NATURAL RATIONALITY AND THE PSYCHOLOGY OF DECISION: BEYOND BOUNDED AND ECOLOGICAL RATIONALITY

Benoit Hardy-Vallée

University of Toronto

Jackman Humanities Building

170 St. George St., 4th Floor,

Toronto, ON, M5R 2M8

Phone: (416) 946-5982

Fax: (416) 978-8703

ben.hardy.vallee@utoronto.ca

http://www.hardyvallee.net

ABSTRACT

Decision-making is usually a secondary topic in psychology, relegated to the last chapters of textbooks. It pictures decision-making mostly as a deliberative task and rationality as a matter of idealization. This conception also suggests that psychology should either document human failures to comply with rational-choice standards (bounded rationality) or detail how mental mechanisms are ecologically rational (ecological rationality). This conception, I argue, runs into many problems: descriptive (section 2), conceptual (section 3) and normative (section 4). I suggest that psychology and philosophy need another—wider—conception of rationality, that goes beyond bounded and ecological rationality (section 5).

KEYWORDS: Rationality, decision-making, neuroeconomics, evolution, psychology

WORDCOUNT: 4827

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1. INTRODUCTION

The standard psychological conception of decision-making construes it as an explicit deliberative process, such as reasoning (Hardy-Vallée, in press). For instance, in a special edition of *Cognition* on decision-making (vol. 49, issues 1-2, Pages 1-187), one finds the following claims:

> *reasoning and decision making are high-level cognitive skills [...]*(Johnson-Laird & Shafir, 1993, p. 1);
>
> *decisions . . . are often reached by focusing on reasons that justify the selection of one option over another* (Shafir et al., 1993, p. 34).

Therefore, one must not be surprised that most decision-making studies rely on multiple-choice tests using the traditional paper and pen method. Psychological research assumes that the subjects' competence in probabilistic reasoning as revealed by these tests is a good description of their decision-making capacities. Without much surprise psychologists discovered that humans are not very good at following normative decision theory and proposed alternative models. Yet the main assumptions of these experiments are rarely, if ever, discussed: why should decision-making be represented as an internal process of symbolic inference? Why questionnaires are considered as reliable tools for exploring decision processes? Why linguistic inferences should be the medium of decision-making? It seems that decision-making is construed as a separate faculty: something that is not perception, memory, emotion, but a central competence, what philosophers named "reason", "understanding", etc.

This conception, I argue, runs into many problems: descriptive (section 2), conceptual (section 3) and importantly normative (section 4). I suggest that psychology and philosophy need another—wider—conception of rationality, that goes beyond bounded and ecological rationality (section 5).

2. THE STANDARD CONCEPTION AND ITS DESCRIPTIVE PROBLEMS

Although decision-making may require high-level processing and linguistic inferences, it needs not to be construed as such. Robotics shows the efficiency of a strong perception-action coupling over of a deliberative, symbolic, central planner (Brooks, 1999). Other research in psychology indicates that cognitive processes are supported by sensorimotor simulation, for instance, mirror neurons in mental states attribution (Barsalou, 1999; Rizzolatti & Craighero, 2004). After Damasio, neuroscience recognizes that humans are better at decision-making when their emotional processing capacities are functional (Damasio, 1994). Finally, research in neuroeconomics—the neuroscientific study of of decision-making—also suggest that in many occasions decision-making is not an intellectual faculty, but a process that operates through a synergy of reward, emotional and cognitive mechanisms (seeHardy-Vallee, in press). For instance, when an agent decides whether she should buy a product we could ask her about her reasons or reconstruct the pattern of reasoning that lead to her choice. We would end-up with folk-psychological statements such as "she wanted X more than Y". Neuroeconomics challenges that simple account. Knutson and colleagues presented their subject with a picture of a labeled product (Knutson *et al.*, 2007). Subjects had 4 seconds to decide whether they would like to acquire the product. After that, they were presented with the price asked for the product, which varied from cheap to expensive, and had to decide if they wanted to buy it at that price. Not surprisingly, when the prices were perceived as exaggerated (e.g. $80 for a box of chocolates) subjects did not buy them: they preferred to buy products at lower prices. We could explain their preferences by citing beliefs and desires that rationalize subjects' behavior. Those who bought a chocolate box at $7 did so because they *desired* the chocolate and *believed* that purchasing the chocolate would lead to the satisfaction of their *desire*. Those who refused to pay $80 for the same box either had no desire for the chocolate, or believed that the price was exaggerated and that they should not buy the product at that price. The neural data suggest something more informative.

