

Normative Ecological Rationality: Normative Rationality in the  
Fast-and-Frugal-Heuristics Research Program \*

D. Wade Hands  
Department of Economics  
University of Puget Sound  
Tacoma, WA, 98416  
[hands@pugetsound.edu](mailto:hands@pugetsound.edu)

Final Pre-Publication Version  
Published in: *Journal of Economics Methodology*, 21, 2014, 396-410.  
DOI: 10.1080/1350178X.2014.965907

\*I would like to thank John Davis and the symposium editors for helpful comments on earlier versions of this paper.

*An elaborate theory of rational decision has been developed by economists and statisticians, and put to widespread use in theoretical and policy studies. This is a powerful, mathematically precise, and tractable theory. Although its adequacy as a description of actual behavior has been widely questioned, it stands as the dominant view of the conditions that a rational decision should satisfy: it is the dominant normative theory. (Robert Nozick, 1993, p. 41)*

## 0. Introduction

Since at least the early twentieth century the fields of economics, psychology, and philosophy have engaged in a long series of spirited debates over human decision-making. For economists and for the school of experimental psychology that has most influenced behavioral economics – the Behavioral Decision Research program associated with the work of Ward Edwards, Daniel Kahneman, Amos Tversky, and others<sup>1</sup> – the focus on decision-making has lead naturally to the question of rationality, and in particular to what philosophers have traditionally called practical rationality: the question of what it is rational to do (as opposed to theoretical rationality: what it is rational to believe). While the emphasis on rationality seems natural to the discussion of decision-making, it also introduces a certain normative element and raises the question of whether the subject is the scientific study of decision-making – an investigation that is descriptive (and/or predictive and/or explanatory) – or whether it is a more philosophical inquiry into the norms of rational action (what one ought to do in order to be rational). It seems obvious that the decisions an individual actually makes (and the scientific study of such decisions) is something fundamentally different from the question of the decisions that a rational individual ought to make (and the inquiry into such rational decisions), but it is not always entirely clear which aspect of decision-making psychologists, economists, and philosophers are concerned with. One would suspect that social scientists would be more concerned with scientific description-prediction-explanation<sup>2</sup> and philosophers more concerned with normative questions – and to a certain extent that is correct – but, as we will see, the issue is not always that simple.

At some point during the first half of the twentieth century the dominant conception of rational decision-making (both descriptive and normative) became rational choice theory (hereafter RCT). RCT is a particular instantiation of a more general approach to

---

<sup>1</sup> See Davis (2010) and Heukelom (2011, 2013) for a discussion of the Behavioral Decision Research program and its relationship to behavioral economics.

<sup>2</sup> Since this paper has nothing additional to contribute to the philosophical question of whether successful science describes the phenomena, or makes accurate empirical predictions, or provides scientific explanations (or fulfills other possible scientific goals), I will essentially assume that a successful science does all of these things, and will, for the most part, just use the term "description" as a generic term for that which successful science does.

rationality: instrumental rationality. Instrumental rationality is means-ends rationality – using the most appropriate means for achieving any given goal/end – and it has become the core, or default, theory of rationality within the contemporary literature:

The notion of instrumental rationality is a powerful and natural one. Although broader descriptions of rationality have been offered, every such description that purports to be complete includes instrumental rationality within it ... In this sense, instrumental rationality is the default theory, the theory that all discussants of rationality can take for granted, whatever else they think. (Nozick, 1993, p. 133)

Although RCT need not involve optimizing behavior, it often does. If the ends are sufficiently structured that they can be reduced to a single well-behaved objective function, then rationality is simply the optimization of that function.<sup>3</sup> Although instrumental rationality does not restrict the content of the agent's ends – one could prefer the pain and suffering of others or oneself and still make rational choices given such preferences – it does restrict the structure of those ends/preferences. The goals/preferences must be sufficiently well-ordered that an instrumentally rational action exists. Thus rationality enters into RCT in two separate ways: 1) the goals must be rational in the sense that they must satisfy certain minimal structural conditions (such as transitivity) and 2) the agent must act in an instrumentally rational way to achieve those (rational) goals. Rational choice involves both having rational goals/preferences and choosing rationally given those goals/preferences.

The two main theoretical frameworks associated with RCT are expected utility theory for risky decision-making and ordinal utility theory for decision-making in risk-free environments. Ordinal utility theory is the way that RCT has traditionally been employed within economics (although this seems to be changing) and expected utility theory is the way that RCT is characterized by scholars in most other fields (philosophers, psychologists, etc.). Over the last few decades various groups of experimental psychologists and economists have accumulated a substantial amount of empirical evidence that challenges RCT's adequacy as a descriptive theory of human decision-making. The evidence demonstrates systematic deviation from the behavior predicted by RCT and the associated choice anomalies – such as "loss aversion," "framing," "constructed preferences," and "endowment effects" – are now part of the professional vernacular in both economics and experimental psychology.<sup>4</sup> Since expected utility theory involves both the agent's preferences (utility function) over various outcomes as well as the probability associated with each outcome, these empirical results are called "choice" anomalies when they involve the agent's utility function (or how it is acted upon) and "judgment" anomalies when they involve the agent's beliefs about (or use of) probabilities (Camerer and Loewenstein, 2004, p. 9).

---

<sup>3</sup> There is also an abstract set-theoretic definition which defines rational choice in terms of the existence of a choice function (Arrow 1959), but I will focus on the more traditional notion of choice: the goal-directed actions of individual agents.

<sup>4</sup> This literature is far too vast to cite, but Kahneman and Tversky (2000) is a classic and Camerer and Loewenstein (2004) is a useful survey of the relevant literature in behavioral economics.

One of the first contributions to this critical literature that attracted the attention of economists was Kahneman and Tversky's 1979 paper on prospect theory (Kahneman 2003). The general approach that Kahneman, Tversky, and associates employed came to be called the heuristics-and-biases program in experimental psychology. The core idea of the heuristics-and-biases program is that real humans do not behave as RCT predicts, but rather employ a number of heuristics in decision making; the result being that behavior is often biased in systematic ways and thus irrational by RCT standards. These ideas prompted a number of economists to employ Kahneman and Tversky-like techniques to discover additional anomalies in various areas of economic decision-making and the heuristics-and-biases-based program in behavioral economics was born (e.g. Thaler 1980).<sup>5</sup> The anomalies associated with the heuristics-and-biases program have become a serious concern for contemporary economic theory, and even economists who believe these concerns can be addressed within the confines of traditional theory, now generally agree that such anomalies need to be addressed in some way.

