993) and fast and frugal heuristics (such as Gigerenzer & Goldstein, 1996; Gigerenzer & Gaissmaier, 2011) established that humans could be good information processors when using simple heuristics. Simple heuristics use little of the large amounts of data available when the information is valid and the heuristic fits the choice environment well. Simple heuristics such as "take the best" (Gigerenzer & Goldstein, 1999) can also be used as techniques to simplify decisions, just like mnemonics and mnemotechnics can be used to overcome memory bottlenecks. To overcome overload, summaries, the prioritization of information, and mnemonics can be useful and have been used in medical education practice to help cope with feelings of information-caused stress (Smith, 2010).

Another cost of too much information and choice is the time cost. Over the decades, evidence has been accumulated that time is an increasing function of the amount of information and choice: There is a positive linear relationship between the total amount of information available and the time spent processing and evaluating information (Jacoby, 1974); people take longer to decide when confronted with larger as opposed to smaller choice sets (Iyengar & Lepper, 2000). Decision time rises over the entire range of task complexity as the number of alternatives in a choice set increases (Hogarth, 1975; Loewenstein, 2000).

However, there is some biological evidence (eye movements) showing that people can somewhat shorten processing times per item when the choice set increases (Reutskaja et al., 2011). Ironically, even if people actually take longer to choose from larger sets, the time that is *perceived* to pass often feels shorter (Fasolo, Carmeci, & Misuraca, 2009). This faulty perception can be harmful, leading to delays, further increases in time pressure, and time mismanagement. Indeed, many people tend to underestimate the time spent making a decision when facing an extensive array (say, 24 options) and, inversely, overestimate the time spent when facing a small choice set (say, only six options).

Motivation for choosing and consumption

Motivation to act refers to the intention to select one or more alternatives from a given set in order to then act upon them in one of many ways, including choosing, buying, or consuming them. More choice often means greater variety, and the provision of some variety has a positive effect on the motivation for choosing, purchasing and consumption. For example, in their study on food intake, Rolls et al. (1981) found that the participants consumed more yogurt when presented with three options—each differing in taste, color, and texture—compared to when just one yogurt flavor was offered. Interestingly, when the three yogurts were different flavors but visually indistinguishable, no increase in food consumption was observed. Moreover, consumption increases not only when the actual variety increases but also when the *perceived* variety increases (Kahn & Wansink, 2004).

However, too much information and choice may also lower the motivation to choose and cause people to defer choosing or simply to select a default option (Dhar, 1997; Shafir, Simonson, & Tversky, 1993). Probably the best-known evidence of choice overload is the "jam

study" (Iyengar & Lepper, 2000), where a tasting booth offering either six or 24 different flavors of jam was set up in an "upscale grocery store" in California. Although more customers stopped at the larger booth (the one with 24 rather than six jam flavors), they purchased less when faced with the larger set of jam. A lab study carried out by the same authors (Iyengar & Lepper, 2000) found that participants who sampled from a limited rather than an extensive assortment of chocolate bars were more likely to choose chocolate instead of cash as compensation for participating. Large sets are more attractive at first sight but they are demotivating for decision makers.

So, is it better to have a larger or smaller choice set available when it comes to consumption, buying, or choosing? As this review has shown, research suggests that neither of these options is optimal, and it is best to offer a "golden mean" to decision makers. Purchasing behavior follows an inverted-U pattern according to the number of alternatives in the set, and the peak for buying is reached when people choose from sets of an intermediate size. In one experiment, people could purchase pens from sets of varying sizes. More people purchased pens from intermediate sets (10 alternatives) rather than from small sets or large sets (two or 20 alternatives). Intermediate sets were more "motivating" for people than larger or smaller sets (Shah & Wolford, 2007). There is also biological evidence of too little and too much choice being demotivating. A brain-imaging study in which participants had to choose images from different-sized sets demonstrated that the activity in several brain areas also follows an inverted-U pattern (Reutskaja et al., 2018). Activity in the striatum (the area that has been shown to reflect reward or value processing) and the anterior cingulate cortex (ACC, the area that integrates cost and benefits) was the highest when subjects actively chose from sets with an intermediate number of alternatives, which were considered to have the right number of alternatives. The fMRI activity in those areas was lower for sets that were considered by participants to be too small or too large. Reutskaja et al. (2018) suggested that the activity in those areas reflected a motivational signal that maintained cognitive and behavioral engagement in decision-making.

Additionally, when the choice set is large, people have a stronger preference for simple, easy-to-understand options (Iyengar & Kamenica, 2010). More importantly, when the choice becomes too difficult, people often defer that choice, even when it negatively affects their future well-being. Iyengar, Huberman, and Jiang (2004) studied the influence of "too much" choice on a life-changing decision: participation in the US 401(k) retirement plan. The plans offered anywhere from 2 to 59 investment options. For every 10-option increase, the predicted individual participation probabilities declined by 1.5–2 percent. If there were only two funds offered, participation rates peaked at 75 percent, while the participation rate dropped to 61 percent when the number of plans amounted to 59.

Decision accuracy and quality

Decision accuracy (defined as selecting the best item out of a set), like many of outcome variables discussed earlier, exhibits an inverted-U-shaped relationship with information load (Jacoby et al., 1974a). For example, in a laboratory experiment, subjects were asked to choose a detergent from among 4, 8, or 12 different brands, each of which was described using two, four or six items of information. As the information load increased, the decision accuracy initially increased but ultimately leveled off. The number of brands and the information available about each brand (which both constitute information load) had opposing effects on decision accuracy. The number of brands was negatively related to decision accuracy, while the information per brand had a positive effect on decision accuracy. The results were confirmed in the follow-up experiment by the same authors (Jacoby, Speller, & Berning, 1974), which used larger amounts of information. (See also Malhorta, 1982.)