When subjects had to choose whether to purchase a product, two things happened. Desirable products caused activation in the nucleus accumbens, a brain area associated with anticipation of reward. However, when the price appears exaggerated, activity is detected in the anterior insula, an area involved in pain, disgust and other negative affects. If the price is perceived as acceptable, a lower level of insular activity is detected, but prefrontal structures involved in estimation and planning are more stimulated. Activation of these areas was a reliable predictor of whether subjects would buy the product: prefrontal activation predicted purchasing, while insular activation predicted the decision not to purchase. Thus, purchasing is not explained as an inference from beliefs and desires to action, but as a tradeoff, mediated by prefrontal areas, between the pleasure of acquiring (exhibited in the nucleus accumbens) and the pain of purchasing (exhibited in the insula). Thus in the whole sequence of events, there is no such things as beliefs, desires or symbolic inferences that enter the causal nexus. We do not need a reasoning faculty to explain decision-making when we have neural mechanisms, or at least we do not need an *intellectualist* picture of beliefs, desires and inferences.

3. THE STANDARD CONCEPTION AND ITS CONCEPTUAL PROBLEMS

Decision-making is not only construed as a separate faculty, but also as a separate *topic*. Decision-making figures in psychology textbooks, but most of the time chapters on decision-making acknowledge the failure of the *Homo economicus* model and propose to understand human irrationality as the product of heuristics and biases. In a recent article, H.A. Gintis documents this neglect of decision-making:

> *(…) a widely used text of graduate- level readings in cognitive psychology, (Sternberg & Wagner, 1999) devotes the* ninth *of eleven chapters to "Reasoning, Judgment, and Decision Making," offering two papers, the first of which shows that human subjects generally fail simple logical inference tasks, and the second shows that human subjects are irrationally swayed by the way a problem is verbally "framed" by the experimenter. A leading undergraduate cognitive psychology text (Goldstein, 2005) placed "Reasoning and Decision Making" the* last *of twelve chapters. This includes one paragraph describing the rational actor model, followed by many pages purporting to explain why it is wrong. (…) in a leading behavioral psychology text (Mazur, 2002), choice is covered in the* last *of fourteen chapters, and is limited to a review of the literature on choice between concurrent reinforcement schedules and the capacity to defer gratification*
> (Gintis, 2007, pp. 1-2)

There is here not a descriptive, but a conceptual problem: something is wrong in theoretical relationships between concepts of rationality and decision-making across disciplines. The peripheral role of decision-making in psychology does not square well with its central role in biology. There is a strong connection between *being a decision-maker* and *being an animal*. On the one hand, the decisions biological individuals make increase or decrease their fitness, and thus good decision-makers are more likely to propagate their genes. On the other hand, natural selection is likely to favor good decision-makers and to get rid of bad decision-makers. Animals have two fundamental imperatives: survival and reproduction. They need not to be aware of these necessities, but if their decisions never achieve some degree of success in these two matters, natural selection will easily discard them. Decision-making is then oriented toward certain goals, either ultimate (survival and reproduction), instrumental goals that allow individuals to survive and reproduce or instrumental goals that once served survival and reproduction. Without goals, there is no need to make decisions since there are no priorities. Since animals have goals, they cannot be systematically indifferent between courses of actions. Certain actions facilitate the acquisition of resources, predator avoiding, reproduction, etc., while others impede it. In order to choose the proper courses of action, and given that energy and information are not free and unlimited, animals must ground the selection of actions on devices that rank preferences and act upon them, i.e., *decision-making* mechanisms.