But there is also an entirely different response to these anomalies. Perhaps changing economic theory is not necessary; perhaps there is "an honorable way out" (Heukelom, 2011, p. 30). As noted above, RCT has always lived a double life as i) a descriptive/scientific theory of individual decision-making and also as ii) a prescriptive/normative theory of rationality. Even if these anomalies present a serious challenge to RCT as a descriptive theory, they are not necessarily a threat to the normative interpretation. The fact that real people violate a norm does not in any way detract from the legitimacy of that norm.<sup>6</sup>

At this point it would seem useful to discuss the normative theory of rationality associated with the heuristics-and-biases program, but that is not really necessary since the heuristics-and-biases view of what a rational agent ought to do is essentially the same as the traditional RCT-based view. The problem with heuristics and biases according to the heuristics-and-biases program is that they lead people to make mistakes; they violate the RCT-based norms of rationality. Standard practice in behavioral economics calls "into question the validity of standard economic/decision theory as a sound descriptive theory; on the other

---

<sup>5</sup> Behavioral economics is closely linked to experimental economics, and experimental economics is often associated with Vernon Smith and his associates. Smith and Kahneman jointly received the Nobel Prize in Economics in 2002 but the programs are quite different. Kahneman's approach – the heuristics-and-biases program – focuses on individual choice and how heuristics and biases prevent agents from making rational decisions while Smith's program – experimental-market-economics – focuses more on market behavior and on institutional design rather than violations of RCT (Lee 2011). See Heukelom (2011, 2013) and Sent (2004) for detailed discussions of the historical development of the relationship between heuristics-and-biases and behavioral economics.

<sup>6</sup> One example of such a defensive move – falling back to the normative interpretation from an initially descriptive interpretation of RCT when confronted with contrary empirical evidence – concerns Leonard Savage. His early work on expected utility theory with Milton Friedman (Friedman and Savage 1949, 1952) was primarily descriptive while his later work (Savage 1954, 1972) was primarily normative and it has been argued that the change was in response to the contrary empirical evidence offered by Maurice Allais (Allais and Hagen 1979). See Guala (2000, p. 67), Heukelom (2013), Jallais, Pradier, and Teira (2008, pp. 53-54) and Mongin (2009, p. 348).

hand, they avoid challenging the validity of the same theory as a reliable provider of the normative ideal of rationality" (Lee, 2011, p. 761).<sup>7</sup>

But heuristics-and-biases is not the only heuristic game in town. During the last few decades another approach to heuristics has developed: the bounded rationality program of fast-and-frugal-heuristics (hereafter FFH) of Gerd Gigerenzer and his associates (e.g. Gigerenzer 2008, Gigerenzer and Gloldstein 1996, Gigerenzer, Hertwig and Pachur 2011, Gigerenzer and Selten 2001a). This program will be discussed in detail in the next section, but the basic idea is that whether a particular decision is rational or not depends on the specific environment in which the decision takes place. Calculating the exact angle of approach and mathematically computing the "optimal" escape route may not be the rational strategy when faced with a charging rhino. Perhaps a heuristic that is good enough in a wide range of low information and computationally limited environments makes a lot more sense. From the perspective of FFH, heuristics are not always associated with biases or mistakes; sometimes they produce decisions that are much more "rational" than those offered by RCT. FFH is fundamentally an empirical and descriptive inquiry - studying how various heuristics work and in which environments they work (what Gigerenzer calls the "adaptive toolbox") - but it also has a normative side. If the track record of a particular heuristic is very good in a reasonably large and relevant set of environments, then perhaps that is what decision-makers ought to do in such environments, not the utility maximization recommended by RCT. Gigerenzer calls the normative aspect of FFH "ecological rationality."<sup>8</sup> Thus unlike the heuristics-and-biases program, FFH offers both a descriptive and a normative alternative to RCT.

Given these introductory remarks it is now possible to state the goal of this paper. The paper will examine the normative aspect of FFH - ecological rationality - and compare and contrast it with the normative interpretation of RCT. In particular, it will i) investigate the ways in which empirical/descriptive evidence - the facts of the matter - have been used to justify the normative interpretation of RCT, and ii) see if the FFH program is, or can be, supported/justified in a similar way. The goal is to develop a naturalistic framework for appraising the relative adequacy of FFH versus RCT as a normative theory of rationality.

## 1. Reasoning the Fast-and-Frugal Way

FFH is a particular version of the bounded rationality approach to human decision-making. Although Herbert Simon introduced ideas related to bounded rationality as far back as

---

<sup>7</sup> An easy way to see how behavioral economics accepts the traditional RCT-based notion of rationality is in the welfare economics inspired by behavioral economics: the so-called nudge literature of libertarian paternalism (Sunstein and Thaler 2003, 2008). The basic argument of this literature is that since people do not act rationally - they make mistakes - it is the proper goal of regulatory institutions to "nudge" them into doing that which they ought (rationally) to do, but would not do on their own. In a sense, nudges are needed because people are insufficiently neoclassical.

<sup>8</sup> It should be noted that Smith (2003, 2008) also calls his experimental-market-economics approach "ecological rationality," but there are differences with the FFH version. In this paper "ecological rationality" means exclusively the Gigerenzer FFH version. See Lee (2011) for a discussion of the similarities and differences in the two programs.

Administrative Behavior (1945), the first explicit use of the term "bounded rationality" came in Simon's Models of Man in 1957 (Klaes and Sent, 2005, p. 37). Simon's argument was that the optimization-based - "Olympian" (Hertwis and Herzog, 2009, p. 663) - rationality of RCT required more information and computational ability than humans possess and so it is necessary to rely on satisficing strategies that work effectively in real world choice environments.

