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Epistemology of Decision

Rational Choice, Neuroscience
and Biological Approaches

 Springer

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To the memory of my father and Valentina

Preface

The story usually goes as follows. On one side there are the supporters of normative rationality, with their typical belief that to make a decision is basically a matter of ordering the preferences according to a rational framework; on the other side there are people who are enthusiastic about psychological findings showing that real individuals are not so “rational” as the opponents believed. In fact, human beings get continuously conditioned by biases and traps for the mind. It seems that human rationality is not so efficient as one can suppose. The controversy between normativists and descriptivists on decision theory is about the very nature of human understanding. How much is “free” or “bounded” the rationality to determine overt behavior? Is the maximization of personal gain the real “rationale” of human understanding? Immanuel Kant was irresistibly fascinated by the idea that rationality is able to autonomously determine the moral behavior. Indeed, in his opinion, a behaviour can be considered as “moral” only if this is the case. According to an old philosophical tradition, human behaviour is more or less “moral and efficient” insofar as it is more or less “rational”, i.e., not conditioned by anything else. Emotions, of course, are especially to be avoided. We have to consider a choice as rational if the used means are appropriate to the given end; and, it seems that in balancing means and ends there is no room for emotions and any other non-rational elements. Nowadays, it seems that the scene is changed. We are finally aware of the ecological and embodied character of human understanding. Reason is no more regarded as an emotionally bland and cold thing. Moreover, reasoning itself—not emotion—is affected by a lot of bias which subconsciously drives our thought pathways to many kinds of mistakes.

This book argues that a third way between normative and descriptive accounts of rationality in decision theory is possible. It is matter of a sort of normative rationality with a human face, that is, a naturalistic account of rationality disciplined by the needs of the economic paradigm. This latter involves a certain interest in the way things ought to be. It is the economic perspective itself, even in the case of the “biological economy”, which Mario Graziano—following Alfred Marshall—endorses, that implies a normative constraint. Economics, even if inspired by biology, cannot be a purely positive science. In this book the reader can appreciate a naturalistic account on decision theory. The word “naturalism” in philosophical discussions means many things. However, it is uncontroversial that

if only natural science can tell us how the world really goes, then there is no space for any kind of normative facts—a crucial point for decision theory. In *this* book, naturalism is inspired by the biology of complex systems and neuroeconomics. One of the most intriguing facets of *this* book is the appeal to the social cognition in order to deal with the main problems of decision theory. This move depends on an epistemological worry, that is, to adopt a theoretical framework compatible with both the interpersonal dimension and a normative evaluation. Moreover, because of its dependency by neuroscience, social cognition provides the naturalistic compatibility which is a major tenet of the book.

The desire of a third way between normativism and descriptionism in decision theory is urged by the field of application of the analysis. Since economic behavior is the core *explanandum* of the book, some amount of normativity is requested. This attitude could be a good example in the usual debate. Should the decision theory be subjected to a normativist or a descriptive account? Perhaps the right answer can be: “It depends”. In fact, it depends on the purposes of which our scientific enterprise is engaged. For example, if we are interested in improving certain budget standards in a health care system, then we ought to be also interested in some amount of normativity. It could be useless to know only why the managers are conditioned by their mental biases. We would like to improve their behaviors. And, of course, “improvement” is a normative concept. Knowledge about the cognitive architecture and the neurophysiological basis of mental biases is a wonderful thing. We can deduce many significant consequences from that knowledge. The improvement of the behaviors in order to fulfill a certain purpose is another kind of question. In *this* book the “it depends-strategy” is guided by the theoretical needs of the economic perspective, but it can be proposed more in general as the right attitude towards the normativism/descriptionism debate in decision theory.

