**WHITHER RATIONALITY?**

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1. **Models of Human Rationality**

Until recently, the debate on how best to define human rationality revolved around four main standpoints. These were the following: 1) Unbounded Rationality (UR); 2) Optimization under Constraints (OuC); 3) Heuristics and Biases (H&B); 4) Ecological Rationality (ER).

Let me review them briefly.

* 1. *Unbounded Rationality*

UR is the classical view in rationality theory. Famous holders of this view are, e.g., von Neumann & Morgenstern (1944), Friedman (1953), Savage (1954) or Jeffrey (1983). According to their standpoint, normal (i.e., rational) human action is to be viewed as some sort of empirical instantiation of a model of normative optimization (rational choice theory). This approach assumes agents’ preferences to be complete, well ordered and well behaved in terms of a certain number of axioms of choice (completeness, transitivity, independence of irrelevant alternatives, sure-thing principle, etc.), and proves that, under such assumptions, non-self-defeating agents behave in order to maximize individual expected utility.

Typically, these models do not take into account any constraints (e.g., time constraints or cognitive processing limitations). This is the reason why the term ‘unbounded’ is used in their characterization. This disregard from time or procedural constraints entails two unwelcome consequences though. First, in many situations, UR models cannot even be specified because, in the absence of such constraints, the space of possibilities that must be taken into account is unlimited. Second, algorithms implementing those models that can be specified tend to generate serious problems of computational complexity and intractability.

The moral usually drawn from these consequences is twofold: first, the models themselves are to be seen as regulatory ideals; second, the above-mentioned empirical instantiation should be considered to be only approximate.

* 1. *Optimization under Constraints*

OuC is a standpoint trying to combine the classical approach to rationality with a concern with at least some of the bounds within which decisions in the real world have to be made.

OuC theoreticians admit being divided into two groups.

To the first group belong those claiming that normal (i.e., rational) human action is best viewed as an instantiation of a model of optimization that is subject to a number of time, cost or information processing constraints (see, e.g. Stigler 1961). The holders of this view have developed optimization algorithms designed to represent the way the *mind* takes into account variables such as the cost of information gathering. According to such algorithms, search should terminate when its costs outweigh its benefits.

 To the second group belong those claiming that normal (i.e., rational) human action is best viewed as an optimal adaptation of the agent’s behavior, given its goals, to certain relevant aspects of the decision *environment*. Their idea is to use optimization algorithms in order to predict human behavior from the structure of the environment rather than from the structure of the mind. This is the view usually called ‘Rational Analysis’ (cf. Anderson 1990, 1991).

However, no matter the group they belong to, the algorithms put forth by OuC theoreticians tend to be computationally extremely complex. That is, they tend to suffer from the very same intractability problems – typical of UR models – that they were intended to overcome in the first place. As a matter of fact, J. R. Anderson himself could not help confessing that (Anderson 1991, 474):

The major complication in this step is analytic tractability.

* 1. *Heuristics & Biases*

Proponents of the H&B standpoint start from the claim that the human mind is inescapably bounded and suggest that normal human action is determined mainly by non-rational heuristics and biases the human cognitive apparatus is stuck with in the course of the evolutionary process. These heuristics and biases, frequently called ‘quick and dirty’, are simple cognitive shortcuts that direct us in our ways of acting; moreover, they are independent from experience and very hard to overcome by learning. One way of conceiving them is as cognitive analogs of visual illusions studied in the psychology of perception (such as the famous Müller-Lyer illusion).

Thus, according to this view, the “ways of man” contradict, to a large extent, the prescriptions of classical rational choice theory. As a consequence, man should be considered to be, to a large extent, a non-rational creature. The job of rationality theorists, in turn, should be to strive to identify these heuristics and biases and to suggest methods for helping people becoming aware of their own irrationality and correct it.

Holders of this view are, *inter alia*, Tversky (1969, 1974, 1975, 1981), Kahneman (1982, 2011), Piatelli-Palmarini (1994) or Lichtenstein and Slovic (2006).

* 1. *Ecological Rationality*

ER is the view according to which rationality is to be equated with adaptability.