The FFH program started from Simon's bounded rationality but leveraged it into a broader non-optimization-based theory of decision-making with both descriptive and normative aspects. The core idea, like Simon's, is that humans cannot do - or at least cannot always (in all environments) do - what RCT demands, and that heuristics will be employed that allow quick and effective decision-making given the constraints that humans face (information and computational ability, but also other environmental constraints). Like heuristics-and-biases, the FFH program is heuristics-based - specifically fast-and-frugal heuristics that are quick to execute and ignore part of the information - but unlike heuristics-and-biases, these heuristics are not irrational; they are not simply biases that prevent rational decision-making. Instead, these heuristics are quite rational in the sense of providing strategies that are as good as RCT in particular environments; particularly in complex and noisy environments where agents have low information, limited computational ability, and face pervasive uncertainty. RCT is based on the unbounded rationality of Homo economicus; it "encompasses decision-making strategies that have little or no regard for the constraints in time, knowledge, and computational capabilities that real humans face" (Gigerenzer, 2001, p. 38) while FFH is based on Homo heuristicus who "has a biased mind and ignores part of the available information, yet a biased mind can handle uncertainty more efficiently and robustly than an unbiased mind relying on more resource-intensive and general-purpose processing strategies" (Gigerenzer and Brighton, 2009, p. 107).

There are three different aspects to the FFH program:<sup>9</sup>

1. The Adaptive Toolbox (the descriptive aspect): the scientific investigation of the heuristics that people use in particular environments. What are the building blocks of the heuristics and how do human capacities make use of these building blocks? Some of this is laboratory work, some is field work, and some involves evolutionary biology.
2. Ecological Rationality (the normative aspect): This is the investigation of which heuristics are effective in which environments: both the relationship between specific local environments and also how they might generalize to a broader set of environments. The goal of ecological rationality is "to make comparative statements about what is best" (Gigerenzer and Todd, 2012, p. 494) - statements like "strategy X is more accurate (frugal, fast) than Y in environment E" (Gigerenzer and Gaissmaier, 2011, p. 457) - and to "discover structures that permit more general conclusions about the match between processes and environments" (Gigerenzer, 2008b, p.26).

---

<sup>9</sup> This tripartite scheme is presented in a number different publications (e.g. Gigerenzer 2008a, p. 8; Gigerenzer 2008b, p. 23; Gigerenzer and Sturm 2012, p. 247).

3. Decision Improving Design (the application or art aspect): This is the applied aspect of the FFH program. It uses (1) and (2) to "design environments and create expert systems that improve judgment and decision making" (Gigerenzer and Sturm, 2012, p. 247).

The vast majority of the existing research has focused on the adaptive toolbox. Most of it involves empirical studies of heuristics that are of particular interest to those within the FFH program - for example the take-the-best heuristic (Gigerenzer and Goldstein 1996) and the recognition heuristic (Goldstein and Gigerenzer 2002) - but there is also work on heuristics introduced outside of the program such as Simon's satisficing and tit-for-tat from game theory.<sup>10</sup> Since the main concern here is the normative side of FFH, I will just set aside the question of the adequacy of this empirical literature and assume that the analysis that Gigerenzer and others have done demonstrates what the authors say it demonstrates. I would also note that - unlike the extensive discussion of policies that goes on within the heuristics-and-biases program - there has been fairly little work on the third part of the FFH program.

Gigerenzer and others supporting FFH firmly insist that it is a normative program that can provide advice about what one ought to do - what heuristics to apply - in particular environments, as well as providing a general framework for thinking about normative rationality that is often better than the advice available from RCT. I say "often" because the FFH program does not say that RCT can never provide appropriate guidance about rational decision-making; it only says that it does not always do so and that what RCT recommends can be subsumed under the broad umbrella of ecological rationality. Ecological rationality begins with instrumental rationality - "our psychological research program picks out one specific sense of rationality ... a kind of means-ends rationality" (Gigerenzer and Sturm, 2012, p. 245) - but goes on to "supplement the instrumental notion of rationality by an 'ecological' dimension" (ibid.). The question is not whether RCT or FFH always provide the correct norm; the "question instead is in what environment is a given heuristic more accurate than an optimization strategy, and when is the opposite true?" (ibid., p. 246).

It is useful to note that those supporting the FFH program recognize some of the philosophical issues raised by ecological rationality. They call it "rationality naturalized" because their approach involves getting a normative "ought" from what "is" the case (what works) and they recognize the threat of the naturalistic fallacy:

To repeat, ecological rationality is a normative discipline that requires descriptive knowledge about the process underlying decision making ... Despite long-standing admonitions to avoid the so-called naturalistic fallacy - never derive ought from is - in this case the ought, how people should make decisions, is not independent from the is, how people are able to make decisions. (Gigerenzer and Todd, 2012, p. 494)

---

<sup>10</sup> See Gigerenzer and Shelten (2001a) or Gigerenzer (2008a) for detailed discussion of these various empirical results and the associated analysis.

Supporters of FFH are also clear about how different their approach to normative rationality is from that of the heuristics-and-biases literature. They stress that FFH "provides an alternative to current norms, not an account that accepts current norms and studies when humans deviate from these norms" (Gigerenzer and Selten, 2001b, p. 6).

## 2. Normative Rational Choice Theory and the Facts of the Matter

It is clear from the previous section that to Gigerenzer and his co-authors ecological rationality provides a FFH-based normative theory of rationality that challenges the traditional RCT-based normative theory. Since the FFH program defends the normative program of ecological rationality by citing the (actual empirical) success of the adaptive toolbox, it seems that the most useful way to make the comparison with RCT-based normative theory would be to compare ecological rationality to the various ways that the facts of the matter have been used to support and/or justify RCT-based normative theory. Once we have an understanding of how empirical evidence has been used in the defense/justification of the traditional view, we can directly compare and contrast the two views. Of course both may suffer from problems associated with the naturalistic fallacy, but at least we will have a framework for comparing the two normative views along a single dimension – the naturalistic dimension – which is certainly the most relevant dimension for contemporary debates. To that end I will discuss the various ways that what "is" has been used to defend RCT-based normative theory. Unlike FFH, RCT has a long and complex history, and as a result there are many different ways that empirical facts have been used to support RCT-based normative rationality. Given the amount of literature on this topic I only discuss a manageable subset of the positions that might be considered.