Anyway, in *this* book we can appreciate the possibilities of a naturalistic account on decision theory committed to the normative constraints involved in the economic behavior. A great part of this commitment depends on the appeal to the paradigm of social cognition. This way of reasoning is perhaps similar to what Steven Stich proposed in an essay on the Daniel Dennett’s theory of intentional systems (“Dennett on Intentional Systems,” *Philosophical Topics*, 12, 1, 1981, pp. 39–62; now in S. Stich, *Collected Papers*, vol. 1, p. 73). “So any object will count as an intentional system if we can usefully predict its behavior by assuming that it will behave rationally. And what is it to behave rationally? Here, Dennett suggests, the full answer must ultimately be provided by a new sort of theory, intentional-system theory, which will provide us with a normative account of rationality. This new theory “is envisaged as a close kin of—and overlapping with—such already existing disciplines as epistemic logic, decision theory and game theory, which are all similarly abstract, normative and couched in intentional language” (D. Dennett, “Three kinds of intentional psychology,” in *Reduction, Time, and Reality*, Cambridge University Press, 1981, p. 19).

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Introduction

What does it mean to make a decision? One frequently cited answer is that a decision is the result of what we want and the chances we have of obtaining it: all the alternatives in this regard have true costs and consequences. As part of the social sciences, the scientific study of how we make our decisions, how we can optimize or at least render them satisfactory, and the factors that might influence them is known as decision theory. Diverse and heterogeneous areas of inquiry from various perspectives have been employed to study the decision-making process. Decision-making has been studied by philosophers, economists, psychologists, mathematicians, physicists, biologists, and sociologists, who have attempted for different purposes to shed light on the mechanisms and modalities that lead individuals to make a certain decision rather than another.

As part of the normative approach to the study of decision-making, a basic concept is “rational choice”, conceived as the result of a decision-maker’s calculation that employs perfectly logical processes of thought. Initially, this concept was the dominant paradigm in economics. In fact, a fundamental premise of neoclassical economics was that economic phenomena were essentially due to the action of fully rational agents, equal and therefore indistinguishable from one other, all of whom were individually pursuing only their own personal gain. This postulate was followed by another epistemological postulate that found in economic phenomena the possibility of applying certain general laws that could be expressed in mathematical terms. Undoubtedly, over the past two decades, this explanatory model has exercised considerable influence beyond the sphere of economics.

The extension of rational choice theory to all the social sciences was initially due to its universal aspirations. In fact, if we hypothesize the same operations and the same intent to all individuals and rationality as manifested in an identical way in all agents at all times, all social phenomena can be explained by the same model. Furthermore, a purely mathematical model allows both the construction of a personal process of deliberation and a description and analysis of social phenomena.

The adoption of this model of explanation is therefore motivated by the deductive and universal productivity that it applies to the simple and rigorous analysis of all social phenomena. In addition to traditional economic challenges, the propagation of this model primarily stems from the fact that rational choice

theory has long been considered a scientific and not a purely speculative theory because it was possible to rigorously, precisely, and coherently derive from it many accurate predictions through mathematical description, and these predictions could also be compared with social facts observed.

Therefore, the normative models of choice proved to be excellent tools that were appropriate and useful for analyzing decision behavior in many situations. However, since the 1950s, extensive literature has highlighted numerous theoretical and empirical limitations regarding the analysis of a wide range of real decisions. One of the first scholars to explain the discrepancy between actual behavior and the standard theory of decisions was undoubtedly Simon (1972), who strongly criticized the notion of normative rationality centered on the concept of optimization with emphasis on cognitive and evaluative human limitations and the assumption that individuals act according to a bounded rationality. Beginning from Simon's considerations, many researchers have subsequently sought to emphasize decision-making agents by considering actual human cognition. One of the most famous and important decision-making models (if only because its creator won the Nobel Prize) is the Prospect Theory of Kahneman and Tversky (1979) that, moving from expected utility theory, proposed amendments to introduce explanations of decisions of the changes that can make decisions on behalf of a real individual. The subjects in the experiments tended to choose situations by their own classification (framing), i.e., according to how they perceived them, showed a marked aversion to risk and loss of a certain sum of money (a greater propensity to win the same amount of money) and were even more averse to showing ambiguity and lack of information. Research conducted as part of economic psychology, especially cognitive psychology (also known as Behavioral Decision Theory), has led many economists to note that decision-makers actually depart from the assumed model of rational choice theory. This result emphasizes that certain psychological phenomena (such as how one is mentally presented with a decision problem, how one presents that information, risk aversion, etc.) lead individuals in the act of making choices to commit many more "errors" than expected by normative theory, which suggests an extremely pessimistic view of the subjects' reasoning ability. In fact, regardless of the specific implications of the theories proposed, the profile of the man who emerges from these studies is one whose forms of reasoning are inevitably forced by their very nature to be limited and fallible and have little in common with the image of *Homo Economicus*, a proposal from neoclassical economic theory.