Similarly to H&B theoreticians, ER proponents turned to the idea that the human mind is inescapably bounded. They therefore agree that normal human action is frequently the outcome of the triggering of non-normative heuristics they prefer to call ‘fast and frugal’. The replacement of the negative term ‘dirty’ with the positive ‘frugal’ is, however, not merely terminological.

As a matter of fact, and dissimilarly to H&B theoreticians, ER proponents also state that, within its proper environment, and under the right sort of circumstances, the display of any of these heuristics is a more robust way of dealing with an uncertain and complex world than highly complex optimization tools. Thus, resorting to a fast and frugal heuristics might frequently be the rational (i.e., adaptive) way to go.

The main holders of this view are G. Gigerenzer, P. Todd & The ABC Group (1999) and G. Gigerenzer (2000).

1. **The Debate**
	1. *Round 1*

Proponents of H&B or ER typically criticize UR or OuC models for being descriptively inadequate at the behavioral level and highly unrealistic at the cognitive level. More particularly, they put forth the objections A) and B) below.

Objection A): The axioms (e.g., transitivity or independence) from which normative models of rational behavior have been derived have been shown by experimental economists and psychologists not to be true of concrete human subjects in multiple situations (cf. , e.g., Allais 1953, Tversky 1969, 1975).

Objection B): The complexity involved in the implementation of these models outside of simplified toy worlds is staggering; therefore, when matters are considered from an evolutionary perspective, the cognitive processing of such a complexity would be too costly and largely inefficient. This objection is, of course, just a rewording, wrapped up in evolutionary considerations, of the two unwelcome consequences of rational choice theory already diagnosed in section 1.1.

Supporters of H&B or ER thus claim that expecting real people to conform to such norms, even if only approximately, requires not only disregarding important results in cognitive psychology, but also assuming that their minds contain a kind of superdupercomputer similar to the one needed to equip the mind of a Laplacean demon. Models based on such expectations and assumptions should thus be viewed as describing the would-be cognitive and behavioral capabilities of god-like creatures and not those of real world biological creatures, such as humans.

* 1. *Round 2*

In general, UR or OuC supporters respond to these criticisms along the same lines that were famously put forth by Friedman (1953) more than sixty years ago. These are the following:

Reply to Objection A): The sort of criticism instantiated by this objection falls prey to a basic logical fallacy, namely, the fallacy of the negation of the antecedent. This reply has a Popperian flavor: it implies that theories are to be assessed by the success of their predictions only. From this perspective, empirically driven axiom testing is basically pointless (cf. also Davidson 1980, 1995).

Reply to Objection B): The sort of criticism instantiated by this objection fails to see that UR or OuC approaches are selectionist and that they are predicated on two biologically sound assumptions, namely, the following. First, both human cognition and behavior are adaptive; second, what adaptation amounts to is optimization.

Taken together, these assumptions should justify the axioms of rational choice and the theory of human action that follows from them. Therefore, criticisms based on unproven allegations regarding the details of cognitive implementation (about which nobody knows much) are both misplaced and theoretically detrimental. As is well known, evolution is supposed to *write straight with crooked lines*. Once again, J. R. Anderson put the point nicely (cf. Anderson 1991, 483):

It is in the spirit of a rational analysis to prescribe what the behavior of a system should be rather than how to compute it.

* 1. *Round 3*

Obviously, the dialectic does not stop here. ER theoreticians, for instance, claim that what they are looking for is an *integration* of the question of *why* it is that humans behave in the way they do with the question of *how* it is that they manage to do what they do. Their ambition is therefore meant to be explanatoryin a *deeper* sense*,* namely, in the sense in which an explanation of a natural phenomenon should provide us with some understanding of the underlying causal mechanisms producing it and not only with the ability for making successful predictions. Seeing things from this perspective, computational tractability and feasibility seem to be unavoidable boundaries for the cognitive implications (the *crooked lines*) of a behavioral theory.

Deeper explanations should also have better predictive value though (that is, they should *write straight* too). Thus, ER theorists devised various cognitive experiments aimed at showing that the outcome of the deployment under the appropriate circumstances of the fast and frugal heuristics they claim to have identified match human behavioral facts better than the predictions made according to UR, OuC or even H&B theories.