A. Willingness to Correct Mistakes in Rationality Justifies RCT-based Normative Theory (Matter of Fact Interpretation): RCT is what people will revise their behavior in light of and this provides its normative bite. This argument takes a variety of forms, but generally it involves some version of these three (ostensibly) factual claims: i) humans want to be (or must be) rational, ii) RCT is an "absolutely convincing" theory of rational action (Morgenstern, 1972, p. 711), iii) therefore people can, and actually do, change their behavior (or preferences or beliefs) when it is pointed out that their decision-making conflicts with RCT. The argument is that these three things together provide a justification for RCT-based normative theory. This does not involve deducing an ought from an is, but it is using a set of factual claims, that if correct, would, it is argued, provide a compelling reason for committing to RCT for guidance on how one ought to make decisions. It is often argued that RCT is in this sense like logic or arithmetic; if a person is doing a calculation and they make a "mistake" they quickly correct it because the rules of arithmetic are absolutely convincing. As Oskar Morgenstern explained:

For economics, consider an individual who professes to possess a utility as described by the von Neumann-Morgenstern axioms of expected utility. If it is shown to him that in his actual behavior he deviates from that function, the theory being absolutely convincing, will tell him how he should modify his behavior in order to conform to his own chosen preference system. This



"convincing" is equivalent to the conviction carried, say, by the inspection of mathematical calculation in which mistakes can be pointed out. The person having calculated wrongly will acknowledge and correct the mistakes because the computing procedures are completely convincing. (Morgenstern, 1972, p. 712)

Of course since there are three separate empirical claims here and there are also some implicit causal relationships among the three claims, they have been mixed and matched in the literature in various ways. For example, is the "fact" that people change their behavior the only evidence for the "fact" that RCT is absolutely convincing, or is there independent evidence for the inherent persuasiveness of RCT? Of course since there are so many moving parts to this argument, one could be generally sympathetic but still question some of the empirical claims or implicit causal arguments (see B below).

Finally, it should be noted that this argument also comes in an "expert" version where the only people that matter in i), ii), and iii) are the relevant experts. One argument for this is that although the general public may want to be rational, it is in fact unlikely that they are going to find a formal theory of rational action absolutely convincing and are therefore unlikely to change their behavior when confronted with violations of RCT: but experts will (and should) and the general public should follow their lead. The prescriptive use of RCT would be

... justified as long as they captured the decision rule actually applied by those considered wisest in making uncertain choices (businessmen, gamblers, insurers, etc.). The underlying consequentialist principle is that imitating them is the best to achieve our goals, since their practical success provides compelling evidence of the virtues of their decision rules. We would be thus justified in adopting EUF [expected utility theory] as one of such rules if it can be empirically shown that they effectively predict the choices of these experts. (Jallis, Prodiar, and Teira, 2008, pp. 46-53).

**B. Willingness to Correct Mistakes in Rationality Justifies RCT-based Normative Theory (Hypothetical Interpretation):** This view is the same as the previous one except it is entirely hypothetical. It says i) if people want to be rational, ii) and if RCT is an absolutely convincing theory of rational action, iii) and if people in fact change their behavior when it is shown to be in conflict with RCT, then RCT-based normative theory is justified. It is the same argument about how empirical facts could justify RCT-based normative theory, but it takes all of empirical claims in A - about how people are, how persuasive RCT is, and whether people actually do change their behavior when confronted with such inconsistency - as hypotheticals. If these three empirical claims are true (or mostly true, or true enough for the cases we care about, etc.) then B is the same as A. This version is necessary because a number of authors who seem to support this hypothetical justification, also doubt whether the facts of the matter are as A suggests.

For example Daniel Ellsberg (1961) accepted the expected utility theory as hypothetically normative – if people in fact used expected utility theory to correct their mistakes, it would be a justification of the axioms – but doubted that people would in fact do so.

If you should repent on your violations – if you should decide that your choices implying conflicts with the axioms were 'mistakes' and that your 'real' preferences, upon reflection, involve no such inconsistencies – you confirm that the ... postulates are, if not descriptive rules for you, your normative criteria in these situations. But this is by no means a universal reaction; on the contrary, it would be exceptional. (Ellsberg, 1961, p. 655)

Of course this position could be interpreted as an argument against RCT as both a descriptive and normative theory (Ellsberg's position), but it could also be the basis for nudge-like efforts to gently push people in the direction of rationality (either through education and persuasion, or by modifying the choice architecture). Certain authors argued for such corrective measures long before the recent literature on libertarian paternalism. For example, Ellsberg notes that the lesson for the game theorist Howard Raiffa was that "people need more drill on the importance of conforming to the ... axioms" (Ellsberg, 1961, p. 646); that real people need "some thoughtful guidance about how they might wish to act in a wiser fashion in real situations" (Raiffa, 1994, p. 4).

C. Empirical Elimination: This is the argument that agents who act in ways that violate RCT will (in fact) cease to exist or at least cease to play an active role among the relevant class of decision-makers. Non-RCT-agents will be eliminated in social interaction with RCT-agents. The two most common forms of this argument are the money pump (for agents who have intransitive preferences and thus make choice mistakes) and the Dutch Book (for agents who violate the axioms of probability theory and thus make mistakes in judgment). This seems to be the most common way that contemporary economists justify RCT and it is an argument that goes back to at least Davidson, McKinsey, and Suppes in 1955. It is empirical because the claim is that non-RCT-practicing agents would in fact be eliminated in most relevant social environments and although it is most commonly used to defend RCT as a descriptive theory, it can also be used to defend RCT as a normative theory.

Since there is now quite a bit of evidence that people often do violate both transitivity and the laws of probability, and yet these people do not seem to be in any immediate threat of being eliminated from the ranks of decision-makers, it is clearly contestable whether this is a reasonable empirical claim. But contestable or not, money pumps and Dutch books are clearly taken to be empirical evidence by many who study and use decision theory (particularly economists).