However, an eye-tracking study demonstrated that people were able to make choices that were better than random from sets of all tested sizes (up to 16 alternatives) even under extreme time pressure of three seconds, although the probability of picking the best item from the set of seen alternatives decreased slightly when the choice set increased (Reutskaja et al., 2011).

Detrimental effects of extensive information load have been further confirmed in other disciplines and contexts. For example, one study on information overload in an online environment found that the probability of a correct choice decreased as the number of attributes where the products differed increased, although the number of alternatives had no effect on accuracy (Lee & Lee, 2004).

Feelings and subjective states

The provision of information and choice can also affect the subjective states of individuals. Having access to full information and choice can be beneficial from a psychological point of view, as people like to feel "informed" and defend their "right" to access relevant information (Jacoby, Speller, & Kohn, 1974). Research has also shown that the ability to make choices by themselves gives people a feeling of autonomy and self-control (Zuckerman et al., 1978; Deci & Ryan, 1985). For example, people in nursing homes feel happier and more satisfied when provided with choices, even when the decisions are relatively unimportant and inconsequential (Langer & Rodin, 1976). These positive psychological states have the potential to enhance life satisfaction, general well-being, and thus social welfare overall.

However, extensive information and choice offerings can impose high psychological costs on individuals. These costs may be emotional (rather than cognitive) and stem from discomfort caused by uncertainty about preferences, lack of expertise, concern or regret about making an incorrect decision, and the presence of trade-offs (see, for example, Loewenstein, 2000). The mere fact of making a decision naturally involves some degree of emotional conflict because the selection of one option always accompanies the rejection of other alternatives (Botti & Iyengar, 2006). Freedom to choose can thus turn into a "tyranny" (Schwartz, 2000). A choice offering may also induce attachment to the options in the choice set, and people can feel they have lost the items they have not chosen. In addition to this, as the choice increases and the number of forgone options increases, the nonchosen options appear more attractive and feelings of loss increase (Carmon, Wertenbroch, & Zeelenberg, 2003). As the amount of information increases, not only will more options necessarily be rejected but people's standards in relation to the outcomes will rise (Schwartz, 2000). If the result of the decision is unsatisfactory, people may feel personally responsible for choosing a "wrong" alternative. When people realize that their choices are not ideal, they fall prey to the "tyranny of freedom." This outcome may be exacerbated by a modern society that fosters high expectations of achieving perfection in every aspect of life.

Selection from larger choice sets is also associated with greater perceived decision difficulty (Iyengar & Lepper, 2000; Reutskaja & Hogarth, 2009), less desire to have additional information (Jacoby, Speller, & Kohn, 1974; Jacoby, Speller, & Berning, 1974), less confidence in one's choice, and greater confusion (Malhotra, 1982; Lee & Lee, 2004). Moreover, individuals experience less satisfaction with the task and choice when selecting from a large rather than a small sample of choices (Malhotra, 1982; Iyengar & Lepper, 2000). However, as with many other previously described variables, satisfaction with both the chosen item and the decision-making process itself are inverted U-shaped functions of the number of alternatives, with people being the most satisfied with intermediate rather than small or large sets of alternatives (Reutskaja & Hogarth, 2009). In addition, having many alternatives may lead to less satisfaction

with decisions even when more choices yield better objective outcomes (Schwartz, 2000, 2004; Iyengar, Wells & Schwartz, 2006).

When the choice leads to painful ethical dilemmas, the emotional impact of having to choose is very strong, especially when the decision maker is personally responsible for making the choice. For instance, people who personally make psychologically painful decisions (e.g., ending a life-sustaining treatment) feel more intense negative emotions (such as anger, depression, guilt, and regret) compared to those who face the same outcome (e.g., the death of a loved one) as the result of a decision made by someone else. Personal responsibility adds to the feeling of loss (Botti, Orfali, & Iyengar, 2009).

The opportunity to choose, the amount of information, and the size of a choice set all influence not only actual post-choice feelings but also expectations about how one will feel about the choice, which can be quite different from the actual experience. For example, one study found that people anticipated experiencing greater satisfaction with their choice and with the selection process, as well as less regret over their choice, when choosing from a larger list of 20–50 potential dating candidates rather than from a smaller list of four. However, when participants actually chose a date from a mock website, they experienced greater memory confusion regarding their choices and showed no improvement in their affect when choosing from 20 rather than four profiles of potential partners. So, their expectation did not match their experience (Lenton, Fasolo, & Todd, 2008).

Overall, while the provision of information and choice can positively influence the feelings of individuals, extensive information and choice have a detrimental effect on the subjective states of decision makers, making intermediate sets the most satisfying. When the choice concerns painful outcomes, the mere act of choosing can trigger negative emotions.

Conclusion

This chapter has summarized evidence collected by researchers for more than half a century on the topic of information and choice overload, exploring how people deal with large amounts of information, how they make choices from sets with multiple alternatives, and what consequences choice provision has on decision-making process and choice outcomes. Traditionally, economics and psychology have emphasized the benefits of more information and more choice but a more recent body of research has demonstrated the negative consequences of too much choice. Too much information and choice hinder information processing and usage, the motivation, and the quality and accuracy of decisions, and detrimentally impact the affective states of decision-makers. All in all, empirical evidence suggests that both too little and too much choice and information are bad and there is a golden mean of how much choice is enough but not too much.

Note

1 A fixation occurs when a subject looks at an item for a continuous period of time: at least 100 ms, and usually for 200–400 ms (Salvucci & Goldberg, 2000).

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