Decision-making is not, however, *equivalent* to fitness maximization. It is rather one of the means by which biological agents attempt—but may fail—to maximize their fitness. They maximize their fitness when they generate copies of their own genes or through their life-history strategies, not when they catch a fish or climb a tree. Animals do not choose to become sexually mature at a particular age or to invest a large part of their caloric intake in reproduction. Most of these traits are chosen by natural selection and unfold in the whole lifetime. What agents *do* choose, however, is to mate with *this* particular partner, run from *this* predator, eat *this* particular prey, etc. Even when partner preferences are fixed by natural selection, the explanation of the fact that they choose *this* particular one cites the individual's own internal mechanisms. Natural selection may be able choose which *type* of food or partner a biological agent will seek, but not which *instance*. As Richard Dawkins puts it,"[g]enes are the primary policy-makers; brains are the executives" (Dawkins, 1976, p. 59). It is therefore more appropriate to see organisms as "adaptation executors", not fitness-maximizers (Tooby & Cosmides, 2005, p. 14), although it is likely that executing adaptations, in the appropriate environment, *usually*, but not necessarily leads to fitness-maximization. In other words, Nature has a preference for agents that have preferences, a claim supported by the explanatory and predictive success of behavioral ecology (Sih & Christensen, 2001).

Behavioral ecology models animals as economic agents that achieve ultimate goals—survival and reproduction—through instrumental ones such as partner selection, food acquisition and consumption, *etc.* (Krebs & Davies, 1997; Pianka, 2000). Optimal foraging theory (OFT), for instance, represents foraging as a maximization of net caloric intake. With general principles derived from microeconomics, optimization theory and control theory, coupled with information about the physical constitution and ecological niche of the predator, it is possible to predict what kind of prey and patch an animal will favor, given certain costs such as search, identification, procurement, and handling costs. Mathematically speaking, OFT is the translation of decision theory axioms—together with many auxiliary hypotheses—into tractable calories-maximization algorithms. It make sense only if animals—and humans, since OFT also model human behavior—are competent decision-makers.

In sum, if animals make decisions, there are good reasons to think that decision-making is a central, basic function of animals' cognitive processing rather than a human sophisticated refinement. Deciding should not be studied like a separate topic (e.g. perception), an occasional activity (e.g. chess-playing), a uniquely human faculty (e.g. language) or a high-level competence (e.g. logical inference), but as the central object of any science of the mental. A decision-maker is an agent endowed with control mechanisms, that is, internal structures that process sensory information and motor commands.

4. THE STANDARD CONCEPTION AND ITS NORMATIVE PROBLEMS

The standard conception of rationality, in psychology, is also normatively problematic. It offers a simplified picture of human rationality, or more exactly *irrationality*, that may be reconstructed as the following argument:

(P1): If humans are rational, they follow rational-choice theory (RCT)

(P2): Humans fail to follow RCT

(C).: Humans, therefore, are not rational

Again, Gintis's (*Ibid*., p.1) review of psychology textbooks support this interpretation:

(Sternberg & Wagner, 1999) [offer] two papers, the first of which shows that human subjects generally fail simple logical inference tasks, and the second shows that human subjects are irrationally swayed by the way a problem is verbally "framed" by the experimenter. [...] (Goldstein, 2005) [...] includes one paragraph describing the rational actor model, followed by many pages purporting to explain why it is wrong. (...)

However, as I argue in this section, there are problems with both (P1) , (P2) and (C).

4.1 PROBLEMS WITH P1

The problem with the first premise ('If humans are rational, they follow rational choice theory') is that RCT can be computationally demanding, or even uncomputable.

