



The information inelasticity of habits: Kahneman's bounded rationality or Simon's procedural rationality?

Elias L. Khalil¹

Received: 1 December 2020 / Accepted: 16 July 2022 / Published online: 13 August 2022
© The Author(s) 2022

Abstract

Why would decision makers (DMs) adopt heuristics, priors, or in short “habits” that prevent them from optimally using pertinent information—even when such information is freely-available? One answer, Herbert Simon’s “procedural rationality” regards the question invalid: DMs do not, and in fact cannot, process information in an optimal fashion. For Simon, habits are the primitives, where humans are ready to replace them only when they no longer sustain a pre-given “satisficing” goal. An alternative answer, Daniel Kahneman’s “mental economy” regards the question valid: DMs make decisions based on optimization. Kahneman understands optimization not differently from the standard economist’s “bounded rationality.” This might surprise some researchers given that the early Kahneman, along with Tversky, have uncovered biases that appear to suggest that choices depart greatly from rational choices. However, once we consider cognitive cost as part of the constraints, such biases turn out to be *occasional* failures of habits that are otherwise optimal on average. They are optimal as they save us the cognitive cost of case-by-case deliberation. While Kahneman’s bounded rationality situates him in the neoclassical economics camp, Simon’s procedural rationality echoes Bourdieu’s “habitus” camp. To abridge the fault line of the two camps, this paper proposes a “two problem areas hypothesis.” Along the neoclassical camp, habits satisfy wellbeing, what this paper calls “substantive satisfaction.” Along the Bourdieu camp, habits satisfy belonging, love, and bonding with one’s environment, what this paper calls “transcendental satisfaction.”

Keywords Heuristics (priors) · Cognitive cost · Mental economy · Dual process theory · Perspectives (framing contexts) · Ratio bias · Routines · Institutions · Prejudice · Cognitive illusions · Satisficing · Bourdieu’s habitus · American pragmatism (John Dewey)

✉ Elias L. Khalil
elias.lafi.khalil@gmail.com
https://www.eliaskhalil.com

¹ School of Economics, Administration and Public Policy, Doha Institute for Graduate Studies, Altarfa Street, Zone 70, PO Box 200592, Doha, Qatar

1 Introduction

Information inelasticity is the *raison d'être* of habits. This is not a controversial statement. It is a fact that decision science theorists acknowledge—irrespective of their many disagreements. The issue is rather how these decision science theorists explain this fact. This fact is puzzling for the dominant approach in economics, viz., the neoclassical optimization approach, which is identified with standard rational choice theory:

The Puzzling Question of Habits: Why would rational decision makers (DMs) adopt habits directing them to ignore pertinent information, even when such information is freely-available?

This paper studies how the optimization approach solves this puzzle, focusing on the later work of Kahneman (2011; see Khalil & Amin, 2022). This work relies heavily on the neoclassical concept of “bounded rationality.” Namely, the information inelasticity of habits is puzzling only if we restrict the cost of gathering information to transaction costs understood as the physical mobility and time involved in search. However, it would not be puzzling if the costs also included a *cognitive cost*, where information was costly to process mentally, even if the information was freely-available.¹

This paper also studies another approach that does not acknowledge the question, i.e., an approach that does not regard the information inelasticity of habits to be puzzling in the first place. This approach is prominent in the decision-making literature: Simon’s (1976) concept of “procedural rationality” and its further development by Gigerenzer and his collaborators (e.g., Gigerenzer & Selten, 2002; Gigerenzer & Sturm, 2012; see Khalil, 2013b). For this concept, DMs proceed with given habits which they do not question at first approximation. Hence, it is no puzzle that DMs ignore pertinent information—even if it is free. At first approximation, DMs act according to rules-of-thumb, heuristics, or more generally habits considered as primitives, i.e., the entry-point of understanding behavior that does not need to be explained in terms of standard rational choice.

This paper identifies the fault line dividing Kahneman’s concept of bounded rationality and Simon’s concept of procedural rationality. It should be clear that the question is limited to one class of habits adopted by DMs expressly to ignore pertinent information, irrespective of whether it is freely-available.

Section 2 lays out the framework. Section 3 advances the view that Kahneman’s rendition of heuristics is akin to the neoclassical economist’s. Section 4 demonstrates Simon’s critique of optimization. Section 5 shows how Simon’s concept of procedural rationality links with the quest after friendship, love, and bonding, which Adam Smith captures with his concept of “mutual sympathy.” Sections 6 and 7 provide a critique of Simon’s concept of procedural rationality.

¹ The recognition of cognitive cost—i.e., the economy of the cognitive architecture—should not be new to the psychological literature. It can be traced at least back to Anderson (1991; see Tsotsos, 1991) and more recently to Lieder and Griffiths (2020).

2 The Framework

2.1 Beyond the Descriptive/Normative Dichotomy

One important departure of this paper is that much of the debate in the decision sciences, particularly around the status of rational choice, has centered around the so-called “descriptive/normative dichotomy.” For instance, Baron (2008) employs the dichotomy, and even adds a third dimension he calls “prescriptive, as the framework of organizing his encyclopedic coverage of the decision making sciences of the preceding few decades. Likewise, Wallin (2013) takes the descriptive/normative dichotomy as the entry-point to the classification of what she calls “the rationality wars.”

The descriptive/normative dichotomy was ushered in modern social sciences by David Hume. It has vitiated these sciences under different lexicon, the most famous is the “fact/value dichotomy.” It is outside the scope of this paper to expose the philosophical problems of the dichotomy. Marchetti and Marchetti (2017) present a summary of these problems, synthesizing diverse critiques of the dichotomy as expressed by recent philosophers such as Charles S. Peirce, William James, F.C.S. Schiller, John Dewey, C.I. Lewis, Iris Murdoch, Philippa Foot, Donald Davidson, Hilary Putnam, Ruth Anna Putnam, Richard Rorty, and John McDowell.

While this paper cannot show why the dichotomy should not be the entry-point to the study of the focus of this paper, habits, it is sufficient to state that this paper has no use for this dichotomy. Indeed, it would be a conceptual error to use the dichotomy at first approximation of thinking about habit. It is true that a phenomenon such as habits strikes researchers as a descriptive deviation from normative rationality. However, such a deviation, as this paper shall establish, vindicates “normative” rationality with great ease, i.e., without any ad hoc auxiliary assumptions. The deviation would be predicted by standard rational choice once analysts acknowledge the importance of cognitive cost.²

2.2 What is the question?

The class of habits studied here is restricted to preset judgments, priors, and beliefs in the sense of heuristics acting as habits. As defined here, habits-as-heuristics, are shortcut impressions, generalizations, and stereotypes of professions, people, businesses, neighborhoods, countries, and so on, that individuals adopt, usually within limits, expressly to ignore even freely-available pertinent information.

If the DM forms the impression (heuristic) that a specific route to work is the shortest, the habit-as-heuristic generally immunizes him or her from examining even freely-available data regarding alternative routes. Likewise, if the DM forms

² Polonioli (2014, 2016) also does not consider the deviations from rationality as a challenge to standard rational choice theory. Hence, similar to the conclusion of this paper, Polonioli does not think that the approach of Simon, Gigerenzer, and their collaborators has established a strong case against standard rational choice theory (cf. Polonioli, 2015). However, Polonioli seems to suggest that the motive of Simon, Gigerenzer, and their collaborators is to explain the deviations from standard rationality—whereas, as this paper shall establish, this cannot be their motive. They do not recognize standard rationality in the first place.

heuristics about vacation spots, brands of coffee, hotel chains, novelists, academics, movie directors, and so on, the heuristics generally make him or her prejudiced, i.e., dismissive of further information about the subject of judgment, even if such information is freely-available. As shown below, however, the DM only ignores pertinent freely-available information up to a limit. Nonetheless, it is puzzling that they overlook such information even within such a limit.

Overlooking such information, i.e., following habits-as-heuristics, should prove to be effective on average. On some occasions, however, it turns out *ex post* to be an error, giving rise to what Kahneman (2011) regards as cognitive illusions, or more generally, as behavioral biases. Examples of biases include the occasional *ex post* errors arising from the availability heuristic, ratio bias, mental accounting, priors that make DMs susceptible to the priming effect, the guesses about Linda in the famous Linda problem, and others. This paper cannot discuss all of these examples, but a few to illustrate the proposed solution to the puzzling question posed at the outset (see Khalil, 2022a, b).³

This puzzling question is restricted, by tautology, to habitual tendencies adopted by DMs to immunize the self from pertinent freely-available information. This excludes a host of other behavioral tendencies even when the literature calls them “habits,” “heuristics,” and so on. Examples of the excluded behavioral tendencies include the so-called “four-fold pattern” that attempts to classify the following varieties of risk-taking (Harbaugh et al., 2010): i) the certainty effect (gains with high probabilities); ii) risk-seeking in the loss frame (losses with high probabilities); iii) the purchase of lottery tickets (gains with low probabilities); and iv) the purchase of insurance (losses with low probabilities).

Risk-seeking characterizing many behavioral tendencies might be the wrong entry-point of classification. As argued elsewhere (Khalil, 2022b), any classification must be rooted in the basic structure of decision making—and the issue of risk may not be central to such basic structure. A classification commencing with a behavioral trait might generate a classification that is more confusing than the phenomena it tries to explain. For example, “risk-seeking” might be a catch-all phrase, i.e., highlighting a superficial feature of actions arising from different motivations. The four-fold pattern might not be a pattern, but rather a collection of unrelated phenomena tied together by a catch-all phrase.

This paper is not the place to investigate whether the four-fold pattern is a mistaken concept that might not warrant a single decision rule such as the “priority heuristic” suggested by Brandstätter et al., (2006; Birnbaum, 2008). It is sufficient to observe

³ This paper also cannot discuss the difference between “bias” and what Kahneman calls, in a later co-authored book, “noise” (Kahneman et al., 2021). For instance, different doctors from the same hospital may give a diagnosis of a patient that is very similar to each other. The nearly-agreed judgment can be a “bias,” nonetheless. In this case, as in Kahneman’s early work with Tversky, we reason that the diagnostic tool might be somewhat malfunctioning or all the doctors were trained at the same academic program that has a unique approach. But if we do not know the true ailment, we have no way of knowing whether the nearly-agreed judgment is biased or not. On the other hand, “noise” is when the assessments of the doctors are scattered, i.e., diverge in significant ways from each other. The scatter (the noise) could have some pattern or without pattern. What we know is that we cannot assert whether there is a common bias. But we can say that each opinion, maybe except one, is biased in its own eccentric way. That is, we know that there can be no more than one single person whose opinion is non-biased.

that the four kinds of risk-taking listed above are not about habits—not to mention habits as defined by the puzzling question posed at the outset of this paper.

To repeat the question: why would rational DMs adopt habits-as-heuristics to immunize themselves from fully attending to pertinent information, even if such information was freely-available? To answer the question, we first need to define “rationality.”

There are two different senses of rationality, the strict and the broad. In the strict sense, rationality is about having a consistent ranking of bundles of goods, i.e., it is about having consistent preferences. As von Neumann and Morgenstern (2007) show, transitivity and completeness are the most important axioms needed to ensure the consistency of this sense of rationality. In the broad sense, rationality is about commanding the best bundle, which entails attending to given constraints such as income and relative prices (Becker, 1993; Gilboa, 2012). If there were no constraints, one would choose all the available bundles. Indeed, there would be no need to rank them consistently. Given there are constraints, it pays to rank the diverse bundles consistently.

Any information that helps the DM to know the qualities of the bundles and the constraints is pertinent. DMs are sensitive to any pertinent information, as it allows them to make the optimal choice—one maximizing the benefit. That is, at first approximation, for a choice to be rational, it must be information elastic. However, at second approximation, the choice would be information inelastic if the cost of the pertinent information turned out to be greater than its expected benefit. The DM would not search for information regarding the cost of, say, a dress, if such a search was costlier than the expected saving. However, if the pertinent information is freely-available, one’s choice must be information elastic.

In this light, the question posed at the outset is indeed puzzling. However, it is neither puzzling nor valid if the set of habits is adopted for a reason other than immunization from freely-available information. For example, as shown below, a set of habits can be adopted in the face of Knightian uncertainty in the sense of total ignorance of the future state of the world or its probability distributions.

However, the question of habits continues to be puzzling if habits are expressly adopted to immunize DMs from pertinent freely-available information. Such habits are puzzling to standard (neoclassical) economists who suppose rational DMs would want to use all freely-available information. To solve the puzzle, economists develop a richer view of rationality, called “bounded rationality.” According to the bounded rationality view, DMs may ignore freely-available information when processing such information requires a cognitive cost greater than the expected benefit of such *seemingly* freely-available information.

We must recognize that the concept of “bounded rationality” is pleonasm. In light of the definition of rationality, if there were no boundedness (constraints), rational choice would lose its *raison d’être*. Nonetheless, it is useful to continue and use the pleonasm “bounded rationality” term, as it signals that the theorist is recognizing the cognitive cost as part of the set of constraints.

Kahneman’s term “mental economy” is even more suitable than the neoclassical term “bounded rationality.” The term “mental economy” suggests more explicitly that the enriched set of boundedness is the outcome of mental effort.

Kahneman, to note, is not in a minority among the psychologists to use the neoclassical economics concept of mental economy or mental effort. For a recent survey of the growing literature in psychology regarding cost–benefit analysis of mental effort, see Székely and Michael (2021). What is provocative about Kahneman’s work, along with Tversky, is that it is often misperceived as a challenge to neoclassical theory.⁴

There is a reason for such a misperception. The young and early Kahneman did not employ the concept of “mental economy” to account for the diverse behavioral biases that he, along with Tversky, had uncovered. The failure to provide the mental economy explanation might have suggested to other researchers, if not also to Kahneman and Tversky themselves, that they have uncovered evidence that disconfirms rational choice theory. However, this is the case only if one uses a narrow definition of rationality, i.e., one excluding cognitive cost from the set of constraints. With an expanded definition of rationality including cognitive cost as part of the set of constraints, as the later Kahneman (2011) acknowledges, the diverse behavioral biases and cognitive illusions confirm rational choice theory and the neoclassical approach in general.

In his 2011 book, Kahneman does not present his concept of “mental economy” as a total break from his earlier work in collaboration with Tversky. Kahneman (2011, pp. 6, 411–415) rather laments that researchers have misunderstood his early work as a fundamental critique of rational choice. In any case, researchers who consider his early work as a fundamental critique of rational choice must subscribe to the “two Kahnemans” idea, as they would be surprised upon reading his 2011 book. Namely, Kahneman explains the heuristics and their associated biases as the working of “mental economy,” the efficient operation of cognition when cognitive cost matters (see Khalil & Amin, 2022).