D. Ought Implies Can: This argues that something which is not (in fact) possible is not something that one is normatively obligated to do. While "is" is certainly not sufficient for "ought," it is necessary. If the fact of the matter is that it is impossible to comply with the utility maximizing strictures of RCT, then this undermines the legitimacy of RCT-based normative theory.

... though it is not necessary that a useful normative theory be satisfied by everyone, it seems necessary that it be a theory which can be satisfied by someone: that is, that it not be a theory which is such that in order to satisfy it a being would have to possess powers, capacities, abilities, and skills far beyond those possessed by human beings as they now are. (Nozick, 1963, p. 24)

This is one way of interpreting the bounded rationality and satisficing arguments of Herbert Simon. If humans do not have the information and/or the computational ability to optimize in the way RCT argues they do, then this undermines RCT as a normative theory of rationality. What human agents ought to do must be in fact something that they can do, and if Simon was right, then rationality as characterized by RCT is impossible, and thus RCT cannot serve as a normative standard of rational action. As Philippe Mongin explains:

We finally mention the connection implied by the cognitive preconditions of rational decision-making. Since Simon's work on bounded rationality, it is a well taken point that in order to have any normative force, a rule of decision must make feasible demands on the individual's ability to collect information and make computations. This new linkage of the normative and the empirical is but a contextual way of making good the meta-ethical principle that "ought" implies "can." (Mongin, 2009, 349)

Although the ought-implies-can argument has often been used as a critique of RCT-based normative theory, it could be used as a defense, and was used (at least implicitly) as a defense for much of the second half of the twentieth century. The implicit argument was that the predictive and explanatory success of microeconomic theories built on RCT foundations (pre-heuristics-and-biases-anomalies) gave us good reason to accept utility maximization as an appropriate theory of rational action. Granted, such an argument confuses necessary and sufficient conditions, but it was made nonetheless.

Before leaving the discussion of these four arguments it is useful to note that many authors are not consistent about exactly which one they are employing and it is sometimes clear that more than one is involved. As one of many possible examples consider the following remarks by Jacob Marschak:

The results of decisions based on "correct" conclusions are, in some sense, "preferable" to results of decisions based on incorrect ones. It is "advisable" to follow the rules of decisions based on correct ones. It is "advisable" to follow the rules of logic and arithmetic. In dealing with his environment ("nature" which includes "society") a man who often makes mistakes in his inferences and his sums is, in the long run, apt to fare less well than if he had been a better logician and arithmetician." (Marschak, 1950, p. 112).

So is this A or C in the above list? It seems to be both and it might even be an argument for the expert version of A. My point is not to single out Marschak as particularly

problematic in this respect; it is just to make the point that while there seems to be a fierce commitment to the idea that RCT is the proper characterization of rationality, there is much less commitment to why that is the case.

In closing let me quickly mention two other possible justifications that were not included in the above list. One common defense of RCT-based normative theory, particularly among philosophers, is the normativity often associated with Donald Davidson (Davidson 2001, 2004). There are several versions of this view but the common idea is that rational action explanations are based on having reasons for the action and those reasons are necessarily normative. Given the necessity of the relationship, these views have been called inherent normativity (Grüne-Yanoff 2008). This literature has contact points with continental philosophy and is often opposed to the naturalism implicit in all of the above arguments and that was the reason for not including it. Another way that normative rationality has been defended is based on the idea of a reflective equilibrium. Although this way of justifying norms has traditionally been associated with moral, rather than rational, norms (Rawls 1971) it can also be used in the context of normative rationality. The idea is to bring our normative beliefs into a coherent equilibrium with a broad range of our other beliefs and intuitions. Although factual information may be involved in such a reflective exercise, it is not primarily a justification based on the empirical evidence and is therefore outside of the current discussion.

### 3. Normative Ecological Rationality: What It Is and What It Isn't

So now that all of the pieces are in place we can start to assemble the comparison of RCT-based normative theory and ecological rationality (at least with respect to naturalistic arguments). I will make two general points, and then turn to the specific relationship between FFH and the four ways that empirical evidence has been used to justify RCT-based normative theory.

The first general point concerns the accuracy of the perception that FFH is a relatively bold, or maybe even radical, research program in the theory of rationality. On first gloss this is certainly the idea that one gets, both from the tone of the writings of FFH supporters<sup>11</sup> and from the dearth of other research programs willing to challenge RCT on normative grounds. In some sense research programs that challenge RCT on descriptive grounds are a dime-a-dozen – heuristics-and-biases, Simon and his generation of behavioral economists, institutionalists and a variety of other heterodox critics, strict behaviorism, and on and on – but almost no one challenges RCT as a normative theory. And yet the FFH program does precisely that.

As unique as FFH seems to be for accepting this challenge, perhaps it is not as bold as it first appears. Most importantly, FFH is committed to the same (default) general notion of rationality – instrumental rationality – as RCT: "ecological rationality is broadly defined in

---

<sup>11</sup> Gigerenzer's rhetoric often conveys this: for example "... a serious program of bounded rationality needs to emancipate itself from the Christian idea of an omniscient and omnipotent God, or its secularized version, Laplace's superintelligence" (Gigerenzer, 2001, p. 40).

terms of success, and thus involves looking for means suited to certain goals" (Gigerenzer and Sturm, 2012, p. 255). Granted, unlike RCT, it does not require optimizing behavior and it does "not maintain that reasoning is only about satisfying preferences" (ibid.), but it is certainly not a position that stands against the tide of modern philosophical thinking about rationality. The instrumental conception of rationality involved in both RCT and FFH is hypothetical or contingent – given the ends, certain means are rational, but instrumental rationality says nothing about the ends – and the imperatives stemming from any normative version of such rationality are hypothetical, not categorical, imperatives: if one's goal is x, one ought to do y. FFH program broadens the range of ends (it is not strictly a preference-based theory) as well as the range of behaviors that trigger a decision (stopping rules are not necessarily associated with max U or max EU), but it does not involve any fundamentally different notion of rationality. It is still means-ends rationality, it is just that it accommodates a wider range of both ends and means than traditional RCT. The normative interpretation of FFH still says that one ought to use effective means for achieving one's given ends, and that is hardly a bold or radical way of characterizing what a rational person ought to do. Perhaps this is a good thing,<sup>12</sup> but the point is that it is quite different from the way the FFH program is often perceived and/or marketed.