If an ideal agent makes decisions according to probability, utility and, in game-theoretic context, its opponent's strategies, this agent processes information. This frictionless agent is not limited: information storage, use, consultation or transformation must be unlimited and perfect. The most perfect information-processing system is a Universal Turing Machine, an abstract automaton able to implement any computable function. Everything an ideal agent can compute, a Turing Machine can compute it. If one refuses to interpret the ideal agent in term of computability, then one must also refuse to consider the ideal agent as an information-processing system, for a channel of information is formally equivalent to a Turing Machine (Bohan Broderick, 2004). There is no information-processing without computability, and without information-processing the concept of an ideal utility-maximizer loses its substance. Hence a normative theory of an ideal rational agent unboundedly processing information should at least be cast out as effective and computable procedures (Marion, forthcoming).

The problem is that game and decision theory are *axiomatic* theories that list logical constraints on the formal representation of decision-making, not *procedural* models. Theorems demonstrate the existence of utility functions and game equilibriums, but do not specify *procedures* to reach a conclusion about a decision or the equilibrium. In a nutshell, they tell us where to go, but not how to get there. Mathematical result showed that decision-theoretic rationality and Turing calculability are inconsistent sets of restrictions (Kramer, 1967): nothing can be at the same time a Turing Machine (an unbounded perfect system) and a rational agent that conforms to the axioms of game theory. Similar results apply for game theory (Levesque, 1988; Lewis, 1985; Rabin, 1957; Velupillai, 2000).

Now suppose that we have a charitable interpretation of these theories, and consider that they have an implicit algorithmic translation: decision theory, for instance, would be a procedural model of an agent that lists every possible action and its consequences, assesses the probability and utility of each, sorts the list according to a subjective utility criterion and then chooses the first on the list. But even with an algorithmic interpretation, normative theories fail to be *tractable*, that is, solving problems in a 'reasonable' time. Computer scientists usually consider problems of the P class (when the relation between the input length and computation time is no greater than a polynomial function) as problems that can be implemented by a physical computer, a system that is not, like a Turing machine, unbounded in memory and computational capacity. For instance, preference ordering is already computationally problematic: in order to sort preferences, one must maximize the coherence in a set of propositions. However, Thagard et Verbeurgt (1998) showed that coherence maximization is a NP problem, and hence cannot be solved in polynomial time (if of course we adopt the common view that P≠NP). This is the rule rather than the exception in neo-classical economics (Norman, 1994): logical constraint on rationality, such as coherence or logical closure, make these theories computationally problematic.

4.2 PROBLEMS WITH P2

A problem raised by the second premise ('Humans fail to follow RCT') stems from the meaning of "following RCT". By "following RCT", psychologist means making linguistic inferences whose structure comply with RCT. It does not mean that their *behavior* is not rational.

A consequence of Tversky and Kahneman's reasoning (humans are too biased to be rational) is that in a market economy general equilibrium is impossible. Pareto-efficient optimum requires perfectly rational agents and complete information. However when subjects carry out transactions in an experimental market, traders converge rapidly towards equilibrium (Smith, 1991b). Hence *irrational* beings are able to reach equilibriums that can only be reached by *rational* agents. In fact, “imperfect” rationality might be necessary for equilibrium attainment. Subjects having limited information converge quickly towards the global optimum (Smith, 2002). When they have complete information on supply and demand, their performance is lower (Smith, 1991a, pp. 103-110). Thus subject may achieve rational *behavior* even if testing their thought processes reveals irrationality.