Heuristics, or habits in general, are rather optimal rules-of-thumb in cases when the cost of optimization exceeds its benefit. DMs adopt heuristics to economize the cost of optimization. Thus, heuristics, as deviations from optimization, are not examples of non-rational choices. To the contrary, they are examples of rational choice. If the DM insists on undertaking the first best choice, when such choice involves more cognitive cost than the expected benefit, the DM would be undertaking a suboptimal choice (see Khalil, 2022a). This should not mean that DMs do not commit non-rational choices—as the weakness of will phenomenon amply exemplifies (Khalil, 2015, 2017a)—but the adoption of heuristics cannot be an example of such choices.

What adds to the confusion is that in his 2011 book Kahneman did not clearly declare himself as a neoclassical economist. On the other hand, he does not need to make such explicit declaration. Hardly any neoclassical economist does. What qualifies a social scientist as a neoclassical economist is how he or she explains phenomena. And Kahneman explains the phenomenon under focus, i.e., heuristics, throughout the first 24 chapters of his book via the “mental economy” concept (Kahneman, 2011, pp. 19–265). Namely, heuristics express shortcuts taken by the cognitive system to

⁴ Given that Kahneman’s conception of mental economy is situated within neoclassical economics, how come economists and others misperceive his work as a challenge to standard economic theory of rational choice? Ross (2014) provides a good reason. Standard economists are mostly interested in the efficiency of markets and, hence, really do not worry at first approximation about behavioral biases. They introduce such biases only when cognitive limitations may explain the failure of some markets to reach efficient allocation outcomes.

economize on the mental cost of examining each case according to its expected costs and benefits. Given that cognitive deliberation is costly, it pays to adopt such shortcuts in belief formation. However, such shortcuts fail on some occasions, where the failures appear as behavioral biases and cognitive illusions. DMs would tolerate the cost of the occasional failure, and hence continue to use the heuristics, if such heuristics entailed a saving on case-by-case deliberation costs greater than the expected cost of the occasional failures. Such a decision is the epitome of rational choice.

Indeed, when Kahneman explicitly mentions rational choice, he makes it clear that the uncovered behavioral biases do not contravene rational choice (Kahneman, 2011, p. 4). And he expresses understanding of why many readers misunderstand his early work with Tversky, i.e., the uncovering of behavioral biases as a challenge to rational choice theory, when it is not (see Kahneman, 2011, pp. 411–415).

Readers who find such a “two Kahnemans” thesis surprising, the first 24 chapters of *Thinking, Fast and Slow* affirm that at least the later Kahneman, i.e., the one advancing “mental economy,” is in the camp of the expanded rational choice theory (Kahneman, 2011, pp. 19–265; see Khalil & Amin, 2022). While these chapters are rich with diverse examples of behavioral biases and cognitive illusions, they are redundant in terms of the proposed explanation–mental economy. This demonstrates the resilience and power of the neoclassical approach.

However, there is an alternative approach disputing the mental economy concept and the neoclassical explanation altogether, spearheaded by Simon and elaborated further by Gigerenzer and collaborators. For them, there is no need for the neoclassical explanation, as there is no puzzling question in the first place. It is true that habits amount to rule-following actions entailing information inelasticity. However, DMs do not demand information to optimize. Rather, DMs demand information to meet a pre-given level of satisfaction that Simon (1956) calls “satisficing”—a blend of “satisfaction” and “suffice.” Satisficing is far from the fictitious “satisfaction” supposedly sought by rational DMs who rather ignore pertinent freely-available information insofar as they have reached a threshold, the given “satisficing” level.

Gigerenzer et al. (2011) provides computer simulations and empirical findings of what is called “less-is-more effects.” Namely, in situations of uncertainty, defined as non-calculable risk, the wellbeing of DMs would be better off if they ignored freely-available information. Otherwise, if they processed such information, they would lose focus and the heuristic that secures the pre-given “satisficing” level would become foggy.

Ironically, Simon coined the term “bounded rationality” expressly to highlight the state of fogginess resulting from trying to process all information and to make the optimal decision. Given the uncertainty, i.e., the fact of incalculable risk, it is impossible to compute the optimal solution (Simon, 1957). To be clear, however, for Simon, even if the risk is calculable, it is impossible to compute the optimal solution because such solution does not exist. That is, Simon’s critique of optimization does not depend on Knightian uncertainty. Simon was disappointed with how neoclassical economics has co-opted his coined term “bounded rationality” and, hence, replaced the hijacked term with a new one, “procedural rationality”, to express what he has originally meant by the term “bounded rationality” (see Barros, 2010).

This paper shows that Simon's concept of procedural rationality greatly resonates with Pierre Bourdieu's (1990) concept of "habitus"—both reject the rational choice (instrumental) explanation of habits. To explain briefly, Bourdieu advances "habitus" as a critique of two entrenched traditions in sociology and philosophical discussions for the greater part of the twentieth century. The first is the structuralist tradition that viewed behavior basically as the mechanical execution of social rules, while the second is the individualist tradition that viewed behavior as the expression of individual aspiration and quest after autonomy. Bourdieu proposes habitus as the conceptual bridge that helps us supersede this structuralist-individualist duality.

However, as clarified elsewhere (Khalil, 2022a), there is another axis beside the structuralist-individualist duality axis characterizing the habitus concept. Namely, are habits basically technologies DMs design as instruments in order to manipulate physical and social constraints to satisfy pre-given set of preferences—a view that the standard rational choice theory advances? Or are habits basically embodiments consisting of attitudes, inclinations, or predispositions of how a person broadly interacts with the environment while ready to adjust and change the predispositions in light of errors arising from experience—a view that the habitus concept advances? It is this instrumental-embodiment duality axis that is the focus of this paper.

According to the embodiment view, habits are attitudes, here called "heuristics," that embody the person in the same manner that one's arms, legs, teeth, and so on, characterize them. Habits cannot be instruments as much as these biological features cannot. These embodiments express the person's identity in the sense that they afford bonding, comfort, and attachment of the person to his or her environment—whether physical, social, or the mix of the two. It is the embodiment view of habits-as-heuristics that, as this paper registers, likens the Simon/Gigerenzer/Selten approach to Bourdieu's habitus.

Furthermore, this paper shows that the puzzling question posed at the outset persists even if we accept the computer simulations confirming the efficacy of rule-following and the superiority of "less-is-more effects" over the processing of all information available. The puzzling question about the information inelasticity of habits remains in the residual cases of risk, i.e., cases of known probabilities, or even in riskless choices. For a DM who is used to shop, say, at a familiar grocery store, he or she might still resist examining freely-available information about an alternative store, even where there is no risk involved in such examination.

2.3 Are Habits Puzzling?

The question posed above is non-trivial, as the pertinent information is reasonably cheap or, better, freely-available. Therefore, the validity of the question is independent of whether DMs are facing known risks about future states or uncertainty. The question is orthogonal to whether the world is a Knightian uncertainty or risky in the sense of known low-probability outcomes of lotteries. To recall Knight's (1971) risk/uncertainty distinction, "uncertainty" denotes future states that lack objective

probability distributions, while “risk” denotes future states that follow objective probability distributions. In Knightian uncertainty, DMs cannot optimize, while in risk they can. If we recognize, as this paper shall establish, that DMs adopt habits as part of optimization, the question is valid: Why would DMs adopt habits immunizing them from pertinent freely-available information?

Incidentally, Stigler (preface, Knight, 1971) argues that Knight’s risk/uncertainty distinction cannot be sustained considering Savage’s “subjective expected utility theory” (SEUT). Savage (1954), however, limited SEUT to small events, conceding there can be unknown events that cannot be subjectively guessed. Nonetheless, the literature assimilated SEUT to undermine the Knightian risk/uncertainty distinction. DMs simply guess the probability of such unforeseen states and proceed to calculate the expected utility as if they were calculating outcomes considering only the risk, i.e., the objective likelihood of the different states. Further experiences help them update such subjective guesses.

In any case even if we keep SEUT limited and accept Knightian uncertainty, the focus of this paper is on habits that are possible to witness in an uncertainty-free world, i.e., where unknowns are risky. Indeed, the critics of optimization assert that even in an uncertainty-free world, the question posed at the outset of this paper is invalid. DMs simply cannot optimize even in the standard, neoclassical world of calculable risk. DMs cannot process information in the optimization sense even in a world free of risk, not to mention Knightian uncertainty. A leading tradition, especially in psychology, that is critical of the standard sense of rationality is the work of Simon (1976; see also Gigerenzer, 2000, 2008). Simon’s critique stands irrespective of whether one accepts Knight’s risk/uncertainty distinction. Indeed, even in a world where there is neither risk nor uncertainty, optimization along the standard view of rational choice is impossible for those in Simon’s tradition. The reason Simon is critical of standard optimization differs from why Knight is critical of optimization and for more fundamental reasons.

Put differently, whatever habits are designed to deal with Knightian uncertainty, they do not exhaust the set of all habits. This paper focuses on the subset of habits DMs adopt expressly to relieve them of examining pertinent freely-available information. Such information would be sought after by DMs if the habits under question were adopted in the face of Knightian uncertainty.

2.4 Defining habits

First, we need to distinguish habits from perspectives. Perspectives amount to viewpoints, convictions, beliefs in the sense of ideologies, and what behavioral decision scientists recognize as contexts engendering framing effects as illustrated in the famous Asian Disease experiment (e.g., Tversky & Kahneman, 1981). As argued elsewhere (Khalil, 2010, 2021a), perspectives are gestalt-like organizing principles aiding DMs in making sense, understanding, and appreciating sense data. An example of a perspective is the context used to appreciate a 5% pay increase. The increase would be a source of joy if the context was 2%, while it is a source of anger if the context was 10%. Likewise, is the death of 20 people as a result of airplane crash the source of relief and joy given the context that there were 150 people on board? Or is it the source

of anguish and anger, upon knowing the context that there were only 20 people on board and the death was the outcome of a fire while the plane was waiting to take off?

The perspective, i.e., the context, cannot be confirmed or denied. It is given. If the context is 10% or 150 passengers, it does not change with more sense data about the actual pay increase or the actual number of dead people. Given the perspective and its emotional outcome, the emotion can become *more* or *less warranted* as the sense data changes, which is the actual pay increase or actual dead people in our example.

In contrast, habits do not involve perspectives. They are rather generalized impressions that are wholly the outcome of selected encounters, sense data, and experiences. If the DM experiences a stomachache after visiting, say, three fast-food restaurants, they will form a habit-as-heuristic about that type of restaurants. As such, the heuristic can be fully the subject of confirmation or denial upon further empirical sense data. Thus, prejudices arising from well-entrenched perspectives differ from prejudices arising from well-entrenched habits-as-heuristics.

Second, beside habits-as-heuristics, there is another kind of habits, namely, habits-as-routines. Examples of habits-as-routines include whether the DM uses a cutting board or their own palm to slice tomatoes for salad, how the DM drives to work, and whether the DM smokes or listens to music to relax and focus on writing the next poem, novel, or scientific paper. It can be argued that the analytical study of habits-as-heuristics applies to habits-as-routines, as if they lie along the same continuum. However, this argument falls outside the scope of this paper (see Khalil & Amin, 2022).

Third, do habits differ from institutions? If we restrict the term “habits” to the individual level, institutions are habits shared at the collective level in form of cultural norms or maps of thinking that specify the priors (Denzau & North, 1994). The collective can either be a civil society or an organization that has leadership making decisions to attain common goals (see Douglas, 1986; Hodgson, 1993a, 1993b, 2004, 2006; Khalil, 1995). It would be interesting to study, first, the differences between habits and institutions and, second, the differences between institutions underpinning civil society as opposed to institutions underpinning organizations. However, this dimension is not the concern of this paper.

There are several further aspects of the topic outside the scope of this paper. First, the neurological basis of habit and habit formation (e.g., Barrett, 2014; Graybiel, 2008; Graybiel & Smith, 2014; Smith & Graybiel, 2013, 2014; Yin & Knowlton, 2006). Second, the extent to which the preferences of DMs are shaped by pre-given socio-cultural norms, peer pressures, and social fads (see Khalil, 2017b). And third, path dependence or lock-in habits. It is the tendency of habits to become entrenched, where the *status quo* leads DMs to resist change. This dimension is important, but it raises a question related to the extent a habit or an institution generates network externalities. Such externalities raise the cost of change, which makes it harder to adopt what appears to be more efficient habits (see Khalil, 2013a).

Given the above clarifications, this paper examines the origin and nature of habits: Are habits incidental aspects of the organism, i.e., arising because of association à la behaviorism (Skinner) or as a result of economizing of cognitive cost à la neoclassical economics? Or are habits endemic essences of the organism arising from the search of the organism for identity, belonging, and organic fusion with the environment?

As Barandiaran and Di Paolo (2014) argue, the difference between the instrumental (associationist) and the existential (organicist) camps is the most enduring fault line in the literature regarding the origin and nature of habits. This fault line is the focus of this paper as highlighted by the question posed at the outset. Pitting the two camps against each other has shed light on how to think of habits in relation to efficiency, on one hand, and to existence, on the other. The instrumental/associationist camp regards habits as incidental occurrences that, if not reinforced through reward or enhancement of wellbeing, the DM would shed away. This resonates well with the Kahneman/economics line of thinking. The existential/organicist camp views habits as the expression of the fusion of the self with its home and community. This resonates well with the Simon/Bourdieu line of thinking.

2.5 From Simon's procedural rationality to Bourdieu's Habitus

The Simonian tradition resonates with a tradition in sociology for which the question posed above is also invalid even in a world free from Knightian uncertainty. This tradition in sociology has taken many phases, the one studied in this paper is the "habitus" concept of Bourdieu (1990, 2010). The habitus concept can be found in a number of traditions, for instance phenomenology (e.g., Merleau-Ponty, 2012), American pragmatism (e.g., Bernstein, 2010; Dewey, 1905, 1938; James, 1890), and even Aristotle (2009) and his notion of *hexis* (trans.: disposition).⁵

For these thinkers, DMs do not make decisions in the standard rational choice sense in the first place, i.e., to maximize wellbeing in the pecuniary or substantive satisfaction sense. DMs do not stand as external actors separated from their environment, seeking information about the environment, to instrumentally manipulate it to their end. DMs are rather fused with their environment in an *organic* manner. The DMs and the environment participate in production and consumption activities underlining their harmonious existence, giving rise to satisfaction that is misleadingly characterized by neoclassical economics as being about what can be called "substantive satisfaction." This paper calls the satisfaction arising from the organic fusion "transcendental satisfaction," which amounts to existentialist experience, where DMs see themselves in harmony with nature and with other human beings.