Experimental economists argue their position based on empirical data obtained through the use of laboratory data, which show that agents' reasoning deviates systematically from standard inferences defined by law. However, although we agree with these scholars that "perfect rationality" is an idealization, we attempt to resist the temptation to diminish the importance of our rational standards (including logical and probabilistic reasoning) to fit our limited cognitive abilities. Support shall understand that we humans are "rational animals" because of our ability to reason and certainly not because of the achievement of perfect rationality. In this perspective, then, our rationality is the right use of reason to make

choices in the best possible way: to deliberately achieve our best with the available means. In fact, both design standards and the theories of experimental economists do not consider sufficiently worthy the reality that our judgments about a choice's rationality result from highly contextualized assessments, which involve myriad facets and regulatory standards pertaining to a situation, including the limits of cognitive agents. How is admitted even by some psychologists, although the reasoning of the subject is wrong on the basis of a normative theory, this does not prove that they have reasons for their evaluations. This finding implies that agents do not always deliberate intensively about their choices and the alternatives of each decision. The resolution was only a conscious way about the reason for their actions. Many other actions are not the result of a decision but of routine and habits. For example, we do not make specific decisions when leaving the house in the morning to go to work or while driving a car. However, as the vast majority of our habits, i.e., those who remain aware of what are the reasons why we are going to work or why we walk one way rather than another, and normally we would be able to motivate our choices only if we are required to do so.

In addition, it is sometimes entirely rational to act in a seemingly irrational manner. For example, in amorous situations, a suitor sometimes pretends to be indifferent to arouse curiosity, or in a game, a strategist occasionally enacts "stupid mistakes" to check an opponent via unpredictability. These types of behavior seem "irrational" but might be entirely rational in the long run. Therefore, there are good reasons for doing something one should not do, and in certain circumstances, it is "reasonably appropriate". In this broader sense, rationality is not opposed to irrationality and does not logically imply that a human being as a "rational animal" should respect most principles of our best normative theories of rationality. Rather, this sense of rationality highlights the difference between a "biological organism" that is considered plausibly able to meet the standards of rationality and is evaluated on this basis and organisms such as plants that are not. Therefore, based on these considerations, the orthodox approach of decision theory in terms of maximizing expected utility (which, as we will see, provokes particular problems) should not be construed as the arbitrator or the owner of rationality but as the servant of a more fundamental and deep-rooted concept of rational assessment. Similarly, there is no welcome at all costs, the results of psychological experiments only because there is little doubt that a normative theory can explain all spontaneous and naive intuitions that lead agents to make decisions. We attempt to emphasize that although agents in certain cases and contexts might systematically depart from standard models of rationality, this does not necessarily mean that humans cannot be considered rational animals.

Therefore, in this book, we simply reject the need for a principle of separation between descriptive and normative decision theories, and as we move into the economic paradigm, we simultaneously attempt to justify a conception of rationality according to which rational agents are biological organisms in an environment, without advancing a concept of "natural rationality" purged of any normative dimension. In this way, we advance a naturalist position that seeks to defend evaluative and adaptive rationality by rejecting the terms of the "dilemma"

that impose a descriptivist rationality. To delineate this position that will not be produced in the course of the chapters some axiomatizations, and neither to defend models of psychological–emotional, but we will defend the supplementary explanatory models that have been advanced in the field of neuroeconomic, game theory, and the biology of complex systems.