The right interpretation of these experiments is, however, a matter of controversy.

1. **Unexpected Findings and a Possible ‘Third Way’**

More recently, Stanovich (2013) suggested a fifth standpoint in rationality theory. I will call it ‘Brute Rationality’ (BR) for reasons that will become apparent below. BR puts together elements of the earlier views and combines them in a new direction. This new direction was, in turn, suggested to Stanovich by a series of earlier remarks made by Searle (2001), on the one hand, and by the consideration of unexpected findings he came across when reviewing animal behavior literature, on the other hand.

* 1. *Ultimatum Game with Chimpanzees*

These unexpected findings are undoubtedly important. Thus, and leaving Searle aside, let me make a small detour through some of them before summarizing the essentials of Stanovich’s BR approach to rationality. These findings consist of several experimental results obtained in animal behavior research that seem to suggest that, in a number of circumstances, non-human animals behave rationally in situations in which humans do not. That is, frequently, humans seem to be *less* rational than other animals (e.g., Kagel, C. J. 1987).

Jensen, Call and Tomasello (2007) provide us with one good example of such work. They were able to devise a version of the famous ultimatum game that was accessible to chimpanzees. They then compared the results of the game presented to the chimpanzees with the results obtained in the human version of the same game by practicians of experimental economics.

The outcome of this comparison was the following: chimpanzees always behaved as rational maximizers whereas humans, in general, do not. As is well known, human responders tend to reject low offers because, in their own words, they are ‘unfair’. In fact, most human proposers anticipate that responders will respond this way and, in general, end up making fair offers. Not so with chimpanzees. Proposers almost always made selfish offers and responders almost always accepted anything that was greater than nothing, in agreement with the prescriptions of rational choice theory.

Now, when read either from the perspective defined by UR or OuC standpoints, or from the cognitively inspired criticisms of them, these findings sound paradoxical.

* 1. *“Economic Animal” vs. “Irrational Man”?*

As mentioned above, impressed by these results, Stanovich put forth his own standpoint – BR. In a sense, BR may be regarded as a sort of ‘third way’ in the rationality theory debate. As a matter of fact, although it collects elements from the UR and OuC camp, on the one hand, and from the H&B and ER camp, on the other hand, it remains distinct from both camps. According to this new view, it is not god-like creatures but brutes that admit being best described by traditional optimization models of rationality. That is, being indisputably adaptive, non-human animal cognition is the proper target for being the subject of a Friedman-like optimization approach. Humans, on the other hand, fail to be rational; however, Stanovich claims that humans fail in this task not because their cognitive make-up lacks the computational resources needed to implement highly complex optimization procedures but, rather, because their cognitive complexity makes it *harder* for them to conform to the strictures of rational choice.

Therefore, so the story goes, when *unhindered* by human mental complexity, natural selection shapes the decision algorithms contained in the simple brains of animals into those whose output is the behavior typical of “economic man”. Humans, in turn, seem to have been subject to strange evolutionary pressures that turned them into *the* (partly, at least) *ir*rational animal.

1. **Making sense**

Each of the standpoints reviewed above has undoubtedly its intrinsic merits and demerits. However, irrespective of them, the aspect of the debate I want to elaborate upon is the following: All parties in this debate make an appeal to *evolutionary justifications* in order to substantiate their standpoints*.* But these point in opposite directions. How can we make sense of this?

* 1. *Rationalit*ies

It seems to me that one of the main reasons that makes it possible for all the contenders in this dispute to use what looks like the same sort of evolutionary considerations in order to justify contradictory views on human rationality is the following: these contenders are using the term ‘rationality’ in more than one sense and not always acknowledging that they are doing so.

Thus, in order to discipline the discussion, I will follow a proposal made by Kacelnik (2006) and introduce a clear distinction between three *different* concepts of rationality. These are the following.

First, *P-rationality*, or psychological rationality; this is a concept of rationality associated with belief. Depending on what theory of belief one accepts, P-rationality may or may not be associated with procedural rationality. Theoreticians working within H&B or ER views are clearly making this association.