Under the existentialist experience, DMs regard their habitats as homes and their habits as modes of existing—the meaning of the habitus concept. The habitus concept provides the analytical tool to explain why the physical environment and the community afford DMs the sense of comfort, nostalgic reflections, and the warmth of

⁵ Another interpretation of Simon's emphasis on rules and procedures as the entry-point of understanding behavior is that rules and procedures are the basis of operations of machines and particularly machines operating according to artificial intelligence. Indeed, Simon along with two collaborators, Newell and Shaw, were among the first to develop a programming language of computers, what they call "Information Processing Language" (see Newell et al., 1957, 1958; Simon, 1981; Mirowski, 2002, Ch. 7). This might have inspired Simon to consider the sciences of the machines as the prototype science on how to understand the behavior of organisms, including humans. For a simple reason, however, this paper shall not explore Simon's procedural rationality as being inspired by his research into the sciences of the artificial. Namely, a researcher may break the link between Simon's view of human behavior and his work on artificial intelligence without undermining Simon's view.

identity—i.e., the transcendental satisfaction that the standard rational choice cannot explain.

To wit, the term “habit” originates from the Latin *habitus*. According to an online source, “habitus” means “condition, demeanor, appearance, dress.” It is derived from the past participle of *habere*, which means “to have, hold, possess; wear; find oneself, be situated; consider, think, reason, have in mind; manage, keep” (<https://www.etymonline.com/word/habit>). In the hands of modern sociologists, habitus is the habit of reasoning, wearing, and acting in general that does not spring from rationality, calculated decision making, or deliberation.

Simon (1976) advances a concept of behavior that he calls “procedural rationality”—as an alternative to the neoclassical economic concept that he dismissively calls “substantive rationality.” Simon employs his concept to explain rules within markets and organizations, i.e., heuristics, as stemming from habits that cannot be explained as the product of optimization. As mentioned above, procedural rationality seems similar to the sociological habitus concept. Others who follow Simon, such as Todd and Gigerenzer (2012) and Gigerenzer and Selten (2002), develop further his basic orientation and call it “ecological rationality” (see also Viale, 2020; Gigerenzer et al., 2011; Katsikopoulos & Lan, 2011; Berg, 2014).⁶

Many researchers have discussed and elaborated on the benefits of the ecological rationality approach. For instance, Rich (2016) contrasts it with the axiomatic rationality approach. She starts with the premise of how these two approaches improve human behavior. Indeed, she calls for a “hybrid approach” that uses elements of each insofar as the outcome is the improvement of human behavior. In any case, she correctly considers the axiomatic rationality approach as concerned with the consistency of the preferences. However, she characterizes the ecological rationality approach as concerned with consequences.

Such a characterization misses the point that when the decision maker decides to take an action, while taking his or her consistent preferences as given, the decision maker considers the best action as gauged by the consequences. Indeed, what sets the ecological rationality approach from what she calls the axiomatic approach is how they conceive habits: are they actually the optimum technology given cognitive cost or are they the entry-point of analysis in the sense that they are the primitives, i.e., cannot be explained further.

For the advocates of the ecological rationality approach, such as Gigerenzer and Selten (2002), habits are an “adaptive toolbox”—they mediate between organisms and their niches. That is, habits (or heuristics) are adaptive in the sense of being malleable, dependent on what level of satisfaction that the organism aims to achieve in the given ecological niche.

⁶ Vernon Smith (2003) also uses the term “ecological rationality.” As Dekker and Remic (2019) clarify, though, Smith uses it in a different sense to denote the spontaneous order of society that arises from norms that express the distributed intelligence of the many members of the society. Smith disputes, stated succinctly, the Rousseau-Bentham-Marx view, which he calls “constructivist rationality,” that supposes the state or social planner as the originator of the social and political order. Smith’s “ecological rationality” is inspired by Hayek’s (1988) advocacy of spontaneous order as a critique of state planning or even the neoclassical conception of general equilibrium of markets (see Khalil, 1997b, 2011).

Note, this paper avoids the term “adaptive toolbox” to denote the further elaboration of the ecological rationality approach. The term connotes the neo-Darwinian research approach that is generally called “adaptationism.” To be clear, Todd and Gigerenzer (2012) distance themselves from the adaptationist neo-Darwinian program as it is analytically analogous to optimization à la standard rational choice.⁷ Still, the use of the term “adaptive toolbox” may introduce lexical confusion.

This paper also avoids the term “natural” that is used by Gigerenzer and Sturm (2012) to denote the ecological rationality approach. First, it will lead to confusion if we use different lexicon to refer to the same thing, i.e., ecological rationality. Second, the term has different meanings, depending on the theoretical framework (see Khalil, 1990, 1997a).

Linking Simon’s “procedural rationality” or Todd/Gigerenzer/Selten’s “ecological rationality,” on one hand, to Bourdieu’s habitus, on the other, might come as a surprise to many readers. For one thing, neither Simon nor his followers cite or appeal to the habitus concept. In any case, Simon and his followers advance “procedural rationality” or “ecological rationality” as a view of what underpins thinking and deciding—an operator differing radically from what standard neoclassical economics proposes (see Hands, 2014). If DMs think and decide according to an operator that has no relation to optimization, such an operator most likely expresses belonging, communal solidarity, and bonding—what the habitus concept portrays, or what this paper shall argue.

The claim of continuity of the Simon/Gigerenzer/Selten approach and Bordieu’s habitus might be surprising in another sense. The Simon/Gigerenzer/Selten approach has contributed models on how to make decisions in organizations, medical diagnostics, and many other domains unrelated to communal solidarity, family, or bonding (Gigerenzer & Selten, 2002). It is the case that this approach proposes simple heuristics in the face of complicated and varied facts that should not or, supposedly, cannot be based on the optimization calculus. For this approach, the simple heuristics should rather be based on gut feelings (Gigerenzer, 2008). This paper does not evaluate such models. It rather offers an interpretation of the fundamental ground that provides support for such models. Namely, humans cannot optimize, and hence should follow their gut-feelings, as they are umbilically entangled with their environment. Such entanglement affords comfort and satisfaction, i.e., transcendental satisfaction, differing from the substantive satisfaction of the standard economist.

2.6 From Kahneman’s mental economy to neoclassical bounded rationality

A simplistic rational choice theory ignores habits at first approximation. It does not consider cognition as a scarce resource and, hence, it is destined to overlook the role of habits in making choices. For simplistic rational choice theory, DMs undertake Bayesian probabilistic inference as if cognition was a free resource. Hence, it expects

⁷ As many commentators maintain (e.g., Khalil, 1993, 2009; Sober, 1998), the adaptationist approach of Neo-Darwinism is, with minor differences, identical to standard rational choice. This paper is not the place to demonstrate the point. Briefly, however, given the constraints, the rational agent chooses choice, say, X over Y, which natural selection would also select under the same constraints.

DMs to update their priors or beliefs with every minute change of information about the environment and, correspondingly, to update their choices.

Commencing with a simplistic rational choice theory, it was easy for behavioral decision scientists such as Kahneman and Tversky (1972, 1973; Tversky & Kahneman, 1974) to show flaws in such a theory. They started a research agenda aimed at showing how DMs judgments are greatly erroneous and biased—in the sense of deviating from the prediction of the simplistic Bayesian probabilistic inference. The findings of Kahneman and Tversky's early work were surprising to most economists because they naively subscribed to the simplistic rational choice theory. Once the theory considered cognition as a scarce resource, economists and the later Kahneman (2011) ceased being surprised with the experimental findings of Tversky and the early Kahneman.

In fact, rational choice theorists recognize cognition as a scarce resource when they use the concept of “bounded rationality,” a term hijacked from Simon (e.g., Gilboa & Schmeidler, 1995). The bounded rationality concept in the hijacked, neoclassical sense is re-invented by Kahneman when he calls it “mental economy.” Throughout his book, Kahneman (2011) does not provide a formal definition of “mental economy,” nonetheless, he employs the term repeatedly, which allows one to surmise its meaning to be identical to the hijacked neoclassical “bounded rationality” concept:

Mental Economy (definition): Any decision involves a cognitive process including the attention and collection of all the information regarding the specific case at hand, processing the information, and the careful deliberation to reach the optimum decision. Such a cognitive process is costly. When the expected extra benefits of such a process cannot justify the expected cost, it pays the DM to cut short the process and take a decision in line with a ready-made, good-for-all rule, i.e., heuristic. Such a heuristic is the best rule. Only on a few occasions, the heuristics does not produce the expected optimal outcome and may push one, momentarily, to regret following the heuristics. Still, the DM may continue to *ex ante* employ the heuristics, i.e., avoid the attention to details, if the expected *ex post* mistakes incur less cost than the case-by-case attention to details.

In many cases, the DM usually senses the heuristic as a gut-feeling judgment, i.e., a judgment arising without conscious awareness. But sub-conscious operation is not a necessary feature of heuristics. Heuristics can appear as generalizations arising from conscious cognitive processes. Irrespective of whether the heuristic is the outcome of conscious generalization as opposed to (sub-conscious) gut-feeling operation, it is the subject of mental economy insofar as it functions to economize cognitive costs. Put differently, the mental economy approach can explain the phenomenon of (sub-conscious) gut-feeling heuristics as it can explain consciously generated heuristics. In either case, it does not reify heuristics, i.e., as if they were stand-alone rules independent of rational optimization of cognitive resources.

If we see heuristics as habits regarding judgments, the mental economy concept entails that those habits are the best approximations of optimal behavior or choice. The habits are ready-made, categorical responses that are efficient *on average*. While habits that are information inelastic may lead on a few occasions to *ex post* biases, the mistakes can be tolerated.

Such a standard economist view resembles the approach of behaviorist psychology à la Skinner (1976). Namely, habits arise from *associations* of stimuli that an organism links if such conditions are repeated long enough with reinforcing rewards. According to both traditions, habits are instruments in the sense that they are, ultimately, extrinsic traits. They do not express some identity that defines the existence of the organism vis-à-vis the environment à la Bourdieu's habitus. Hence, habits should not be mistaken as embodied in the organism as if they are habitus, i.e., constituent of what defines the organism.

2.7 Three approaches and two questions

This paper does not endorse all proclaimed biases. Indeed, the determination of what are valid biases and what is misdiagnosed as biases is outside the scope of this paper. It is sufficient to mention that researchers have questioned, to a differing extent, many the kinds of biases (e.g., Gigerenzer, 1996, 2018). Even if the literature contains misdiagnosed biases, this should not mean that humans are free from them, not to mention free from heuristics.

Indeed, the research program spurred on by Simon registers the ubiquity of heuristics (e.g., Gigerenzer et al., 2011). The Simon/Selten/Gigerenzer approach consider heuristics as primitives, i.e., as unexplainable via the optimization calculus. The first inclination of the approach is to welcome heuristics as the outcome of ecological rationality (see also Klein, 2017). That is, at first approximation, the approach embraces existing heuristics as beneficial fast-and-frugal guides in making choices (Hand, 2014; Raab & Gigerenzer, 2015). This does not mean the approach lacks the tools to identify whether the heuristics have gone awry, i.e., have become maladaptive. The ecological approach can identify maladaptiveness: it is a state when the heuristics no longer meet their usefulness, viz., when they attain a pre-given level of functionality in the sense of “satisficing.”

Still, two caveats are in order. First, heuristics cannot be viewed as responding elastically to information regarding the conditions of the niche. Otherwise, the heuristics are information elastic, undermining their *raison d'être* as habits.

Second, while heuristics à la the ecological rationality view eventually responds to sufficient changes in the environment, such change differs from the change à la standard economics approach. While the former embraces the change of heuristics along Simon's procedural rationality, the latter along Kahneman's bounded rationality.

As Table 1 sums up, we need to distinguish among three approaches—viz., the early Kahneman's which starts with simplistic standard rational choice approach, the later Kahneman's which starts with expanded rational choice approach, and the Simon/Selten/Gigerenzer approach. As defined earlier, the expanded Kahneman/economics approach recognizes the cost of cognitive processes, while the simplistic approach does not. The three approaches give different answers and rationales that can be confusing if we do not differentiate between two questions: 1) does the approach embrace heuristics? 2) what is the approach's rationale? The second and third approaches both embrace heuristics, but for radically different rationales. They disagree on whether to recognize cognitive cost.

Table 1 Three Approaches and Two Questions

<i>Three Approaches</i> \ <i>Two Questions</i>	Does the Approach Embrace Heuristics?	What is the Rationale of the Approach?
1. Simplistic Standard Rational Choice Approach: the early Kahneman/Tversky approach	No	Heuristics generate biases (cognitive illusions) that are suboptimal
2. Expanded Standard Rational Choice Approach: the later Kahneman approach	Yes	Heuristics are optimal, given cognitive costs that call for bounded rationality (mental economy)
3. The Simon/Selten/Gigerenzer approach	Yes	They are fast-and-frugal rules that are stable if they secure a certain level of wellbeing (satisficing)

2.8 Erroneous and non-erroneous heuristics, cognitive illusions, optical illusions

This paper distinguishes between “heuristics” and “cognitive illusions.” Heuristics are operative rules existing *ex ante* in the generic sense but underpinning judgments regarding specific situations. Some heuristics are erroneous even *ex ante*: when the benefit of holding the heuristic generates excessive errors that cannot be justified by the saved cognitive cost. If the DM continues to uphold what is determined *ex ante* to be an erroneous heuristic, we have what we might call “cognitive collapse.”⁸

Other heuristics are non-erroneous *ex ante* but generate occasional *ex post* erroneous judgments. In this case, we do not have cognitive collapse but what can be called a “cognitive illusion.” A cognitive illusion or mistake is the occasional *ex post* error, which is an inevitable cost of using optimal heuristics (Khalil & Amin, 2022).

The paper focuses on the non-erroneous heuristics, i.e., cognitive illusions. It attempts to establish that such heuristics are optimal even when they generate *ex post* erroneous judgments.

Researchers use the term “cognitive illusions” broadly, not paying attention to whether the heuristics are erroneous *ex ante*, or whether the heuristics are non-erroneous but occasionally erroneous *ex post*. Behavioral decision scientists (e.g., Pohl, 2016) and a few economists (e.g., Caplin & Dean, 2015) make this subtle distinction. They distinguish between a faulty cognitive system per se, i.e., the generator of *ex ante* erroneous heuristics, as opposed to an adaptive (optimal) cognitive system,

⁸ *Ex ante* erroneous heuristics appear as pathological phenomena. Hence, we should not model them as “irrational preferences” à la Caplan (2000, 2001), i.e., as if they are goods where the DM demands less of them as their price rise.

i.e., the generator of *ex ante* non-erroneous heuristics. Such an adaptive cognitive system produces occasional faulty by-products, i.e., it is a generator of *ex post* occasional errors or cognitive illusions.