The volume is organized as follows. In the first two chapters, I will emphasize how rational action is a central category for the assessment of human reasoning and decision-making. Specifically, in the first chapter, we initially provide a historical reconstruction of the theory of rational choice and describe through a discussion of certain concepts of “game theory”, as the dynamics of strategic interaction in the form of cooperation and conflict can influence individual decision-making. We attempt to highlight how the fallacies of the theory of rational choice pursued by experimental economists who use laboratory data are not exempt, in turn, from criticism. At most, recent empirical studies indicate the difficulties that we encounter on a daily basis to achieve our aspirations of rationality. Moreover, it is paradoxical to infer from these limits that humans are not rational given that the empirical research underlying these conclusions assumes precisely the same standard conception for men as for rational animals. In the second chapter, the epistemological framework is outlined including neuroeconomics, a branch of behavioral economics that seeks to investigate the role of the psychological mechanisms of economic analysis without rejecting a neoclassical paradigm, which provides a theoretical framework based on utility maximization and energy balance. In this sense, neuroeconomics has been defined as the state that allows the use of brain processes to find new foundations for the economic theories (Camerer and Loewenstein 2002). To better understand the mechanisms by which the brain assesses and compares the alternatives there may be traceable to determinations of our choices and our behaviors. Within neuroeconomics, we will focus mainly on the studies that have shown certain parallels between the model’s utility and dopamine (dopamine is a neurotransmitter, and its reduced presence in some nuclei of the brain is related to Parkinson’s disease). We will also, as some models of game theory (Prisoner’s Dilemma, Ultimatum Game) have been used by neuroscientists believe that such collaboration can come out and new results are useful to both economists, is the same brain science. However, the hypothesis to be advanced is that to truly understand what triggers the minds of players in a strategy game, rather than relying on laboratory experiments or on the findings of neuroimaging, we must rely on studies of “social cognition”. According to these studies, many players’ choices (within game theory) prove to be far from a presumed (at least in the opinion of certain experimental economists and neuroscientists) emotionality or irrationality.

In the final chapter, the second part will emphasize that it is inherently implausible that a realistic description of our expertise in psychological reasoning within decision theory cannot consider knowledge derived from biology and evolutionary theory. In this light, we will examine how tissue biology has strong ties with many disciplines, including economics. This type of dialogue has been possible based on the premises that the two disciplines

share characteristics such as the concept of competition, scarcity of resources, maximization, etc. As several authors have referred to an economy as a biological system, Alfred Marshall notes that one can look for an enhanced evolutionary paradigm. In fact, Marshall is the first to argue in favor of “biological economy” based on the assumption that economic and biological phenomena share many affinities, a complex and organic nature, involvement in a world of continuous development, submission and influences both qualitative and quantitative that imply that future events do not ever reproduce the same conditions. The originality of his idea of economic dynamics (or rather of economic development) derived from a biological model was long ignored until evolutionary theories permeated many fields of knowledge. We will see how in biology, natural selection, not a law of nature but a general principle from which one can construct models of explanations that serve to forecast. Developments in the field of evolutionary economics have been paralleled by research activities and publications that have been categorized under the label of “complexity science”. The science of complexity has arisen from the interaction of different scientific fields, including physics, mathematics, biology, economics, industrial engineering, and computer science and now covers numerous important fields of scientific research. We would therefore examine how complexity science can offer a new vision of decision-making. Beginning from the simplest biological systems (ants or bees), this type of analysis has shifted to social systems to study the action of economic agents and to use simulations to test consequences, considering actions and interactions among economic agents. The focus will be mainly on the unpredictable and ambiguous world, the importance of nonlinear relationships and the role of self-organization, emergence, and co-evolution in organizational dynamics; thus, the analysis will avoid a reductionist explanation, foresight and linearity.

These brief ideas, sufficient to reveal the intricate complexity of the problem, will all be tested in the following pages. Ultimately, we do not wish to argue that individuals always behave rationally, although we can agree that individuals do not always behave irrationally. However, as Gould (1980) has already written, although irrationality is the major source of evolution, evolution removes irrationality. My hope is that this book can prove that agents act, to use Kantian terminology, not according to reason but with reason as a purpose.

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