The second general point is that there is less that is evolutionary in ecological rationality than initially meets the eye. Most readers seem to presuppose that arguments for the "success" of particular heuristics in particular environments are evolutionary in nature: that fast-and-frugal heuristics would be "selected" and thus emerge naturally within the population as a result of heuristic variation and selective retention. There is certainly some of this type of evolutionary argument within the FFH literature, but not as much as the abundance of words like "evolutionary," "adaptive," and "ecological" would suggest.

For example, in a recent discussion of the adaptive tool box Gigerenzer and Sturm explain the building blocks of heuristics in the following way:

The building blocks of heuristics ... are based on evolved capacities. An evolved capacity is a product of nature and nurture, a capacity that is prepared by a species' genes but needs practice to express itself."  
(Gigerenzer and Sturm, 2012, p. 252)

In the next section they go on to explain various ways these heuristics are "selected": by memory constraints, learning by feedback, and environmental selection. These selection mechanisms involve both nature and nurture and they certainly suggest an evolutionary process is responsible for the agent's use of heuristics. But is it? Is it that the environment has selected for the heuristic – or is it simply that the environment has helped select the capabilities of agents in ways that allow them to implement such heuristics? The difference is the difference between actually having an evolutionary explanation for the heuristic – why/how it was selected – and simply providing a plausible evolutionary story about how humans came to have the capacity to make decisions that employ such heuristics. If it were a serious selection-based evolutionary explanation, heuristics would be determined by (as

---

<sup>12</sup> For example if one believes that scholars have actually made some progress in thinking about rationality during the last two hundred or so years.

opposed to just allowed by) evolutionary selection, and the only task of the FFH program would be descriptive: to study the heuristics and the selection mechanisms.

Of course one could try to develop a normative naturalism on this basis; in the moral domain there are various programs in evolutionary ethics and a similar strategy could be used for ecological rationality, but this would be fairly risky given the controversial nature of evolutionary approaches to morality: "Even philosophers sympathetic to ethical naturalism (the view that moral facts are themselves natural facts of some sort) have typically been wary of attempts to derive conclusions about morality in the normative sense from fact about evolutionary history" (FitzPatrick, 2012, p. 25).<sup>13</sup> Whether one could effectively defend ecological rationality in this way or not, the fact is that this is not the way it is defended within the FFH literature. I would suggest this is because there is no serious selection-based evolutionary explanation in the FFH literature; the evolutionary story is just about how the capacities necessary for the use of heuristics could have evolved in a way that is consistent with evolutionary theory. Gigerenzer and most other FFH supporters are fundamentally psychologists – not biologists – and their main focus is on self-conscious decision making, not on what the environment allows to survive. Of course this volitional emphasis leaves more room for discussion of how decisions ought to be made – and thus the second and third aspects of the FFH program – but it raises its own problems.

The most obvious problem is that nowadays everyone seems to have a good story about how the capacities necessary to implement their own pet theory of rationality are consistent with evolutionary theory. For example Binmore (2009), Glimcher (2003), and Ross (2005) all provide evolutionary stories about how the capacities to implement their particular version of RCT are supported by evolutionary biology. Since everyone is doing it, this is not going to be a successful way to make the case for ecological rationality over RCT-based normative theory. Consistency with evolutionary theory may be a necessary condition for any theory of rationality (descriptive or normative), but in an intellectual environment where every approach provides an appropriate biological backdrop, there is no obvious advantage against other theories of rationality.

Turning now to the four arguments for how the facts of the matter have been used to defend RCT: which of these, if any, is the way that defenders of FFH use empirical evidence to defend ecological rationality? First, there is hardly any evidence that A can be used to defend a FFH-based normative theory. The main problem is that every instance of people changing their "irrational" behavior to conform with RCT also provides support for normative FFH since FFH does not deny that RCT provides the rational strategy in certain environments. One would need evidence that people are willing to switch to a particular FFH-based heuristic, but not to a RCT-based rule such as expected utility theory. One would need to show that the FFH heuristic was "absolutely convincing" when RCT-based rules were not and there is no evidence for this in the literature. Or put alternatively, if there were such evidence defenders of FFH would have made it the centerpiece of their research and they do not seem to have done so.

---

<sup>13</sup> See Grüne-Yanoff, (2010, p. 78) for some critical remarks specifically directed at FFH.

Ecological rationality also does not seem to gain much from **B** – the hypothetical, agree with how the facts could be used, but doubt that actual facts are adequate to the task, version of **A** – but of course **RCT** didn't get much support from it either. It seems reasonable to say that most of those involved in the **FFH** program would agree that if you could show people that they did not use an ecological rationality-approved heuristic and they were willing to change their behavior on this basis, it would be very supportive of the **FFH** program. But from the available research, at this point, there seems to be little or no evidence that people are actually willing to make such changes.

The argument in **C** – empirical elimination – would be provided by the type of serious evolutionary explanations discussed above. If those who used the wrong heuristic were eliminated because the right heuristic always, or even usually, gets selected for, it would be a strong argument for ecological rationality. But as discussed above, that kind of serious selection mechanism does not seem to be what most supporters of **FFH** have in mind as the "ecological" aspect of the program. Of course if they did, they would run into a number of other problems about how the fact of selection could/would underwrite ecological rationality as a normative theory (or for that matter why we would even need, or be able to use, a normative theory).