This subtle distinction is helpful in characterizing the “two Kahnemans”: the evolution of Kahneman from his early to his later work. As discussed above, the early Kahneman along with Tversky is armed with a narrow definition of rational choice. They conducted experiments that reveal biases, where such biases are the result of a maladaptive cognitive system, i.e., only capable of generating *ex ante* erroneous heuristics. In contrast, the late Kahneman (2011), along with an expanded rational choice theory, re-interpreted the experimental results of the 1970s and 1980s. Namely, he suggested that the diverse behavioral biases and cognitive illusions are occasional mistakes of otherwise efficient cognitive system. To be clear, it is efficient in the *ex ante* sense, i.e., it pays to follow heuristics even if they entail errors in the form of biases and illusions. Such errors appear only *ex post*.⁹

Focusing on cognitive illusions of the second type, the ones that are the by-products of the rather adaptive (efficient) cognitive system, it raises a question. What explains the operative rules, i.e., the heuristics, that may *ex post* generate erroneous judgments (cognitive illusions)? One hypothesis is Kahneman’s, i.e., the mental economy concept, which is in line with the economist’s concept of bounded rationality. Another hypothesis is the Simon/Gigerenzer/Selten approach.

Let us examine the phenomena that are generally called the “availability heuristic.” The term is portmanteau. It encompasses diverse meanings including the availability-by-recency, availability-by-frequency, vividness, and so on. Some literature even sheds doubt on the evidence regarding the availability-by-recency and the availability-by-frequency (e.g., Sedlmeier et al., 1998). To get the example going, let us define the availability heuristic as narrowly about accidental encounters. Accidental encounters influence the DM’s formation of judgments, giving greater weight than warranted to some traits simply because the DM had encountered them, not cognizant of the fact that the encounter is rather accidental. The judgments seem non-rational, amounting to definite cognitive illusions. In the majority of cases, however, a seemingly random encounter is not totally random. Thus, the formed judgments can be good-enough summary of the encountered entity. In this case, the availability heuristic is *ex ante* rational, i.e., one may rely on the “accidental” encounter as a signal even when the *ex post* outcome may turn out to be a cognitive illusion in some cases.

Note, cognitive illusions do not necessarily involve the operation of the optical system, and, hence, should not be conflated with optical illusions. The topic of optical illusions does not concern this paper (see Gregory, 1997). Nonetheless, there is an analytical similarity between the two phenomena (see Khalil, 2021a). Stated briefly, in both phenomena there is a rule that is violated in a few instances. In optical illusion, the violated rule is a “rule of perception” that is usually, otherwise, effective. In cognitive illusion, the violated rule is a “rule-of-thumb” that is usually, otherwise, effective.

⁹ Berge (2014) reaches a similar assessment. The work of Kahneman and Tversky reveals that they implicitly adhered to a “normative” rational choice theory, whereas the observable biases are only “positive” description of factual choices. So, Berge would not be surprised with the evolution of Kahneman, where the late Kahneman came to realize that the earlier discoveries of biases should not undermine the postulate that the cognitive system per se is adaptive.

2.9 The two hypotheses

There is a long and rich history of theories of judgment and decision-making (see, e.g., Payne et al., 1993; Keren & Wu, 2015). To sharpen the analysis, this paper restricts itself to the fault line dividing two opposite approaches, listed as the 2nd and 3rd approaches in Table 1 above: the later Kahneman's and the standard economist's bounded rationality approach, which resonates with the instrumentalist/associationist vision, on one hand, and the Simon/Gigerenzer/Selten approach, which resonates with the existentialist/organicist vision, on the other and.

The task of the paper is to abridge the fault line. It proposes two hypotheses:

1. **The Two Problem Areas Hypothesis:** There is no conflict between the instrumentalist/associationist camp, i.e., the Kahneman/economics line of thinking, and the existentialist/organicist camp, i.e., the Simon/Bourdieu line of thinking. Each camp captures a different problem area. While the instrumentalist approach approximates decision-making that maximizes substantive satisfaction, the existentialist approach approximates decision-making that promotes transcendental satisfaction in the sense of the satisfaction of longing to a home and bonding with one's surrounding.
2. **The Poverty of Procedural Rationality Hypothesis:** As a subsidiary to the first hypothesis, insofar the focus is on decision-making related to substantive satisfaction, Simon's procedural rationality approach is non-satisfactory relative to its competitor, the standard, bounded rationality approach.

Put differently, the habitus concept is pertinent to the analysis of bonding, i.e., the quest after community, love, friendship, and family. But if the focus is on decision-making to maximize substantive satisfaction, the habitus concept and its relative, viz., Simon's procedural rationality, are unhelpful relative to the instrumental approach.

3 Heuristics as optimal rules

3.1 What is "Bounded Rationality"?

The term "bounded rationality" has acquired multiple meanings (see Grüne-Yanoff, 2014; Rubinstein, 1998; Sent, 2018; Katsikopoulos, 2014). For instance, Katsikopoulos (2014) distinguishes between what he calls "idealistic" and "pragmatic" senses of bounded rationality. The idealistic sense corresponds to the simplistic neoclassical optimization concept, i.e., regarding cognition as a free resource. The pragmatic view covers both the simplistic and expanded neoclassical optimization concept—as well as the alternative, Simon's procedural rationality concept.

Obviously, Katsikopoulos's idealistic/pragmatic distinction is not helpful in highlighting the fault line, i.e., the difference between the later Kahneman (bounded rationality) and the Simonian approach.

This paper fixes the definition of the term "bounded rationality" to mean the expanded neoclassical optimization concept, in line with how others use the term (e.g., Rubinstein, 1998). This acknowledges the fact, mentioned earlier, that Simon

(1957) coined the term ironically as a critique of the neoclassical optimization concept. Defined as such, as mentioned above, the neoclassical concept of “bounded rationality” informs Kahneman’s book, *Thinking, Fast and Slow* (Kahneman, 2011).

However, Kahneman avoided the term “bounded rationality” and opted to use the term “mental economy” instead. The likely reason is that Kahneman (e.g., 2003) and many others (e.g., Conlisk, 1996; Jolls et al., 1998; Sent, 2018) have used the term “bounded rationality” as roughly equivalent to an *ex ante* faulty or deficient cognitive system responsible for the discovered biases and cognitive illusions. That is, the term “bounded rationality” connotes in the early work of Kahneman a simplistic view of optimization, where the cognitive illusions and biases reveal that DMs are equipped with a basically maladaptive cognitive system, i.e., generating *ex ante* erroneous heuristics and cognitive illusions.

3.2 Illustrating cognitive illusions

Cognitive illusions need not indicate an *ex ante* maladaptive cognitive system. While many examples are discussed below—e.g., priming effects and Kahneman’s distinction between experiencing and remembering selves—let us briefly examine the errors arising *ex post* from the “availability heuristic” (Tversky & Kahneman, 1973). As explained above, the availability heuristic is not a hypothesis. It is a particular set of phenomena whereas the heuristic is the use of accidental encounters to make judgments.

The tendency to use adjacent experiences does not usually produce biases. The accidental encounters are effective ways of delivering cheap information that is useful to incorporate, especially if the expected benefit is not great. The most recent news is more important than older news simply because the DM can recall the former more easily than the latter. And the deeper reason is that the more recent news is more pressing than older news for the next action that the DM needs to take.¹⁰

However, on a few occasions, the use of information about accidental encounters leads to biases, cognitive illusions. For example, upon hearing of the death of a driver because of a malfunction of the automobile seat belt, DMs tend to abstain from using seat belts at least for a while. Likewise, DMs are readier to drive than fly upon hearing of the incident of an airplane crash, even when it is objectively safer to fly (e.g., Fischhoff et al., 1978).¹¹

¹⁰ The availability heuristic is not without its critics, which can be divided into two camps. The first camp, e.g., Posner (2002), accepts the phenomena insofar as it is not a hypothesis, but merely a description as clarified above. Posner argues that the heuristic does not entail any indication of subversion of rational decision making—a position that is close to a core thesis of this paper. The second camp, e.g., Sedlmeier et al. (1998), denies the scientific status of the “availability heuristic.” This group maintains that the term can be used post hoc to explain any phenomena. This raises the question of the lack of the ability to falsify a theory, a concern that is associated with Popper’s (2002) positivist philosophy of science. While this concern is important, it lies outside the scope of this paper.

¹¹ Miller and Krosnick (1998) show how the order of names has an effect on the results of elections, a phenomenon known as the “order effect.” The order effect is an illustration of the availability heuristic since erratic information, such as arbitrary order, has effect on judgment and choice.

3.3 Mental economy via the dual process theory

Kahneman spent the early part of his career, along with Tversky, showing how lab participants make decisions violating rational choice predicated on Bayesian probabilistic inference (e.g., Kahneman, 1994; Tversky & Kahneman, 1986). As mentioned above, the later Kahneman seems to have realized that an expanded rational choice theory can easily explain most, if not all, of the errors and biases that the early Kahneman has uncovered along with Tversky. With this “economics turn,” Kahneman is a great advocate of the rational choice explanation of cognitive illusions—once rational choice is nuanced enough to accommodate the idea that cognitive processes are costly.

Specifically, the later Kahneman relies heavily, if not exclusively, on the dual process theory as developed by Stanovich and West (2000) and others (e.g., De Neys, 2018)—which can be traced back to Wason and Evans (1974) and even to Wason (1968). Actually, dual process theory is an approach rather than a single theory, but this issue falls outside the scope of this paper.¹²

Briefly, dual process theory distinguishes decision-making into two more-or-less distinct systems. One process, which the literature calls System 1, involves intuitive, fast, and non-deliberative reservoir of heuristics and ready-made attitudes the DM executes regarding a set of cases, overlooking their differences. The other process, which the literature calls System 2, involves fact-based, slow, and deliberative decision-making, where the DM examines each case on its own merit.

As Kahneman (2011, Ch. 6) stresses, the DM is hesitant to revert to the deliberative System 2 out of concern for what is mentioned above, namely, mental economy. The deliberation of each case involves cognitive cost. When Kahneman mentions “cognitive cost,” he does not explicitly refer to foregone alternatives as defined in standard economics textbooks. But as he uses the concept, it includes efforts which System 2 wants to minimize. Kahneman (2011) calls the minimization “laziness” or “cognitive ease,” which the economist immediately recognizes as the maximization of benefit including leisure. Insofar as the DM demands leisure over scanty benefits that may arise from the cognitive effort of the System 2, Kahneman’s “cognitive cost” is the standard economist sense of cost, i.e., foregone alternatives.

Hence, mental economy entails that the DM should employ the deliberative System 2 when the expected benefit exceeds the cost. The DM allows the intuitive System 1, which involves over-generalization, to dominate judgments to free up System 2 to deal with challenging cases that require deliberation.

To warn though, Kahneman’s concept of mental economy is only applicable to over-inference, over-generalizations, the law of small numbers, or in short to habits-as-heuristics—what Kahneman (2011, Chs. 1–24) covers in the first part of the book. It does not apply to other behavioral biases that Kahneman (2011, Chs. 25–29) covers in

¹² The dual process approach consists of different theories (see Sherman et al., 2014). However, for simplicity, it is called generally the “dual process theory.” Further, the theory is not free from criticism. For instance, Osman (2004) reviews the evidence in support of dual process theory. While she is not critical of dual process theory, she advocates a single-system framework that can explain the findings in support of dual process theory as different types of reasoning. Further, Melnikoff and Bargh (2018) also express reservations about dual process theory. But the basis of their reservation is that humans, including theorists, tend to think in binaries (e.g., core/periphery, nature/nurture, and so on), and dual process theory is simply a continuation of such proclivity.

the latter parts of the book, viz., the loss/gain frame effects, loss aversion, endowment effect, the certainty effect, the possibility effect (related to hope), and others. This is the case despite his efforts to explain all these biases via the dual process theory—when the theory should be restricted to habits-as-heuristics (see Khalil, 2022b).

Let us focus only on behavioral biases resulting from habits-as-heuristics, i.e., those limited to situations of quantifiable probability (risk), avoiding Knightian uncertainty. One bias that clearly does not involve Knightian uncertainty is the experiment of Miller et al. (1989). The experiment consists of asking participants in the lab to choose from two urns to win a prize. One urn contains 10 balls of which only 1 is red, while the other contains 100 balls of which only 8 are red. The great majority of the participants opted for the larger urn of the two, while knowing that the probability (8%) associated with the larger urn is lower than the probability (10%) associated with the smaller urn.

The literature names this cognitive illusion the “ratio bias,” which amounts to a redescription rather than an explanation. Kirkpatrick and Epstein (1992; see also Epstein, 1994) offer a plausible explanation that can be modeled via dual process theory. Participants seem to use System 1, which they call the “experiential self,” that relies on vivid absolute frequencies of red balls. Participants do not resort to System 2, which they call the “cognitive self,” that relies on probability of red balls. Put differently, participants tend to neglect the denominator defining the probability. The use of the denominator to compute the true probability is cognitively costly. They use the heuristic of vivid frequency of balls as an efficient way to make decisions.

Note, however, Bourdin and Vetschera (2018) argue there are many factors involved beyond the simple ratio—which renders a dual process explanation non-definitive. However, a laboratory setting is supposed to strip the situation of such variables that may clutter the observation. In fact, outside the lab, where there are many factors, there is more reason to follow the heuristic, i.e., to “focus on the number of instances, not the denominator.” The fact that such a heuristic survives in a controlled laboratory experiment goes to show how deep-seated it is.

The proposed analysis of the ratio bias is not a mere redescription of the cognitive illusion. It would be a redescription if one stated: “DMs do not like to think abstractly in terms of ratios and, hence, they make decisions by focusing on the absolute numerator.” The proposed analysis is rather an explanation as it states: “there is a reason why DMs do not like to think abstractly in terms of ratios—and the same reason also explains why they choose to think abstractly in terms of ratios on some occasions.” To state the reason in other words, the DMs’ inclination to avoid thinking abstractly is not the outcome of preferences, i.e., as if the inclination is written in stone. Rather, DMs are ready to avoid thinking abstractly only if such thinking involves cognitive costs greater than the expected costs of occasional cognitive illusions arising from following heuristics, i.e., rules-of-thumb that are on average sufficiently workable. DMs are ready to think abstractly, i.e., to employ the deliberative System 2, only when the expected reward is sufficiently high to warrant, at the margin, the suspension of the (cognitively) cheaper intuitive System 1.

In short, habits loom larger than case-by-case deliberations because System 1 affords what Kahneman calls “cognitive ease,” a quick decision considering cues that save the DM cognitive effort. DMs devise rules-of-thumb in the face of bounded

cognitive capacity. Such rules or heuristics *ex post* give rise, in some cases, to cognitive illusions. But such a cost would be tolerable given that in most cases, such rules or heuristics economize the use of cognitive capacity. That is, rules-of-thumb amount to optimal techniques because the case-by-case deliberation engenders suboptimal outcomes.

3.4 “Remembering Self” vs. “Experiencing Self”

Kahneman (2011, Ch. 35) reports a difference between what he calls the “remembering self” and the “experiencing self.” This paper proposes that this difference seems to be a variant of the availability heuristic. The analysis of the availability heuristic above should guide us, highlighting why this difference between the two selves is optimal.