Second, *E-rationality,* or economic rationality; this is a concept of rationality associated with behavioral consistency, revealed preferences and maximization of individual expected utility.

Third, *B-rationality*, or biological rationality; this is a concept of rationality associated with fitness maximization.

* 1. *Re-describing the debate*

Kacelnik’s conceptual distinctions are useful in that they allow me to reinterpret the debate above in a more illuminating way. Let me try to make this clear.

First, we may view H&B or ER supporters as criticizing the UR or OuC standpoints along the following *Modus Tollens* lines. UR or OuC theoreticians contend that humans are (approximately) E-rational. However, in order to be able to be, even approximately, E-rational, humans would need to be strongly P-rational; but it is both psychologically implausible and computationally impossible for them to be strongly P-rational; therefore, they cannot be E-rational either, not even approximately.

Second, we may view UR or OuC supporters as presenting the following *Modus Ponens* counter-argument to the criticism above:

Premise 1: Natural creatures are B-rational;

Premise 2: In cognitively sophisticated natural creatures, B-rationality entails E-rationality;

Premise 3: Humans are cognitively sophisticated natural creatures;

Conclusion: Humans are E-rational.

Third, Stanovich’s argument in favor of BR admits, in turn, being rendered as follows:

Premise 1: In Nature B-rationality is pervasive;

Premise 2: For non-human animals, being E-rational is easy;

Premise 3: For humans, being E-rational is very hard;

Premise 4: The worlds non-human animals live in and their cognitive systems are simple;

Premise 5: Human worlds and human cognition are highly complex.

Conclusion: Human cognitive P-complexity is the differentiating causal element that severs (in humans) the otherwise straightforward connection holding in Nature between B-rationality and E-rationality.

* 1. *Is the ‘third way’ a better way?*

Thus interpreted, the debate gains in clarity. For instance, it becomes clear that if Stanovich is right, then the two following conclusions hold. First, strong P-rationality *cannot* be a necessary conditionfor E-rationality (*pace* H&B and ER theorists); therefore, their cognitively inspired objections to Friedman’s or Anderson’s selectionism lose their strength. Second, human P-complexity is a *hindrance* to human E-rationality though (*pace* UR and OuC theorists); therefore, critics of the selectionist justification for classical rational choice theory are nevertheless right, albeit for the wrong reasons.

But is Stanovich right?

His argument is an inductive causal argument of the Millian sort (method of difference). It identifies human P-complexity as the differentiating causal element that accounts for the distinction allegedly observed between human and animal behavior regarding E-rationality. It thus assumes that, in the absence of this human peculiarity, E-rationality would follow, without further ado, from B-rationality.

As we have seen above, that E-rationality follows straightforwardly from B-rationality (in cognitively sophisticated creatures such as humans) is also a premise of the counter-argument by *Modus Ponens* UR or OuC supporters put forth against Objection B (see section 2.2.).

But is it the case that the connection holding between B-rationality and E-rationality is a straightforward one, either in humans or in non-human animals?

1. **B-Rationality**

In order to try to find out an answer to the question above, let me take a closer look at the concept the term ‘B-rationality’ is meant to capture.

* 1. *Fitness Maximization*

As mentioned above, the concept of B-rationality is usually taken to be associated with the idea of fitness maximization. On the other hand, the idea of the fitness of a biological agent is associated with its degree of success relative to that of other agents in the same population. Fitness is thus a relative rather than an absolute notion.

But what does ‘success’ mean for a biological agent? And, whatever it means, how is it measured? The idea of ‘biological success’ is clearly associated with survival and reproduction. But complex organisms neither produce copies from themselves nor survive to themselves. As a matter of fact, what increases or decreases within a given population across long stretches of time is something else, namely, the number of copies of a gene relative to the total *loci* available for that gene in a given population. Thus, it is not organisms but genes that enjoy of more or less biological success. Genes *are* the biological agents.

* 1. *Inclusive Fitness*

Like everything else biological, the behavior of an individual organism also is, in some sense of this term, ‘guided’ by the genes it carries. Thus, it should be possible, at least in principle, to analyze it as a derivative form of implementing fitness maximization. Indeed, this is what theoretical population geneticists do.