The same logic applies to “irrational” behavior in experimental games (Sanfey et al., 2003). In the ultimatum game, a ‘proposer’ (A) makes an offer to a ‘responder’ (B) that can either accept or refuse the offer (Güth et al., 1982). The offer is a split of an amount of money. If B accepts, she keeps the offered amount while A keeps the difference. If B rejects it, however, both players get nothing. According to game theory, rational agents must behave as follows: A should offer the smallest amount possible, in order to keep as much money as possible, and B should accept any proposed amount, because a small amount should be better than nothing. Thus if there is $10 to split, A should offer $1 and keep $9, while B should accept the split. In fact, proposers offer about 40% of the amount and responders tend to accept these offers while rejecting most of the ‘unfair’ offers (less than 20%). Unfair offers trigger, in the responders’ brain, an aversive feeling: the anterior insula is more active when unfair offers are proposed. This affective reaction is not a response to an unsatisfactory monetary reward, since the activation is significantly lower when the proposer is a computer. Subjects feel angered by the intentions of *human* proposers. They have a visceral reaction to another human unfairness, as other experiments showed: offers and their rejection in the ultimatum game are associated with greater skin conductance, a marker of negative emotional arousal (van 't Wout et al., 2006). Moreover, the anterior insula activation is correlated with the degree of unfairness and with the decision to reject unfair offers (Sanfey et al., 2003: 1756). Unfair offers, therefore, elicit strong emotional response. Consequently, when we take non-monetary values into account, subject's behavior makes sense: in the ultimatum game, they optimize personal well-being and hedonic feelings by making offers that they expect to be accepted and refuse offers that makes them unhappy (Hardy-Vallée & Thagard, forthcoming). Maybe this is a deviation from standard RCT interpretations, but it is clearly not irrational.

Rational-choice theory has never pretended to be a substantive theory of rationality: it does not tell subjects what to do from an absolute point of view, but merely assumes that subjects makes choices that maximizes utility.

4.2 PROBLEM WITH (C)

If ones adopt premises P1 (if humans are rational, they follow rational choice theory) and P2 (humans fail to follow RCT) one should conclude that humans, therefore, are not rational (C). I already criticized P1 and P2, and thus I could infer that C is wrong because P1 and P2 do not hold, but I want to criticize C regardless of how it could be derived from the premises.

The textbook claim about human irrationality is grounded, I suggest, in an undisputed endorsement of a disputable conception of normativity: norms of rationality can be derived from rational-choice axioms. It is a disputable claim, first of all, because a theory of rationality should be a theory of what humans are good at. While we may not be good at solving logical puzzles and RCT problems, we are exceptionally good at many things: our species managed to live in all kind of environment, cooperate, make collective decisions, create complex artifacts, etc. We have education, medicine, police, Internet, etc. If we are as irrational as many suggest, then our survival is a miracle: a completely irrational species would have been eliminated by natural selection. A simpler solution is to assume that there are no miracles, but only that RCT as it is commonly used may not fully capture the essence of our rationality. We should expect an overlap between normative and descriptive theories, and the existence of this overlap is warranted by the hypothesis that agents adapt to their environment through natural selection and learning. Evolution and learning do not produce perfect agents, but ones that achieve some proficiency in perception, decision and action.

5. BEYOND CLASSICAL, BOUNDED AND ECOLOGICAL RATIONALITY

Most approaches of rationality take either a descriptive or a normative perspective, and hence tend to see things from one angle only. Some describe cognitive/neuronal processes without concern for their optimality, whiles others state ideal conditions for rational behavior. For instance, while classical economics considers rational-choice theory either as a normative theory or a useful fiction, proponents of bounded rationality refuse to characterize decision-making as optimization (Chase *et al.*, 1998; Gigerenzer, 2004; Selten, 2001). Others advocate a strong division of labor between normative and descriptive projects: Tversky and Kahneman, for instance, concluded that the normativity of rationality models is incompatible with the nature of cognition:

> *(…) deviations of actual behavior from the normative model are too widespread to be ignored, too systematic to be dismissed as random error, and too fundamental to be accommodated by relaxing the normative system. (…) the normative and the descriptive cannot be reconciled.* (Tversky & Kahneman, 1986, p. s272)