The remembering self recalls an episode of moments of pleasure (or of pain) according to a simple ratio: what is the peak moment of feeling relative to the feeling of the last moment. If the ratio of an episode is higher than another episode, the DM would choose the former. But this ratio is unrelated to the actual experiencing self. The experiencing self may undergo a longer duration, of relatively modest peaks, but the total wellbeing is higher than what the remembering self recalls regarding another episode. Still, the DM would choose the episode with the highest peak-to-last moments ratio over the episode with the highest total wellbeing. For instance, if vacation A generates a total amount of pleasure (experiencing self) that is greater than vacation B, but B has a higher ratio (remember self) than A’s, the DM would choose B over A, *ceteris paribus*.

Considering Kahneman’s experimental findings, preferences are as good as what the DM remembers. So, DMs may decide to maximize the utility based on the remembering self. For Kahneman, this would contradict a decision based on wellbeing, i.e., what is recorded by the experiencing self at each moment during the duration of the episode.

However, the fact that the remembering self trumps the experiencing self may not be the blow to rational choice theory as Kahneman (2011, Ch. 35) claims. Given that in the earlier chapters Kahneman (2011, Chs., 1–24) did not consider the availability heuristic and other biases as a blow to rational choice (mental economy), we may equally apply his idea of mental economy to explain the experiencing/remembering selves discrepancy.

Unlike DMs in the lab, those in the field must make decisions quickly. It is simply too costly to recall each moment of the episode. The DM can recall easily the most memorable moments, say, of a vacation, i.e., the peak moment and the last moment. And if such two moments correlate well with the utility of the experiencing self, i.e., wellbeing, it allows decisions based on the remembering self to become approximate of the maximization of wellbeing, again, on average.¹³

¹³ In the last three chapters of his book, Kahneman (2011, Chs. 36–38) turns around and applies his notion of “experienced self” to issues regarding happiness. He notes that the question concerning how people feel from moment to moment captures “experienced life” corresponding to his notion of “experienced self.” In a careful experiment with his colleagues (*Ibid.*, Ch. 37), Kahneman asked women in the USA, France, and Denmark to report via random messages on their mobile phone how they feel at the moment. Kahneman reports interesting differences. But then suddenly Kahneman discusses the wellbeing-happiness paradox,

4 Simon's critique of optimization

Kahneman's "economics turn" amounts to grounding habits on instrumental, optimization grounds. Simon (1976) would be critical of such an approach. He posits that DMs operate according to procedures that are stable if they attain a certain level of satisfaction or what Simon (1957) calls "satisficing." Such procedures simply exist as part of what constitutes the DM.

As noted at the outset, these procedures correspond to Bourdieu's habitus concept. For Bourdieu, habitus is how the body becomes a part of its environment and vice versa. The DM does not stand outside of the DM's milieu as if he or she can manipulate the milieu instrumentally by adopting effective and efficient heuristics. For Bourdieu, the DM is organically part of the milieu that surrounds him or her. Heuristics cannot be technologies—and in fact technologies and even simple tools do not stand outside the DM. To put Bourdieu's view simply, instruments are only imagined figments in the minds of standard economists and fellow-travelers such as Kahneman.

Bourdieu was not the first to articulate "habitus." It has received a prominent position in the philosophy of perception of Maurice Merleau-Ponty (2012). Opposing the Cartesian dichotomy between the DM as an actor and the objects of the environment, Merleau-Ponty regarded the DM as a body that already encompasses the objects of the environment. As much as the DM cannot choose the body or its components, the DM cannot choose objects of the environment in an instrumental, rational manner.

The embodied cognition view is the basis of the work on language and metaphors by Lakoff and Johnson (2001); see Borghi & Cimatti, 2010; Johnson, 2017; Varela et al., 2017; Rosen, 2005; see Gallagher & Zahavi, 2008). It also informs the work of Damasio (1994) and Bechara et al. (2000). Damasio regards moral judgments as part of such bodily functioning. If a patient loses the part of the brain where the emotional and moral processes reside, the patient may appear rational, but only at the superficial level. The patient would not have a clue about simple choices regarding social decorum. For Haidt (2001), morality is a deeply seated emotion, appearing to the consciousness as a tail disciplined by the rational dog, i.e., reason, when indeed it is to the contrary.¹⁴

Footnote 13 continued

known also as the Easterlin paradox. People report experienced life that remains steady once income rises beyond US\$75,000 (or less in cheaper locations). Kahneman explains the paradox in a rather ad hoc fashion: once people have sufficient income and maybe continue to experience better wellbeing with the additional purchases, they start to lose pleasure from the little and cheaper expenditures in their life. This means that the little pleasure must actually be so painful as to offset the rising pleasure beyond the US\$75,000. But such an explanation does not flow from mental economy and also does not flow from the dual process theory that he advances. More importantly, it is totally unrelated to the experienced/remembering selves distinction that he had just advanced in the previous chapter which was supposed to be a build-up to his solution of the paradox (*Ibid.*, Ch. 35). To solve the wellbeing-happiness paradox, we need actually to distinguish the wellbeing metric from the happiness metric, which falls outside the scope of this paper (see Khalil, 2022d, 2019).

¹⁴ Beside classical sociology and the embodied cognition approach, the Simon/Gigerenzer/Selten modularity approach resembles the philosophy of American pragmatism (Dewey & Bentley, 1949; see Khalil, 2011a, 2013b), old institutionalist economics (Veblen, 1934; see Hodgson, 1993a, b, 2004), some aspects of Keynesian economics (e.g., Duensberry, 1949), and the evolutionary "spandrelism" view (see, Marciano & Khalil, 2012). The spandrelism view, in particular, rejects the simplistic optimization theory of origins

Likewise, for Simon, behavior is not governed by a supposed rational head wagging the habit-dependent behavioral tail. The DM (or the organism in general) simply behaves according to regularities arising from the fusion of the self with its environment. Such a fusion is the outcome of proceeding in making a living as has been done in the past, where the DM cannot process information to inform its beliefs or actions.

Simon's procedural view of behavior should not be confused with how Kahneman understands the automatic System 1. While Kahneman (2011) also defines the automatic System 1 as the execution of intuitive reactions according to habits without examining the informational details of a situation, he theorizes such habits originating from the cost-and-benefit calculus performed across many cases. Such a generalized calculus expresses mental economy, generating habits as optimal technologies.

In contrast, Simon's procedural rationality rejects any efficiency explanation of the origin of habits—and corollary, the change of habits. For Simon, if we think the DM cannot choose his or her own identity, then likewise the DM cannot choose his or her habits. Habits are constitutive of identity; they are not techniques to be chosen to maximize satisfaction. For Simon, the organism does not seek, and indeed *cannot* seek, the maximization of satisfaction. The organism is content with the habits that act, in the final analysis, as modules, i.e., packets of regularities (see Callebaut & Rasskin-Gutman, 2005). These modules remain stable as long as they sustain a level of satisfaction. While such satisfaction is about substantive satisfaction, it differs from “satisfaction” understood as the quantity that is maximized à la neoclassical economics.

How do habits-qua-modules change according to Simon—and according to other promoters of the procedural rationality approach (e.g., Gigerenzer, 2000, 2008; Gigerenzer & Selten, 2002)? Habits change in response to a crisis severe enough to undermine satisficing, the pregiven level of wellbeing. DMs do not stand on some Olympic ground to select the optimal alternative because there is no such ground. DMs rather choose any nearby habit resorting to a certain level of functioning, which may or may not restore the previous level.

The Simon/Gigerenzer/Selten modularity/procedural approach has a pedigree with different fields. Beside Bourdieu's habitus, the approach resonates with classical sociology. For classical sociology, societies have *structures* of interconnected norms ensuring the *functioning* and *stability* of the social order, what is called “structural-functionalism” approach (e.g., Bottomore, 1975; Parsons, 1951). The social structure affords ready norms for the DM to adopt, and the DM is ready to adopt them to receive approval and, more importantly, to satisfy the yearning after friendship, love, and community.

Footnote 14 continued

of traits insofar it ignores structures that may generate *ex post* maladaptive by-products. This is equivalent to rather efficient (adaptive) habits-as-heuristics that may generate *ex post* erroneous by-products—as described in this paper. This debate is summed up in the debates surrounding the Evo-Devo approach (Callebaut & Rasskin-Gutman, 2005). The modularity approach hypothesizes the organism consists of modules that have risen through a process of learning. This view springs from Simon's (1962) explanation of the rise of complexity: an organism would be stable against shocks if different components (modules) are kept apart, each unit operating according to its own rules (norms)—where the function of each module complements the functions of the other modules.

5 The quest after friendship, love, and community

This paper makes it clear at the outset that the “information inelasticity of habits” phenomenon is not a puzzle. It is a puzzle only for the standard rational choice approach, not for the Simon/Gigerenzer/Selten approach. The latter links, as this paper registers, with Bourdieu’s habitus concept, which views habits as embodiments of the DM. Embodiments, similar to biological features of the individual, express the identity of the individual in the sense of attitudes, predispositions, and ways of carrying everyday living that make the individual bond with the environment. Insofar as this environment is made up of other living beings, bonding amounts to friendship-and-love that is the basic block of the community.

As evidence from causal empiricism shows, the individual seeks bonding, especially with living beings, as captured by Bourdieu’s existentialist/organicist vision. The DM regards the physical place supporting his or her livelihood as part of his or her home that provides a feeling of comfort and a sense of belonging. The physical home consists of the river, the valley, the shore, the stone-paved alley, etc. Many thinkers have stressed the importance of physical place for the development of bonding (e.g., Margalit, 2004; Said, 2000).

Note, though, the physical place is also instrumental, i.e., it provides resources for the enhancement of substantive satisfaction. However, even after it ceases to be instrumental, the physical place tends to continue to be part of the DM’s sense of attachment, bonding, and identity.

There is no need for a community of humans for the attachment and bonding to develop, as in the case of Robinson Crusoe if he happened to develop an attachment to his island. Of course, the sense of attachment and bonding becomes stronger if the place also involves other human beings, as in the case of bonding with a family, a friendship, or a church. The quest after bonding subsists insofar as the friend or the community member provides succor and comfort for the DM simply because of listening to the DM’s happy and sad events in his or her life.

Many ancient and modern thinkers have pondered the nature of friendship-and-love (e.g., Nehamas, 2016; Pakaluk, 1991). But given the thesis of the substantive/transcendental distinction, it is worthwhile to discuss Adam Smith’s (1976, pp., 13–16; Khalil, 2022c) view. He sharply distinguished friendship, i.e., transcendental satisfaction, from material benefit, i.e., substantive satisfaction. For him, friendship affords a benefit that cannot be reduced to substantive satisfaction. If friendship is merely a substantive satisfaction, no one would be ready to listen to the sad event that occurred to a friend. If friendship is sympathy of the kind that reflects substantive satisfaction, it is only beneficial if the friend shares his or her joyful events. If one listens to his or her friend’s non-joyful events, it would make one sad. This, in turn via continuous reflexivity or mirroring, would make the holder of the original emotion even sadder (Khalil, 2011b). Thus, no one would choose friendship if friendship, which Smith traces to what he calls “mutual sympathy,” was no different from (ordinary) sympathy. Smith understood ordinary sympathy as, first, copying or mimicking the emotions of others and, second, as judging whether the pitch or extent of response to stimulus excessive as opposed to proper. Whether ordinary sympathy is mere mimicking or, further, judging, it is about the spread of substantive satisfaction

in the case of mimicking, or about approbation of substantive satisfaction in the case of judgment. In either case, such substantive satisfaction differs from transcendental satisfaction (mutual sympathy) that friendship-and-love affords.

Stated differently, for Smith, the fact that people seek friends in the times of loss and pain proves the contrary—calling for the delineation of mutual sympathy from sympathy. Smith notes, the telling of a tragic event to a friend makes both feel pleasant, which amounts to mutual sympathy (transcendental satisfaction). Hence, Smith concludes, friendship cannot be constituted of the same currency as substantive satisfaction. Friendship always occasions pleasant feelings, even if the substrate event is tragic.

Smith (*Ibid.*) calls friendship “mutual sympathy”—in contradistinction to the substantive satisfaction which he calls “sympathy.” Smith (1976, p. 14) reasons that friendship-and-love must tap “another source of satisfaction”—i.e., transcendental satisfaction that is incommensurable with substantive satisfaction. The transcendental satisfaction expresses the fusion of the DM’s self with others.

While the experience of friendship needs not involve trading goods, it is possible such exchange may involve kindness and wishes of good fortune. Indeed, the simple act of purchasing a cup of coffee at a café involves the exchange of well-wishes, smiles, etc., between the buyer and the seller (see Bruni & Sugden, 2008). Friendship, everything else equal, indeed cements and furthers more complex market- or, more generally, substantive-based contracts (Gui, 1996, 2000; Gui & Sugden, 2010). As Guiso et al., (2004, 2006) show empirically, trust based on friendship, what the literature calls “social capital,” enhances economic development and growth.

Nonetheless, as clarified elsewhere (Khalil & Marciano, 2021a), this literature starts with the supposition that substantive-based and transcendental-based utilities are intertwined. It views any substantive exchange as necessarily involving friendship. It does not recognize friendship as separate from substantive satisfaction.

Note, however, that if the substantive-based contracts come to an end, kindness and social niceties usually also come to an end. In contrast, the problem area discussed here, viz., communal love and solidarity, can stand alone. For instance, the communal love that a member of a church or a family feels toward another member does not hinge on any substantive-based contract. Such a DM may purchase an automobile from a member of the church, but such a substantive-based exchange is incidental to the constitution of their relationship, i.e., communal bonding that stands independently of the substantive-based exchange.

It is important to recognize communal bonding, the quest after friendship, or the yearning for love, as analytically separate from substantive-based exchange. But such a mode of conception raises a new challenge. How to put substantive and transcendental satisfaction back together? While they are analytically separate, they must be related somehow. For example, the loss of a job may lead to frustration, loss of aspiration, dissipation of hope, and even addiction that undermines friendship, not to mention family bonding. But the investigation of how each genus of utility differs from the other, while still related, falls outside the scope of this paper.

For our purpose, the substantive/transcendental satisfaction distinction is paramount. Otherwise, if yearning for friendship-and-love is only an aspect of substantive-based exchanges, it would be hard to conceive of the relevance of the

habitus concept à la Bourdieu. The habitus concept would be superfluous—or as superfluous as the niceties accompanying the purchase of coffee at a cafe, i.e., what is basically a substantive-based exchange.

But once we recognize that friendship-and-love can stand alone, we can see how the habitus concept is relevant. It allows us to see habits as identity-defining modes of being. Habits would not be instruments or techniques designed by rational choice to ultimately maximize wellbeing.

Still, the habitus concept need not necessarily exhaust the total space of habits. It is possible, as the “two problem areas hypothesis” stated above ascertains, that there is a set of habits that are instruments or techniques designed by rational choice to enhance wellbeing. This would, at least partially, undermine the habitus view that underpins Simon’s procedural rationality, as discussed next.