Finally, the last argument – ought implies can – seems to provide better support than the other three, but even here is not entirely unproblematic. If we accept the view that Simon was making the case for the rejection of **RCT**-based normative theory because **RCT** was not something that it was possible for human agents to do, and we accept the extensive **FFH** literature showing how people can successfully use particular heuristics in particular environments, then it seems that unlike **RCT**, **FFH** has at least passed the necessary condition for providing a normative theory of rationality. The problem is that there has been an extensive amount of empirical research on **FFH** heuristics and this seems to be a very small payoff; as noted previously, showing it is not impossible for people to do what ecological rationality says may be a necessary condition for accepting **FFH**, but it is certainly not sufficient. Of course research is ongoing and perhaps additional evidence will turn up that is more powerful, but at this point we seem to be left with the argument that **FFH** is better than **RCT** because the evidence has shown that it is not impossible for agents to do that which **FFH** says they should do. This is something, but it is a pretty thin empirical claim on which to hang the replacement of modern economics and decision theory.

For my final point I would like to discuss an issue that is not directly related to the four naturalistic arguments that have been the main focus here, and to note something that is a problem for both **RCT** and **FFH**, but seems to be worse for **FFH**. Since both of these approaches are particular instantiations of instrumental rationality, they are, as I noted above, only hypothetical imperatives. In the case of ecological rationality it would take the form "if heuristic *x* says to do *y*, and if *x* is more effective/fast/frugal than other heuristics in environment *E*, and one is in environment *E*, then do *y*." Given the goals, the constraints, and the environment, then the agent has a rational obligation to do what **FFH** recommends, but what they ought to do is entirely contingent on these three factors. **FFH** is a more flexible theory because it allows for multiple, and less structured, goals, and that

may make it a more robust theory, but it can also be argued that makes it a more contingent theory. FFH heuristics may be what one ought to do in more environments than RCT, but there are multiple FFH-based heuristics and which one (or ones) ought to be followed depends on the environment (in addition to the goals and beliefs necessary for RCT). With RCT if one has goal x and has beliefs and constraints y, then it is clear one ought to do z. In the case of FFH, if one has goal x and has beliefs and constraints y, and is in environment, informational, and computational space w, then one ought to do z. All instrumental rationality-based theories offer only hypothetical, not categorical, rationality, and many consider that to be a weakness, but FFH seems to compound the problem. Not only is what one ought to do in order to be rational contingent on one's goals and beliefs/constraints, it is also contingent on the (broadly defined) environment in which the decision is being made. This may be the best we can do - or at least the best that can be naturalistically defended - but it does not seem to be very satisfying. Can this be all there is to rationality?

#### 4. Conclusion

This paper examined the normative theory of rationality associated with FFH - ecological rationality - and in particular tried to assess how it stands up to the various empirical-based arguments that have been made in favor of RCT-based normative theory. In the process (in section two) I explained in detail the four main naturalistic arguments that have been used to defend RCT as a normative theory of rationality. This was probably a useful exercise in its own right - given the lack of clarity on this matter over the years - but it allowed us to compare and contrast FFH and RCT as normative theories of rationality. The assessment ended up rather mixed. Ecological rationality did seem to win on "ought implies can" grounds; there are fairly persuasive arguments going back to Simon that humans cannot do what RCT requires them to do, and there are also some fairly persuasive empirical studies within the FFH literature demonstrating that humans can in fact execute the fast-and-frugal strategies the FFH program recommends. But this is at best a necessary condition and as noted above, FFH raises concerns not raised by RCT, or at least they do not seem to be as problematic. It was also argued that both RCT and FFH are traditional instrumental rationality-based views of rationality (both descriptive and normative) and that despite the rhetoric to the contrary, FFH is not a radical alternative to the dominant theory. It was also argued that ecological rationality does not provide serious evolutionary explanations of the various heuristics it defends. The bottom line is that FFH gets away from utility/preference and optimization (which some consider an advantage), but it seems to lack any knock-down arguments for replacing RCT as the dominant view of what one ought rationally to do.



## References

- Allais, Maurice and Ole Hagen (eds.) (1979), Expected Utility Hypothesis and the Allais Paradox, Dordrecht, NL: D. Reidel,.
- Arrow, Kenneth J. (1959), "Rational Choice Functions and Orderings," Economica, 26, 121-27.
- Berg, Nathan and Gigerenzer, Gerd (2009), "As-If Behavioral Economics: Neoclassical Economics in Disguise?" History of Economic Ideas, 18, 133-66.
- Binmore, Kenneth (2009), Rational Decisions. Princeton, NJ: Princeton University Press.
- Camerer, Colin and Loewenstein, George (2004), "Behavioral Economics: Past, Present, and Future," in Advances in Behavioral Economics, Princeton: Princeton University Press, 3-51.
- Davidson, Donald (2001), Essays on Actions and Events. 2nd Edition, Oxford: Clarendon Press. [1st Edition 1980].
- Davidson, Donald (2004), Problems of Rationality. Oxford: Clarendon Press.
- Davidson, Donald; McKenney, John C. C.; and Suppes, Patrick (1955), "Outlines of a Formal Theory of Value," Philosophy of Science, 22, 140-60
- Davis, John B. (2010), Individuals and Identity in Economics. Cambridge: Cambridge University Press.
- Ellsberg, Daniel (1961), "Risk, Ambiguity, and the Savage Axioms," Econometrica, 75, 643-65.
- FitzPatrick, William (2012), "Morality and Evolutionary Biology," in The Stanford Encyclopedia of Philosophy, E. N. Zalta (ed.)  
<<http://plato.stanford.edu/archives/spr2011/entries/morality-biology>>
- Friedman, Milton and Savage, L. (1948), "The Utility Analysis of Choices Involving Risk," Journal of Political Economy, 56, 279-304.
- Friedman, Milton and Savage, L. (1952), "The Expected-Utility Hypothesis and the Measurability of Utility," Journal of Political Economy, 60, 463-74.
- Gigerenzer, Gerd (2001), "The Adaptive Toolbox," in Bounded Rationality: The Adaptive Toolbox, G. Gigerenzer and R. Shelten (eds.), Cambridge, MA: MIT Press, 37-50.