Proponents of "ecological rationality" also recognize that humans are not ideally rational but argue that they are ecologically rational. What is rational is then what is adaptive in the environment of evolutionary adaptation (EEA), i.e., the "statistical composite of enduring selection pressures" to which a species is adapted (Tooby & Cosmides, 2005, p. 22). Humans are adapted to social life, fish are adapted to water, bees are adapted to foraging, etc. Hence when human fails to solve formal problems, we should not deem it as irrational, ecological rationalists argue, because it would be like saying that fishes' respiratory system is inefficient because it is not optimal out of the water. While Tversky and Kahneman showed that our inference processes might suffer from cognitive illusions, Gigerenzer and his colleagues argued that these illusions happens only in non-ecological situations.

5.1 CONFUSIONS OF CURRENCIES

Although ecological rationality seems a viable solution to reconcile the normative and the descriptive, Stanovich and West highlighted the confusions of this concept (Keith E. Stanovich, 2007; Stanovich & West, 2003). For instance, in a claim such as "ecological rationality depends on decision making that furthers an organism's adaptive goals in the physical or social environment" (Gigerenzer & Todd, 1999, p. 364), it is not clear what count as ecologically rational. Is it the survival and reproduction of the organism, or is it the attainment of an instrumental goal? The confusion stems from a failure to distinguish the *instrumental* (maximizing utility) from the *evolutionary* (maximizing fitness) rationality. It thus conflates two levels of description: the *replicator* and the vehicle (Dawkins, 1976). The replicators are the entity that passes on its structure, while the vehicle is the entity that interacts with its environment and houses the replicators. This distinction maps on the distinction between genes (the replicators) and organisms (the vehicle of the genes). Both levels are characterized by two different optimization currencies: fitness (replicators) and value (vehicle). The Darwinian process of natural selection optimizes fitness, the genes' currency, whereas decision-making optimizes utility, the organisms' currency. As Stanovich and West showed, the ecological rationality literature is filled with inconsistencies (see 2003, pp. 206-209): authors switch from talk about the vehicle to talk about the replicator or assume that efficiency in fitness-maximization will bring about efficiency in utility-maximization. So the debate is stuck in an uncomfortable position: either we are completely irrational (bounded rationality) or rationality is fitness enhancing (ecological rationality). It sounds like it is impossible to be good at doing what we do: since we no longer live in EEA-like environments, bounded rationality and ecological rationality make the same claims about us in contemporary environments: we are irrational. In order to solve the descriptive, conceptual and normative problems related to bounded and ecological rationality, I would like to suggest another avenue, what I call "natural rationality".

5.2 NATURAL RATIONALITY

Cognition, to use Reuven Dukas's formula, is the set of "neuronal processes concerned with the acquisition, retention, and use of information". Decision-making is the *use* of that information (Dukas, 2004, p. 347). Decision-making is not specifically human, but rather a behavioral control scheme typically found in animals endowed with sensory, motor and control apparatuses, and more specifically brainy animals (craniates, arthropods and cephalopods). When animals forage their environment, select preys, patches, or mates, no one presupposes that they consciously comply with RCT. There is, nonetheless, a presupposition that "much of the structure of the internal mental operations that inform decisions can be viewed as the product of evolution and natural selection" (Real, 1994, p. 4). The focus on being a *product* of evolution is the key notion here, because it is not plagued by Panglossian assumptions about the optimality of the *outcome*. It implies that, at least to a certain degree, the neuronal processes concerned with the use of information are effective and efficient, otherwise natural selection would have discarded them. I shall label this presupposition, and the mechanisms it might reveal, "natural rationality". Natural rationality is therefore the assessment of biological decision-making *mechanisms*.