6 A critique of simon’s procedural rationality

The modularity or procedural approach has some appeal. Insofar as we study why DMs want to belong to families and other groupings ranging from the church to the nation, we need a set of tools such as Bourdieu’s habitus or Simon’s procedural rationality. The consumption of goods affording a sense of belonging, which is crucial for happiness, has also not escaped the attention of anthropologists since the inception of the discipline (e.g., Mauss, 1990; see Khalil & Marciano, 2021a).

At the same time, however, DMs allocate resources, combine them in non-arbitrary ways, and consume products in a well-balanced manner. For instance, they do not live in highly extravagant houses, leaving them with little money for food and transportation. The normal DM does not wear a \$5,000 dress, while not having money for an appropriate pair of shoes to match.

The rational balancing of the consumption of goods, i.e., the non-arbitrary combination of inputs, seems to be analytically separate from the enjoyments arising from bonding with one’s surroundings, reflecting upon what is being consumed, and celebrating achievements—all are transcendental enjoyments in the sense of transcending the pecuniary, substantive satisfaction. For instance, a hunter-gatherer may decide that a valley is the best place to roam because of its abundant resources, while simultaneously experiencing the decision via rituals that make him or her experience the new habitat as home, a place of belonging and identity.

This double-track interaction with the environment—one that is both instrumental and existential—can be enriched with the participation of other humans. Such participation can be purely instrumental if based on cooperation defined by a nexus of contractual agreements. The participation can be purely existential if based on reflection and rituals, or it can be an amalgamation of both types.

This paper cannot elaborate the double-track interaction hypothesis (see Khalil & Marciano, 2021a, b). However, given the hypothesis, the choice faced by the theorist is not either/or: it is not whether social interaction is either ultimately instrumental or ultimately existential. Both types can exist in their pure form. For instance, one can interact with friends, share sad events in his or her life, and experience love without necessitating the two people to be involved in any contract-based exchange of goods.

Likewise, two neighbors can agree on how to combat a drought, a locust swarm, or any substantive activity without necessitating that the two people to be involved in any relationship of friendship, love, or comradeship.

Given the proposed dual-track interaction hypothesis, Simon/Gigerenzer/Selten's procedural or ecological rationality approach cannot amount to a general theory of habits-as-heuristics. Likewise, Kahneman's bounded rationality cannot amount to a general theory of habits-as-heuristics. The procedural/ecological rationality approach is rather a special theory, a theory successful with respect to habits-as-heuristics functioning as bonding and attachment (*habitus*). Regarding the other track, i.e., the habits-as-heuristics functioning as technologies designed to minimize cognitive costs, the heuristics are adopted to maximize substantive satisfaction. In this track, the relevant tool is Kahneman's bounded rationality approach, not Simon/Gigerenzer/Selten's procedural rationality approach.

To clarify, as mentioned above, Kahneman's bounded rationality is applicable irrespective of whether the heuristics are sub-consciously generated, i.e., gut-feeling, or the outcome of conscious generalizations. The sub-consciousness/consciousness issue is orthogonal to this paper's question: how should we model habits-as-heuristics? The answer stands irrespective of whether such heuristics are the result of gut-feeling as opposed to conscious generalization processes.

Thus, even if heuristics used by DMs or by organizations are gut-feelings, i.e., generated by sub-conscious processes, it does not mean that they can be only explained by the Simon/Gigerenzer/Selten's procedural rationality approach. They can also be explained by Kahneman's bounded rationality approach. The decisive issue is not sub-consciousness/consciousness. It is rather whether the heuristics function as technologies to minimize cognitive costs or as *habitus*.

If the heuristics function as *habitus*, they are not mainly aimed to maximize substantive satisfaction. They are rather aimed at satisfying the sense of belonging to and bonding with friends, family members, and communal groups, i.e., to maximize transcendental satisfaction. Consequently, they can be analyzed and explained by the Simon/Gigerenzer/Selten approach.

If the DM's goal is the allocation of resources to produce the optimal bundle in the substantive sense, he or she needs tools such as heuristics that can be justified by bounded rationality. If the DM's goal is finding meaning and bonding with a family or a communal group to satisfy transcendental needs, he or she needs *habitus* that can be justified by procedural rationality.

If a researcher regards procedural rationality as a general theory, i.e., applicable even to decisions pertaining to substantive satisfaction, at least two problems arise. First, procedural rationality would be a superfluous theory. Even in the case of explaining why DMs are ready to question habits and institutions in the face of crises, bounded rationality (i.e., standard rational choice theory) can explain it at least as easily (see Khalil, 2013a).

A second problem facing the generalization of procedural rationality: it cannot explain the origin of habits. Given that habit is the primitive of procedural rationality, it cannot by definition explain the origin of habits. What is the exact criterion making DMs replace one heuristic with another according to the Simon/Gigerenzer/Selten approach? What makes DMs think that one heuristic is more "adaptive" than the

other? To state that DMs learn from their mistakes or discover new facts from experience, which lead them to modify their heuristics, can be easily accommodated by the bounded rationality approach. Learning and discovering new information are not a threat to the neoclassical standard rational choice theory. The neoclassical concept of rationality lives off the set of constraints that includes newly discovered information.

To wit, the modified heuristics are not necessarily more “adaptive” than the old heuristics. Following Kahneman’s bounded rationality, again, the cost of processing the new information might be more expensive than the expected benefit of such information. Thus, we are back to the neoclassical/Kahneman’s theory to judge whether the post-experience heuristics are better than the old ones.

7 From experience to habits

The employment of the dual process theory by Kahneman to explain habits-as-heuristics is the only possible approach to provide an endogenous account of such habits geared to enhance substantive satisfaction. For Kahneman, if the stakes are high, it would be worthwhile for DMs to engage the expensive or deliberative System 2. For instance, DMs would be careful with over-generalization if the judgment were part of, e.g., a college entrance exam or a job interview. Likewise, fewer DMs would be victims of cognitive illusions, such as those few generated *ex post* by the availability heuristic, if the first impression about places or people had great consequences. As Kahneman (2011, Ch. 3) notes, the extent to which habits-as-heuristics go unchecked by the deliberative System 2 depends on the expected rewards as contrasted to expected costs.

Stated in other words, the operation of the deliberative System 2 is certainly costly in terms of the analysis of statistical data (Chabris & Simons, 2010). This cost prompts DMs to avoid deliberation and instead to rely on the intuitive System 1. This should not mean that intuition is a non-rational response as some psychologists suppose (e.g., Stanovich, 2010)—even when the intuition delivers a much more fruitful result than the reliance on extensive deliberation of statistical data (see, e.g., Kay & King, 2020). In this example, indeed, the intuition rather originates from broader understanding of episodes in diverse historical epochs that cannot be captured by available statistical data regarding one slice of events of a single epoch.

On the other hand, many researchers have pointed out the pitfalls of non-critical reliance on intuitions—the main impetus of the early (simplistic) Kahneman/economics approach. Even prior to the early Kahneman, Meehl (1954, 1986) reviewed many studies and clearly established the superiority of judgments and predictions based on actuarial data over judgments and predictions based on clinical, face-to-face interviews. In interviews, first impressions and stochastic variables interfere to the extent the clinician gives greater weight to the wrong variables, while an algorithm based on deliberative study of the data provides steady criteria that avoids biases generated by the reliance on intuition.

Likewise, Ashenfelter (2010) shows the superiority of statistical algorithms based on a detailed analysis of the data regarding wine quality and prices over the (clinical) expert opinion depending on intuition. The intuitive expert opinion is based on tasting

the young wine, where the statistical algorithm expert predicts its value many years later. Given the fact that wine quality depends on many hidden variables that cannot be captured by the intuition based on tasting the young wine, the prediction of the expert based on statistical algorithm trumps the prediction of the expert based on intuition. Kahneman (2011) calls such hidden variables a “low-validity environment” because it is very difficult for wine-tasting experts to make predictions based on cues, intuitions, and first impressions. Note, however, the algorithm needs not be sophisticated. Some salient facts can be sufficient—even when the statistician gives these facts equal weights as Robyn Dawes (1979) demonstrates.

Furthermore, Tetlock (2017) shows that the predictions of the experts in politics, who are aware of so many factors, are equivalent to the predictions of journalists and ordinary people who pay attention to the news. Tetlock, additionally, notes experts are usually unaware and even resist the suggestion their forecasting equal to the forecasting of journalists and avid readers of newspapers. The experts simply do not concede errors, suffering from what Kahneman (2011) calls “skill illusion” or “validity illusion.”

To resolve the long debate between doubters of intuition-based judgments of System 1 (Kahneman) and doubters of deliberation-based judgments of System 2 (Klein), Kahneman and Klein (2009) took part in an adversarial collaborative paper. They agreed that intuitive judgments of System 1 can be trusted, i.e., rational, under two conditions: first, if the variables in the environment vary in a stable fashion allowing for high-validity predictions; and second, the quality of the DM’s intuitive predictions rises with the increase of the DM’s experience. Experience allows the DM to differentiate among cues, i.e., to differentiate which cue indicates what situation (see Klein, 2017).

While intuitions, first impressions, and prejudices do not seem to be substantiated by organized reasoning processes, they are usually efficient if the two conditions are fulfilled. But even if the conditions are not fulfilled, first impressions are useful if the decision is inconsequential. Here, mental economy entails that, if the cost of deliberative System 2 is greater than expected benefit, DMs may rely on an easy heuristic, intuition, or a rule-of-thumb to retrieve association of impressions. For example, a customer’s first impression of a restaurant is efficient if the cost of processing information exceeds the expected benefit.

When a firm launches a product and it turns out to be successful, it makes a good first impression allowing for a “halo effect,” defined as retrospectively weaving a narrative of how each decision was brilliant leading to the success (e.g., Nisbett & Wilson, 1977). The halo effect is efficient if a customer uses it in his or her purchase of another product from the firm—given the cost of the search is high and the expected benefit is inconsequential. However, if the expected benefit is consequential, such as deciding on whether to invest massively in the firm, one must suspend the halo effect.

As Rosenzweig (2014) shows, the hindsight narrative is similar to the halo effect. The hindsight narrative tends to exaggerate the effectiveness or the brilliance of the decisions leading to the successful product. The halo effect is a heuristic that, by definition, downplays the role of good luck or auspicious shocks that are outside the firm’s control. As Kahneman (2001) recounts, the two founders of Google tried to sell it for \$1 million a year after they founded the company, but the prospective buyer found the price excessive. Only after the fact that Google succeeded, business gurus

and self-help book writers started to weave a story of brilliant decisions that led to the success of the company, neglecting the role of luck.

First impressions act as priming in social interaction. To note, the field of social priming has drawn a controversy in the past few years. As Chivers (2019) sums up, many of its experimental findings could not be replicated. However, as Sherman and Rivers (2021) clarify, we need to be aware many of the non-replicated social priming experiments are not social, while other priming experiments that withstood the replication test, at a closer scrutiny, involve a social dimension. That is, the failure to replicate some experiments should not lead us to dismiss the priming phenomenon *per se*.

Priming allows the DM's cognitive machinery to proceed in a particular way as the priming effect excludes many possible associations of ideas (e.g., Moore, 2002; Wilson, 2004). A good example of priming is the anchoring effect phenomenon (Strack & Mussweiler, 1997; Tversky & Kahneman, 1974; Wilson et al., 1996). One tends to estimate that the size of the fifth-grade class in a school to be 30 students, upon learning that a school in a nearby community has a class size of 30. The anchoring effect works in the face of limited information, where, on average, the anchor minimizes cognitive cost. This allows the DM to form estimates when the payoff does not justify the engagement of the deliberative System 2. In the example of class size, the anchor works because usually class sizes in the same area are underpinned by similar economic and social institutional constraints.¹⁵

Priming and anchoring effects rely on the use of readily available memory when, in the first place, the associated events or traits are not totally orthogonal. The events or traits adjacent to each other are usually correlated because they arise from similar economic and social institutions. If we see the sky is full of dark clouds and the air is moving fast, our intuitive system responds by predicting a storm is about to take place. Such a heuristic might be wrong on one or more occasions, but it is a useful heuristic on average.

Given that the anchoring effect is an efficient technology, cognitive illusions arise *ex post* on some occasions. As Ariely et al., (2003) show, DMs who are ignorant of the value of wine bottles usually place values depending on an arbitrary encounter with the digits of their identity cards. These DMs, usually without being aware, use the available digits—which is an efficient heuristic but one that fails in this instance. Given that the guess of the value of wine bottles has trivial payoff, the DM trusts the judgment of the intuitive System 1.

Even when we have cognitive illusions, the judgment of the intuitive System 1 is not non-rational. It rather expresses what we may call “deep rationality.” The organism employs heuristics and first impressions that work on average to economize the use of the deliberative System 2. Therefore, it is unwarranted to restrict rational choice processes to the deliberative System 2 à la Stanovich and collaborators (Stanovich et al., 2018). They develop an elaborate tripartite-process theory in place of the dual

¹⁵ Some researchers (e.g., Simmons *et al.*, 2010) have shown that the anchoring effect can be the outcome of deliberative but insufficient adjustment to the anchor—i.e., not necessarily the outcome of priming that appeals to the hidden but intuitive processes of the brain. Still, even if anchoring is the outcome of insufficient adjustment, the anchor provides, on average, a reliable starting point, when the cost exceeds the benefit of finding out the true facts.

process theory. But still, they basically deny the rational origin of habits residing in the intuitive System 1. They devise a metric, paralleling the IQ metric for measuring intelligence, for measuring rationality that is putatively exclusive to the deliberative System 2. To start with, the idea of measuring different degrees of rationality is foreign to the standard view of rational choice. In any case, their approach ultimately denies the basic premise of bounded rationality, the rationality-based operative principle that explains the intuitive System 1.

The same operative principle is probably behind the “mere-exposure effect,” why DMs tend to favor some objects, even names, more than others, depending on familiarity (e.g., Zajonc, 2001). As Zajonc explains, DMs operate with an invisible default rule: The danger of unfamiliar objects is of a higher probability than familiar objects. Zajonc notes that even nonhuman animals generally adopt such a rule. Familiar objects are liked more than unfamiliar ones simply because, on average, they are the safer of the two.

Of course, on a few occasions, a familiar object may harm the DM. But this does not nullify the deeper rationality of the mere-exposure effect. Likewise, the DM may experience harm on a few occasions for following the herd. However, generally, if their information search is sufficiently expensive, while the expected benefits are not of great weight, the DM would maximize benefit if he or she followed the herd: the first initiator of an investment or a cultural taste must know, usually, something more than the non-active DM (see Devenow & Welch, 1996). Moreover, regarding the errors of logical inference, the DM may incur errors of logical reasoning that should not nullify the heuristic behind the intuitive System 1.