- Gigerenzer, Gerd (2008a), Rationality for Mortals: How People Cope With Uncertainty. New York: Oxford University Press.
- Gigerenzer, Gerd (2008b), "Why Heuristics Work," Perspectives on Psychological Science, 3, 20-29.
- Gigerenzer, Gerd and Brighton, Henry (2009), "Homo Heristicus: Why Biased Minds Make Better Inferences," Topics in Cognitive Science, 1, 107-43.
- Gigerenzer, Gerd and Goldstein, Daniel G. (1996), "Reasoning the Fast and Frugal Way: Models of Bounded Rationality," Psychological Review, 103, 650-69.
- Gigerenzer, Gerd; Hertwig, Ralph; and Pachur, Thorsten (eds.), (2011), Heuristics: The Foundations of Adaptive Behavior. New York: Oxford University Press.
- Gigerenzer, Gerd and Selten, Reinhard (eds.) (2001a), Bounded Rationality and the Adaptive Toolbox. Cambridge, MA: MIT Press.
- Gigerenzer, Gerd and Selten, Reinhard (2001b), "Rethinking Rationality," in Bounded Rationality and the Adaptive Toolbox, G. Gigerenzer and R. Shelten (eds.), Cambridge, MA: MIT Press, 1-12.
- Gigerenzer, Gerd and Sturm, Thomas (2012), "How (Far) Can Rationality be Naturalized?" Synthese, 187, 243-268.
- Gigerenzer, Gerd and Todd, Peter M. (2012), "Ecological Rationality: The Normative Study of Heuristics," in Ecological Rationality: Intelligence in the World. P. M. Todd, G. Gigerenzer, and the ABC Research Group (eds.), Oxford: Oxford University Press, 487-97.
- Glimcher, Paul M. (2003), Decisions, Uncertainty, and the Brain: The Science of Neuroeconomics. Cambridge, MA: MIT Press.
- Goldstein, Daniel G. and Gigerenzer, Gerd (2002), "Models of ecological rationality: The recognition Heuristic," Psychological Review, 109, 75-90.
- Grüne-Yanoff, Till (2008), "Action Explanations Are Not Inherently Normative," Theoria, 74, 60-78.
- Grüne-Yanoff, Till (2010), "Rational Choice and Bounded Rationality," in Religion, Economy, and Cooperation, Ilkka Ryysiäinen (ed.), Berlin: De Gruyter, 61-81.
- Guala, Francesco (2000), "The Logic of Normative Falsification: Rationality and Experiments in Decision Theory," The Journal of Economic Methodology, 7, 59-93.

- Hertwig, Ralph and Herzog, Stephan M. (2009), "Fast and Frugal Heuristics: Tools of Social Rationality," Social Cognition, 27, 661-98.
- Heukelom, Floris (2011), "Behavioral Economics," in The Elgar Companion to Recent Economic Methodology, J. B. Davis and D. W. Hands (eds.), Cheltenham: Edward Elgar Publishing, 19-38.
- Heukelom, Floris (2013), A History of Behavioral Economics. Cambridge: Cambridge University Press [forthcoming].
- Jallais, Sophie; Pradier, Pierre-Charles; and Teira, David (2008), "Facts, Norms, and Expected Utility Functions," History of the Human Sciences, 21, 45-62.
- Kahneman, Daniel (2003), "Maps of Bounded Rationality: A Perspective on Intuitive Judgment," American Economic Review, 93, 1449-1475.
- Kahneman, Daniel and Tversky, Amos (1979), "Prospect Theory: An Analysis of Decisions Under Risk," Econometrica, 47, 263-91.
- Kahneman, Daniel and Tversky, Amos (eds.) (2000), Choices, Values, and Frames. Cambridge: Cambridge University Press.
- Klaes, Matthias and Sent, Esther-Mirjam (2005), "A Conceptual History of the Emergence of Bounded Rationality," History of Political Economy, 37, 27-59.
- Lee, Kyu Sang (2011), "Three Ways of Linking Laboratory Endeavors to the Realm of Policies," European Journal of the History of Economic Thought, 18, 755-76.
- Marschak, Jacob (1950), "Rational Behavior, Uncertain Prospects, and Measurable Utility," Econometrica, 18, 111-41.
- Mongin, Philippe (2009), "Duhemian Themes in Expected Utility Theory," in French Studies in the Philosophy of Science, A. Brenner and J. Gayon (eds.), New York: Springer, 303-57.
- Morgenstern, Oskar (1972), "Descriptive, Predictive and Normative Theory," Kyklos, 25, 699-714.
- Nozick, Robert (1963), The Normative Theory of Individual Choice. New York: Garland Publishing [1990 publication of 1963 Ph.D. Thesis].
- Nozick, Robert (1993), The Nature of Rationality. Princeton: Princeton University Press.
- Raiffa, Howard (1994), "The Prescriptive Orientation of Decision Making: A Synthesis of Decision Analysis, Behavioral Decision Making, and Game Theory," in Decision Theory

and Decision Analysis: Trends and Challenges, S. Rios (ed.), Boston: Kluwer Academic, 3-13.

Rawls, John (1971), A Theory of Justice. Cambridge, MA: Harvard University Press.

Ross, Don (2005), Economic Theory and Cognitive Science: Microexplanation. Cambridge, MA: MIT Press.

Savage, Leonard J. (1972), The Foundations of Statistics, 2<sup>nd</sup> edition, New York: Dover.

Sent, Esther-Mirjam (2004), "Behavioral Economics: How Psychology Made Its (Limited) Way Back Into Economics," History of Political Economy, 36, 735-60.

Simon, Herbert (1945), Administrative Behavior. New York: Macmillan.

Simon, Herbert (1957), Models of Man. New York: Wiley.

Smith, Vernon L. (2003), "Constructivist and Ecological Rationality in Economics," American Economic Review, 93, 465-508.

Smith, Vernon L. (2008), Rationality in Economics: Constructivist and Ecological Forms. Cambridge: Cambridge University Press.

Sunstein, Cass R. and Thaler, Richard H. (2003), "Libertarian Paternalism," American Review, 93, 175-79.

Sunstein, Cass R. and Thaler, Richard H. (2008), Nudge: Improving Decisions About Health, Wealth, and Happiness. New Haven, CT: Yale University Press.

Thaler, Richard H. (1980), "Toward a Positive Theory of Consumer Choice," Journal of Economic Behavior and Organization, 1, 39-60.