It is important here to distinguish internal and external assessment of rationality. An internal (or subjective) assessment of rationality is an evaluation of the coherence of intentions, actions and plans. An external (or objective) assessment of rationality is an evaluation of the effectiveness of a rule or procedure. An action can be rational from the first perspective but not from the second one, and vice versa. Hence subjects' poor performance in probabilistic reasoning can be internally rational (subjects may have good reason to choose a certain prospect) without being externally rational (their behavior is still suboptimal). The Gambler's fallacy is and will always be a fallacy: it is possible, however, that fallacious reasoners follow internally rational rules, maximizing an unorthodox utility function.

Once neural mechanisms of decision-making are spelled out, their optimality and coherence can be evaluated. From an external perspective, once can investigate whether in a particular environment such-and-such mechanism is effective *regardless of the ecological plausibility of the environment*. It is possible that in certain environments (e.g. workplace, school, etc.) classical rationality is the standard; the question is not if the environment is ecologically plausible or not, but how a mechanism performs in it. From an internal perspective, one can investigate whether different kinds of utility are coherent. Kahneman and his collaborators suggested that the concept of utility should be divided in subspecies (Kahneman *et al.*, 1997): *decision* utility (the expected gains and losses, or cost and benefits), *experienced* utility (the hedonic, pleasant or unpleasant affect), *predicted* utility (the anticipation of experienced utility) and *remembered* utility (how experienced utility is remembered after the decision, e.g. as regretting or rejoicing). There are consequently many ways to be internally and externally (ir)rational, and thus a naturalistic study of decision-making is not incompatible with normativity (Hardy-Vallée, 2007).

Consequently, the study of natural rationality is the multidisciplinary study, from both a descriptive and a normative point of view, of the *mechanisms* by which humans and other animals make decisions. I emphasize *mechanisms* because only recently—thanks to the progress in neuroscience—do we have access to the neural processes that leads to choice behavior. A mechanism is "a structure performing a function in virtue of its component parts, component operations, and their organization" (Bechtel and Abrahamsen 2005). A mechanistic explanation of a phenomenon is therefore a specification of how the components of the system produce the phenomenon: it reconstructs the pattern of causal interactions that lead to certain results that need to be explained. For instance, explaining how the pancreas regulates blood glucose levels involves explaining how alpha cells of the islets of Langerhans lower blood sugar by producing insulin while the beta cells raise blood sugar by producing glucagon. The production of these hormones can also be subject to a mechanistic explanation, etc. Mechanisms are what theories of rationality lack: classical rationality relies on rational-choice theory axioms; bounded rationality relies on biases and cognitive illusions; and ecological rationality relies on "fast and frugal" heuristics. Yet nobody explains rationality as a *causal* process.

Natural rationality is an attempt to bridge the gap between these normative and descriptive projects. It is somewhere between ecological optimism and bounded pessimism. It is a more inclusive concept of decision-making, not based on folk-psychology, but based on a mechanistic view of the mind. It is an attempt to ground rationality in the natural world or, to use Darwin's expression, in the "economy of nature" ([1859] 2003; Hardy-Vallée, forthcoming). Understanding natural rationality amounts to understand what evolved rational agents tends to do well, for their own sake. It does not require rationality to be fitness enhancing. Whether a mechanism is efficient is a question, whether it is adaptive is another.

6. CONCLUSION

In this chapter, I argued that the common conception of rationality in psychology is descriptively, conceptually and normatively problematic. It does not account for what other disciplines show about decision-making and it is grounded in an undisputed endorsement of a disputable conception of normativity. I suggested a more general framework of "natural rationality", i.e., the normative and descriptive study of decision-making mechanisms in humans and others animals. This accounts contrasts with those who construe rationality as an idealization and those who preach the elimination of this concept because of its idealized status. Thus, rationality can be conceived not as an *a priori* postulate, but as an empirical and multidisciplinary research program, fully compatible with a normative and descriptive approach. By doing so, I hope to pave the way for a simpler and less confused concept of rationality, similar to Gintis's (2007) proposal.

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