In short, the information inelasticity of habits puzzle is solved. The DM is rational when he or she adopts habits—even when such habits immunize the DM from pertinent freely-available information. Otherwise, i.e., if the DM avoided all habits, he or she would be non-rational, eschewing technologies that would enhance, on average, wellbeing. There is a need for information-inelastic beliefs and practices, i.e., habits, given that cognitive resources are scarce. Further, if the costs of information processing is low while the expected benefit is high, it behooves the DM to rescind intuitive judgments, suspend the comfort of the *status quo*, and make judgments taking into consideration pertinent freely-available information.

8 Conclusion

This paper aims to resolve the puzzle surrounding habits: How could DMs adopt habits that are inelastic with respect to pertinent freely-available information? The paper identified two approaches. The first is the instrumentalist/associationist approach, which resonates with the late Kahneman and the economist’s concept of bounded rationality. It starts by the recognition of the cognitive system as a scarce resource. Hence, for the DM, *ex ante* efficient habits-as-heuristics shield him or her from enduring the relatively high cost of case-by-case deliberation. Habits-as-heuristics enhance wellbeing, i.e., what this paper calls “substantive satisfaction” that is equivalent to the economist’s “utility.”

The second is the existentialist/organicist approach, which underpins Simon's procedural rationality and Bourdieu's habitus. For Simon and Bourdieu, the information inelasticity of habits is not a puzzle: Habits are rather part of the DM's identity and, hence, cannot be chosen following some optimization algorithm. They are part of the DM's existence, affording a particular kind of satisfaction in the sense of belonging and bonding—i.e., “transcendental satisfaction”—which differs from the economist's “substantive satisfaction.”

This paper argues that Simon's procedural rationality has merits, but only with respect to habits that perform the function of Bourdieu's habitus. Such habits allow the DM to bond with the family and community on the basis of relationships of friendship and love.

Bourdieu's existentialist/organicist line of thinking cannot explain habits that make choices inelastic with respect to pertinent freely-available information. To explain such habits, we need the instrumental/associationist line of thinking. Habits immunizing the DM from pertinent freely-available information help the DM to optimize wellbeing on average.

This paper resolved the puzzle surrounding habits via two-track theory of how the DM interacts with his or her surroundings. The interaction can be either instrumental or existential. It is possible, and actually usually the case, that the two kinds of interaction become amalgamated. A habit that arises purely to maximize substantive satisfaction, e.g., the prohibition of the slaughter of cows in some cultures to preserve and sustain capital accumulation, can become a taboo. That is, the instrumental habit designed to enhance substantive satisfaction can become an existential one that expresses bonding, community, or transcendental satisfaction. Future research may explore the link between substantive and transcendental satisfactions.

Acknowledgements This paper benefited from the comments of Jonathan Baron, Konstantinos V. Katsikopoulos, Elsayed Yousef, three anonymous reviewers, and the editorial assistance of Maks Sipowicz. The usual caveat applies.

Funding Open Access funding provided by the Qatar National Library.

Declarations

Conflict of interest The author declares that he has no conflict of interest of any kind.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Anderson, J. R. (1991). Is human cognition adaptive? *Behavioral and Brain Sciences*, *14*, 471–517.
- Ariely, D. (2010). *Predictably irrational: The hidden forces that shape our decisions* (Revised). Harper Perennial.
- Ariely, D., Loewenstein, G., & Prelec, D. (2003). Coherent arbitrariness: Stable demand curves without stable preferences. *Quarterly Journal of Economics*, *118*, 73–106.
- Aristotle. (2009). *The Nicomachean ethics*, ed. Lesley Brown, trans. David Ross. Oxford University Press.
- Ashenfelter, O. (2010). Predicting the quality and prices of bordeaux wine. *Journal of Wine Economics*, *5*(1), 40–52. <https://doi.org/10.1017/S193143610000136X>
- Barandiaran, X. E., & Di Paolo, E. A. (2014). A genealogical map of the concept of habit. *Frontiers in Human Neuroscience*, *8*, 522. <https://doi.org/10.3389/fnhum.2014.00522>
- Baron, J. (2008). *Thinking and deciding* (4th ed.). Cambridge University Press.
- Barrett, N. F. (2014). A dynamic systems view of habits. *Frontiers in Human Neuroscience*, *8*, 682. <https://doi.org/10.3389/fnhum.2014.00682>
- Barros, G. (2010). Herbert A. Simon and the concept of rationality: Boundaries and procedures. *Brazilian Journal of Political Economy*, *30*(3), 455–472.
- Becker, G. S. (1993). Nobel lecture: The economic way of looking at behavior. *Journal of Political Economy*, *101*(3), 385–409.
- Berg, N. (2014). The consistency and ecological rationality approaches to normative bounded rationality. *Journal of Economic Methodology*, *21*(4), 375–395.
- Bernstein, R. J. (2010). *The pragmatic turn*. Polity Press.
- Birnbaum, M. H. (2008). Evaluation of the priority heuristic as a descriptive model of risky decision making: Comment on Brandstätter, Gigerenzer, and Hertwig (2006). *Psychological Review*, *115*, 253–262.
- Borghi, A. M., & Cimatti, F. (2010). Embodied cognition and beyond: Acting and sensing the body. *Neuro-psychologia*, *48*(3), 763–773.
- Bottomore, T. (1975). Competing paradigms in macrosociology. *Annual Review of Sociology*, *1*, 191–202.
- Bourdieu, P. (1990). *The logic of practice*, trans. Richard Nice. Stanford University Press.
- Bourdieu, P. (2010). *Distinction: A social critique of the judgement of taste*, trans. Richard Rice, intro. Tony Bennett. Milton Park, Oxon, UK: Routledge Classics.
- Bourdin, D., & Vetschera, R. (2018). Factors influencing the ratio bias. *EURO Journal on Decision Processes*, *6*(3), 321–342.
- Brandstätter, E., Gigerenzer, G., & Hertwig, R. (2006). The priority Heuristic: Making choices without trade-offs. *Psychological Review*, *113*, 409–432.
- Bruni, L., & Sugden, R. (2008). Fraternity: Why the market need not be a morally free zone. *Economics and Philosophy*, *24*, 35–64.
- Callebaut, W., & Rasskin-Gutman, D. (Eds.) (2005). *Modularity: Understanding the development and evolution of natural complex systems*, foreword Herbert A. Simon. MIT Press.
- Caplan, B. (2000). Rational irrationality: A framework for the neoclassical-behavioral debate. *Eastern Economic Journal*, *26*(2), 191–211.
- Caplan, B. (2001). Rational ignorance versus rational irrationality. *Kyklos*, *54*(1), 3–26.
- Caplin, A., & Dean, M. (2015). Revealed Preference, rational inattention, and costly information acquisition. *American Economic Review*, *105*(7), 2183–2203.
- Chabris, C., & Simons, D. (2010). *The invisible gorilla: And other ways our intuitions deceive us*. Harper-Collins.
- Chivers, T. (2019). What's next for psychology's embattled field of social priming. *Nature*, *576*(7786), 200–202.
- Conlisk, J. (1996). Why bounded rationality? *Journal of Economic Literature*, *34*, 669–700.
- Damasio, A. (1994). *Descartes' error: Emotion, reason, and the human brain*. Grosset/Putnam.
- Dawes, R. M. (1979). The robust beauty of improper linear models. *American Psychologist*, *34*, 571–582.
- De Neys, W. (Ed.). (2018). *Dual process theory 2.0*. Routledge.
- Dekker, E., & Remic, B. (2019). Two types of ecological rationality: Or how to best combine psychology and economics. *Journal of Economic Methodology*, *26*(4), 291–306.
- Denzau, A., & North, D. (1994). Shared mental models: Ideologies and institutions. *Kyklos*, *47*(1), 3–31.
- Devenow, A., & Welch, I. (1996). Rational herding in financial economics. *European Economic Review*, *40*(3–5), 603–615.

- Duesenberry, J. S. (1949). *Income, saving and the theory of consumer behavior*. Cambridge: Harvard University Press.
- Dewey, J. (1905). The postulate of immediate empiricism. *Journal of Philosophy, Psychology and Scientific Methods*, 2(15), 393–399.
- Dewey, J. (1938). *Experience and education*. Macmillan.
- Dewey, J., & Bentley, A. (1949). *Knowing and the known*. Boston: Beacon Press.
- Fischhoff, B., Slovic, P., & Lichtenstein, S. (1978). Fault trees: Sensitivity of estimated failure probabilities to problem representation. *Journal of Experimental Psychology: Human Perception and Performance*, 4, 330–334.
- Gallagher, S., & Zahavi, D. (2008). *The phenomenological mind: An introduction to philosophy of mind and cognitive science*. Routledge.
- Gigerenzer, G. (1996). On narrow norms and vague heuristics: A reply to Kahneman and Tversky. *Psychological Review*, 103(3), 592–596.
- Gigerenzer, G. (2000). *Adaptive thinking: Rationality in the real world*. Oxford University Press.
- Gigerenzer, G. (2008). *Gut feelings: The intelligence of the unconscious*. Penguin.
- Gigerenzer, G. (2018). The bias in behavioral economics. *Review of Behavioral Economics*, 5(3–4), 303–336.
- Gigerenzer, G., & Selten, R. (Eds.). (2002). *Bounded rationality: The adaptive toolbox*. Cambridge, MA: MIT Press.
- Gigerenzer, G., Hertwig, R., & Pachur, T. (Eds.). (2011). *Heuristics: The foundations of adaptive behavior*. Oxford: Oxford University Press.
- Gigerenzer, G., & Sturm, T. (2012). How (far) can rationality be naturalized? *Synthese*, 187(1), 243–268.
- Gilboa, I. (2012). *Rational choice*. MIT Press.
- Gilboa, I., & Schmeidler, D. (1995). Case-based decision theory. *Quarterly Journal of Economics*, 110(3), 605–639.
- Graybiel, A. M. (2008). Habits, rituals, and the evaluative brain. *Annual Review of Neuroscience*, 31, 359–387.
- Graybiel, A. M., & Smith, K. S. (2014). Good habits, bad habits. *Scientific American*, 310, 38–43.
- Gregory, R. L. (1997). Visual illusions classified. *Trends in Cognitive Sciences*, 1(5), 190–194.
- Grüne-Yanoff, T., Marchionni, C., & Moscati, I. (2014). Introduction: Methodologies of bounded rationality. *Journal of Economic Methodology*, 21(4), 325–342.
- Gui, B. (1996). On relational goods: Strategic implications of investment in relationships. *International Journal of Social Economics*, 23, 260–278.
- Gui, B. (2000). Beyond transactions: On the interpersonal dimension of economic reality. *Annals of Public and Cooperative Economics*, 71, 139–169.
- Gui, B., & Sugden, R. (Eds.). (2010). *Economics and social interaction: Accounting for interpersonal relations*. Cambridge: Cambridge University Press.
- Guiso, L., Sapienza, P., & Zingales, L. (2004). The role of social capital in financial development. *American Economic Review*, 9(3), 526–556.
- Guiso, L. (2006). Does culture affect economic outcomes? *Journal of Economic Perspectives*, 20(2), 23–48.
- Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review*, 108(4), 814–834.
- Hands, D. W. (2014). Normative ecological rationality: Normative rationality in the fast-and-frugal-heuristics research program. *Journal of Economic Methodology*, 21(4), 396–410.
- Harbaugh, W. T., Krause, K., & Vesterlund, L. (2010). The fourfold pattern of risk attitudes in choice and pricing tasks. *Economic Journal*, 120(545), 595–611.
- Harvey, N. (2007). Use of heuristics: Insights from forecasting research. *Thinking & Reasoning*, 13(1), 5–24.
- Hayek, F. A. (1988). *The fatal conceit: The errors of socialism*, Bartley, W. W., III, (Ed.).
- Hertwig, R., & Gigerenzer, G. (1999). The “Conjunction Fallacy” revisited: How intelligent inferences look like reasoning errors. *Journal of Behavioral Decision Making*, 12(4), 275–305.
- Hodgson, G. M. (1993a). Institutional economics: Surveying the ‘Old’ and the ‘New’. *Metroeconomica*, 44(1), 1–28.
- Hodgson, G. M. (1993b). *Economics and evolution: Bringing back life into economics*. Polity Press.
- Hodgson, G. M. (2004). Agency and structure. *The evolution of institutional economics: Agency, structure, and darwinism in American Institutionalism*. London: Routledge, pp. 12–40.

- Hodgson, G. M. (2006). What are institutions? *Journal of Economic Issues*, 40(1), 1–25.
- James, W. (1890). *The principles of psychology*. Holt.
- Johnson, M. (2017). *Embodied mind, meaning, and reason: How our bodies give rise to understanding*. University of Chicago Press.
- Jolls, C., Sunstein, C. R., & Thaler, R. (1998). A behavioral approach to law and economics. *Stanford Law Review*, 50(5), 1471–1550.
- Kahneman, D. (1994). New challenges to the rationality assumption. *Journal of Institutional and Theoretical Economics*, 150, 18–36.
- Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review*, 93(5), 1449–1475.
- Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.
- Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. *Cognitive Psychology*, 3(3), 430–454.
- Kahneman, D. (1973). On the psychology of predictions. *Psychological Review*, 80(4), 237–251.
- Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *American Psychologist*, 64(6), 515–526.
- Kahneman, D., Sibony, O., & Sunstein, C. R. (2021). *Noise: A flaw in human judgement*. Little Brown, Spark.
- Katsikopoulos, K. V. (2014). Bounded rationality: The two cultures. *Journal of Economic Methodology*, 21(4), 361–374.
- Katsikopoulos, K. V., & Lan, D. (2011). Herbert Simon’s spell on judgment and decision-making. *Judgment and Decision Making*, 6, 722–732.
- Kay, J., & King, M. (2020). *Radical uncertainty: Decision-making beyond the numbers*. W.W. Norton.
- Keren, G., & George, Wu. (Eds.). (2015). *The Wiley Blackwell Handbook of Judgment and Decision Making*, 2 volumes. Wiley Blackwell Publishers.
- Khalil, E. L. (1990). Natural complex vs. natural system. *Journal of Social and Biological Structures*, 13(1), 11–31.
- Khalil, E. L. (1993). Neo-classical economics and neo-Darwinism: Clearing the way for historical thinking. In R. Blackwell, J. Chatha, & E.J. Nell (Eds.), *Economics as Worldly Philosophy* (pp. 22–72). London: Macmillan. (Reprinted in Geoffrey M. Hodgson (ed.) *Economics and Biology*. Aldershot, UK: Edward Elgar, 1995.)
- Khalil, E. L. (1995). Organizations versus institutions. *Journal of Institutional and Theoretical Economics*, 151(3), 445–466. (Reprinted in B. Guy Peters and Jon Pierre (eds.) *Institutionalism*. SAGE Library of Political Science series, 2007.)
- Khalil, Elias L. (1997a). Economics, biology, and naturalism: Three problems concerning the question of individuality. *Biology & Philosophy*, 12(2), 185–206.
- Khalil, Elias L. (1997b). Friedrich Hayek’s theory of spontaneous order: Two problems. *Constitutional Political Economy*, 18(4), 301–317.
- Khalil, E. L. (2009). Natural selection and rational decision: Two concepts of optimization. *Journal of Evolutionary Economics*, 19(3), 417–435.
- Khalil, E. L. (2010). The Bayesian fallacy: Distinguishing internal motivations and religious beliefs from other beliefs. *Journal of Economic Behavior and Organization*, 75(2), 268–280.
- Khalil, E. L. (2011a). Rational, normative and procedural theories of beliefs: Can they explain internal motivations? *Journal of Economic Issues*, 45(3), 641–664.
- Khalil, E. L. (2011b). The mirror neuron paradox: How far is *Understanding* from *Mimicking*? *Journal of Economic Behavior and Organization*, 77(1), 86–96.
- Khalil, E. L. (2013a). Lock-in institutions and efficiency. *Journal of Economic Behavior and Organization*, 88, 27–36.
- Khalil, E. L. (2013b). Practical beliefs vs. scientific beliefs: Two kinds of maximization. *Theory and Decision*, 74(1), 107–126.
- Khalil, E. L. (2015). Temptations as impulsivity: How far are regret and the allais paradox from shoplifting? *Economic Modelling*, 51, 551–559.
- Khalil, E. L. (2017a). Weakness of will and stiffness of will: How far are shirking, slackening, favoritism, spoiling of children, and pornography from obsessive-compulsive behavior? In M. Altman (Ed.), *Handbook of behavioural economics and smart decision-making: Rational decision-making within the bounds of reason* (pp. 492–514). Edward Elgar.

- Khalil, E. L. (2017b). Socialized view of man vs. rational choice theory: What does Smith's sympathy have to say? *Journal of Economic Behavior and Organization*, 143, 223–240.
- Khalil, E. L. (2019). Wellbeing and happiness. *Journal of Value Inquiry*, 53, 627–652.
- Khalil, E. L. (2021a). Rubin's vase *contra* optical illusions: Why framing effects cannot be cognitive illusions? *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2021a.597758>
- Khalil, E. L. (2021b). Does friendship stem from altruism? Adam Smith and the distinction between love-based and interest-based preferences. SocArXiv. <https://doi.org/10.31235/osf.io/hc4y7> (forthcoming: *Journal of the History of Economic Thought*, 2024).
- Khalil, E. L. (2022a). Mental accounting, heuristics and the second best: Solving the calculator-jacket puzzle. A paper submitted for publication.
- Khalil, E. L. (2022b). A taxonomy of behavioral biases: A guide to the perplexed. A paper submitted for publication.
- Khalil, E. L. (2022c). Why is it taboo to monetize some goods? A theory of preferences via *The theory of moral sentiments*. A paper submitted for publication.
- Khalil, E. L. (2022d). Solving the income-happiness paradox. *International Review of Economics*. <https://doi.org/10.1007/s12232-022-00398-0>
- Khalil, E. L., & Marciano, A. (2021a). A theory of instrumental and existential rational decisions: Smith, Weber, Mauss, and Tönnies after Martin Buber. *Theory and Decision*, 182, 229–247.
- Khalil, E. L., & Marciano, A. (2021b). Other-regarding preferences: The poverty of the self/other dichotomy. *Social Theory and Practice: An International and Interdisciplinary Journal of Social Philosophy*, 47(2), 265–298.
- Khalil, E. L., & Amin, A. (2022). The parallelism of cognitive economy and physiological economy: A rationality-based dual process theory. *Current Psychology*. <https://doi.org/10.1007/s12144-022-03554-5>
- Kirkpatrick, L. A., & Epstein, S. (1992). Cognitive-experiential self-theory and subjective probability: Further evidence for two conceptual systems. *Journal of Personality and Social Psychology*, 63, 534–544.
- Klein, G. A. (2017). *Sources of power: How people make decisions*. MIT Press.
- Knight, F. H. (1971). *Risk, uncertainty, and profit, intro George Stigler*. University of Chicago Press.
- Lakoff, G., & Johnson, M. (2001). Metaphors we live by. In J. O'Brien & P. Kollock (Eds.), *The production of reality: Essays and readings on social interaction* (3rd ed., pp. 124–134). Pine Forge Press.
- Lieder, F., & Griffiths, T. (2020). Resource-rational analysis: Understanding human cognition as the optimal use of limited computational resources. *Behavioral and Brain Sciences*, 43, E1. <https://doi.org/10.1017/S0140525X1900061X>
- Marchetti, G., & Marchetti, S. (2017). Behind and beyond the fact/value dichotomy. In G. Marchetti & S. Marchetti (Eds.), *Facts and values: The ethics and metaphysics of normativity* (pp. 1–24). Routledge.
- Marciano, A., & Khalil, E. L. (2012). Optimization, path dependence and the law: Can judges promote efficiency? *International Review of Law and Economics*, 32(1), 72–82.
- Margalit, A. (2004). *The ethics of memory*. Harvard University Press.
- Mauss, M. (1922). *The gift: Forms and functions of exchange in archaic societies*. Foreword by Mary Douglas. London: Routledge.
- Meehl, P. E. (1954). *Clinical versus statistical prediction: A theoretical analysis and a review of the evidence*. University of Minnesota Press.
- Meehl, P. E. (1986). Causes and effects of my disturbing little book. *Journal of Personality Assessment*, 50, 370–375.
- Mellers, B., Hertwig, R., & Kahneman, D. (2001). Do frequency representations eliminate conjunction effects? An exercise in adversarial collaboration. *Psychological Science*, 12(4), 269–275.
- Melnikoff, D., & Bargh, J. A. (2016). The mythical number two. *Trends in Cognitive Sciences*, 22(4), 280–293.
- Merleau-Ponty, M. (2012). *Phenomenology of perception*, trans. Donald A. Landes. Routledge.
- Miller, D. T., McFarland, C., & Turnbull, W. (1989). When a coincidence is suspicious: The role of mental simulation. *Journal of Personality and Social Psychology*, 57, 581–589.
- Miller, J., & Krosnick, J. A. (1998). The impact of candidate name order on election outcomes. *Public Opinion Quarterly*, 62(3), 291–330.
- Mirowski, P. (2002). *Machine dreams: Economics becomes a cyborg science*. Cambridge University Press.
- Moore, D. W. (2002). Measuring new types of question-order effects. *Public Opinion Quarterly*, 66, 80–91.

- Newell, A., Shaw, J. C., & Simon, H. A. (1957). Empirical explorations of the logic theory machine: A case study in heuristics. In *Proceedings of the Western Joint Computer Conference (1957)* (pp. 218–230). New York: Institute of Radio Engineers.
- Newell, A., Shaw, J. C., & Simon, H. A. (1958). Chess playing programs and the problem of complexity. *IBM Journal of Research & Development*, 2(4), 320–335.
- Ng, Y.-K. (2004). *Welfare economics: Towards a more complete analysis*. Macmillan/Palgrave.
- Nehamas, A. (2016). *On friendship*. Basic Books.
- Nisbett, R. E., & Wilson, T. D. (1977). The halo effect: Evidence for unconscious alteration of judgments. *Journal of Personality and Social Psychology*, 35(4), 250–256.
- Osman, M. (2004). An evaluation of dual-process theories of reasoning. *Psychonomic Bulletin & Review*, 11, 988–1010.
- Pakaluk, M. (Ed.). (1991). *Other selves: Philosophers on friendship*. Hackett.
- Parsons, T. (1951). *The social system*. Routledge & Kegan Paul.
- Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. Cambridge University Press.
- Pohl, by Rüdiger F. (ed.) (2016). *Cognitive illusions: Intriguing phenomena in judgement, thinking and memory*, 2nd Edition. London: Psychology Press (Routledge).
- Polonioli, A. (2014). Blame it on the norm: The challenge from ‘Adaptive Rationality.’ *Philosophy of the Social Sciences*, 44(2), 131–150.
- Polonioli, A. (2015). Stanovich’s arguments against the “Adaptive Rationality” project: An assessment. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences*, 49, 55–62.
- Polonioli, A. (2016). Adaptive rationality, biases, and the heterogeneity hypothesis. *Review of Philosophy and Psychology*, 7(4), 787–803.
- Popper, K. (1935). *The logic of scientific discovery* (2nd ed., p. 2002). Routledge.
- Posner, R. A. (2002). Behavioral law and economics: A critique. *Economic Bulletin* (American Institute for Economic Research), August 2002, 42:8 (<https://www.aier.org/research/behavioral-law-and-economics-a-critique/>)
- Raab, M., & Gigerenzer, G. (2015). The power of simplicity: A fast-and-frugal heuristics approach to performance science. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2015.01672>
- Rich, P. (2016). Axiomatic and ecological rationality: Choosing costs and benefits. *Erasmus Journal for Philosophy and Economics*, 9(2), 90–122. <https://doi.org/10.23941/ejpe.v9i2.231>
- Rosen, R. (2005). *Life itself: A comprehensive inquiry into the nature, origin, and fabrication of life*. Columbia University Press.
- Ross, D. (2014). Psychological versus economic models of bounded rationality. *Journal of Economic Methodology*, 21(4), 411–427.
- Rosenzweig, P. (2014). *The halo effect: ... and the eight other business delusions that deceive managers*. Free Press.
- Rubinstein, A. S. (1998). *Modeling bounded rationality*. MIT Press.
- Said, E. W. (2000). *Out of place: A memoir*. Vintage.
- Savage, L. J. (1954). *The foundations of statistics*. John Wiley.
- Sedlmeier, P., Hertwig, R., & Gigerenzer, G. (1998). Are judgments of the positional frequencies of letters systematically biased due to availability? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24(3), 754–770.
- Sent, E.-M. (2018). Rationality and bounded rationality: You can’t have one without the other. *European Journal of the History of Economic Thought*, 25(6), 1370–1386.
- Sherman, J. W., & Rivers, A. M. (2021). There’s nothing social about social priming: Derailing the ‘Train Wreck.’ *Psychological Inquiry*, 32(1), 1–11.
- Sherman, J. W., Gawronski, B., & Trope, Y. (Eds.). (2014). *Dual-process theories of the social mind*. Guilford Press.
- Simmons, J. P., LeBoeuf, R. A., & Nelson, L. D. (2010). The effect of accuracy motivation on anchoring and adjustment: Do people adjust from provided anchors? *Journal of Personality and Social Psychology*, 99(6), 917–932.
- Simon, Herbert A. “Rational Choice and the Structure of the Environment.” *Psychological Review*, 1956, 63:2, pp. 129–138.
- Simon, H. A. (1957). *Models of man*. Wiley.

- Simon, H. A. (1962). The architecture of complexity. *Proceeding of the American Philosophical Society*, 106(6), 467–482.
- Simon, H. A. (1976). From substantive to procedural rationality. In ed. Spiro J. Latsis (ed.), *Method and appraisal in economics*. Cambridge: Cambridge University Press, pp. 129–148.
- Simon, H. A. (1981). *The sciences of the artificial*. MIT.
- Skinner, B. F. (1976). *About behaviorism*. Vintage.
- Smith, A. (1976). *The theory of moral sentiments*, eds. D.D. Raphael and A.L. Macfie. Oxford: Oxford University Press, 1976.
- Smith, K. S., & Graybiel, A. M. (2013). A dual operator view of habitual behavior reflecting cortical and striatal dynamics. *Neuron*, 79, 361–374.
- Smith, K. S., & Graybiel, A. M. (2014). Investigating habits: Strategies, technologies and models. *Frontiers in Behavioral Neuroscience*. <https://doi.org/10.3389/fnbeh.2014.00039>
- Smith, V. L. (2003). Constructivist and ecological rationality in economics. *American Economic Review*, 93(3), 465–508.
- Sober, E. (1998). Three differences between deliberation and evolution. In P. A. Danielson (Ed.), *Modeling rationality, morality, and evolution* (pp. 408–422). Oxford University Press.
- Stanovich, K. E. (2010). *Rationality and the Reflective Mind*. Oxford University Press.
- Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences*, 23(5), 645–655.
- Stanovich, K. E., West, R. F., & Toplak, M. E. (2018). *The rationality quotient: Toward a test of rational thinking*. MIT Press.
- Strack, F., & Mussweiler, T. (1997). Explaining the enigmatic anchoring effect: Mechanisms of selective accessibility. *Journal of Personality and Social Psychology*, 73(3), 437–446.
- Székely, M., & Michael, J. (2021). The sense of effort: A cost-benefit theory of the phenomenology of mental effort. *Review of Philosophy and Psychology*, 12, 889–904. <https://doi.org/10.1007/s13164-020-00512-7>
- Tetlock, P. E. (2017). *Expert political judgment: How good is it? How can we know?* (New). Princeton University Press.
- Todd, P. M., & Gigerenzer, G. (2012). *Ecological rationality: Intelligence in the world*. Oxford University Press.
- Tsotsos, J. (1991). Computational resources do constrain behavior. *Behavioral and Brain Sciences*, 14(3), 506–507. <https://doi.org/10.1017/S0140525X00071053>
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 5, 207–232.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185, 1124–1130.
- Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *Journal of Business*, 59(4), S251–S278.
- Varela, F. J., Thompson, E., & Rosch, E. (2017). *The embodied mind: Cognitive science and human experience, Revised Edition, forward Jon Kabat-Zinn*. MIT Press.
- Veblen, T. (1934). *The theory of the leisure class*. Modern Library.
- Viale, R. (Ed.). (2020). *Routledge handbook of bounded rationality*. Routledge.
- von Neumann, J., & Morgenstern, O. (2007). *Theory of games and economic behavior*, 60th Anniversary Commemorative Edition, int. Harold William Kuhn, afterword Ariel Rubinstein. Princeton, NJ: Princeton University (1947).
- Wallin, A. (2013). A peace treaty for the rationality wars? External validity and its relation to normative and descriptive theories of rationality. *Theory & Psychology*, 23(4), 458–478. <https://doi.org/10.1177/0959354313489369>
- Wason, P. C. (1968). Reasoning about a rule. *Quarterly Journal of Experimental Psychology*, 20(3), 273–281.
- Wason, P. C., & Evans, J. St. B. T. (1974). Dual processes in reasoning? *Cognition*, 3(2), 141–154.
- Wilson, T. D. (2004). *Strangers to ourselves: Discovering the adaptive unconscious*. Harvard University Press.
- Wilson, T. D., Houston, C. E., Etling, K. M., & Brekke, N. (1996). A new look at anchoring effects: Basic anchoring and its antecedents. *Journal of Experimental Psychology: General*, 125(4), 387–402.
- Yin, H. H., & Knowlton, B. J. (2006). The role of the Basal Ganglia in habit formation. *Nature Reviews Neuroscience*, 7, 464–476.

Zajonc, R. B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science*, 10(6), 224–228.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.