The idea there is to work out a function describing the behavior of particular biological organisms as the behavior of maximizing agents; in order for this to be possible, organisms need to be seen as extensions of their genes. Thus, what is being maximized by them (what theoretical population geneticists call *inclusive fitness*) is still to be understood at the genetic level (i.e., relative success of particular genes within the gene pool) rather than at the individual level.

Operationalizing the guiding principle that B-rational individuals are supposed to exhibit a behavior maximizing their inclusive fitness is, however, no easy task. Below is a short list indicating some of the problems, pointed out by, among others, Kacelnik (2006), afflicting the use of the concept of maximization of inclusive fitness in empirical research.

First, no organism can be expected to maximize inclusive fitness under all possible circumstances; thus, the concept is useful only when relativized to a limited number of them.

Second, the detection that a strategy deployed by a particular organism is a form of maximizing its inclusive fitness must occur together with the identification of a typical situation that is or has been evolutionarily relevant for that organism; but this is easier said than done.

Third, when doing optimality modeling, what is frequently possible to test in practice is which of different strategies a particular organism consistently prefers. But, depending on the assumptions one makes, any of the strategies being tested may be taken to be a proxy for a form of maximization of inclusive fitness. Thus, the inference that the one that seems to be chosen by the organism is the one that indeed maximizes its inclusive fitness under the circumstances being tested seems to be obviously circular.

* 1. *If B-Rational, then E-Rational?*

Regardless of how difficult it is to test B-rationality effectively, is E-rationality actually derivable, at least in principle, from B-rationality?

There is a sense in which it is possible to answer this question trivially in the affirmative. As Kacelnik put it (Kacelnik 2006, 99):

if a subject is a consistent maximizer of inclusive fitness, then it is a consistent maximizer of something, and a consistent maximizer of anything is, by definition, E-rational.

But, regardless of the trivial proposition above, does it really follow that the assumption that an organism maximizes inclusive fitness readily translates into the existence of some particular form of E-rational consistency among its revealed preferences?

As a matter of fact, the answer is no. Besides the studies quoted by Stanovich, the literature on animal rationality contains also many interesting reports of observed inconsistent preference rankings in animals. Moreover, it contains also highly plausible suggestions on how to interpret in a B-rational consistent way E-irrational (i.e., normatively inconsistent) preference rankings (see, e.g., Schuck-Paim, C., Pompilio, L. & Kacelnik, A. 2004 or Houston, McNamara & Steer 2007a, 2007b).

Truth be told, some of the same authors have also shown that, with the introduction of suitable changes to the definition of either the relevant space of events or the utility function, the very same behavior could be reinterpreted in a way that would make preferences come out as E-consistent after all. Of course, once this is systematically done, E-rational interpretations of animal behavior begin to look more and more *ad hoc* and end up running the risk Kacelnik identified of becoming trivial.

The upshot of this work seems then to be the following: the difficulties brought about by an E-rational interpretation of animal behavior are *not essentially dissimilar* to those brought about by more familiar attempts to produce E-rational interpretations of *prima facie* E-inconsistent human behavior. I.e., in this respect human and non-human animals are not that different after all!

Only under a very limited and highly constrained set of circumstances is it to be expected that B-rational and E-rational interpretations of human or animal behavior should be uncontroversially aligned, namely, those circumstances in which maximization of individual expected utility might be taken to be an accurate proxy for inclusive fitness.

1. **There is no human exceptionality**

The distinction introduced above between P-rationality, E-rationality and B-rationality seems to me to be well motivated. But, if we proceed from there, we are led to the following conclusion: it is not possible to straightforwardly derive a useful behavioral concept of E-rationality, both for humans as well as for non-human animals, from the assumption that we are all subject to the constraints of B-rationality.

However, that such a derivation is straightforward and unproblematic for humans is precisely what is taken for granted by the second premise of the evolutionary argument put forth by UR or OuC approaches.

And that such a straightforward and unproblematic derivation should be the default evolutionary assumption is something Stanovich’s Millian argument takes for granted. It is the realization that such a default seems not to apply to human behavior that motivates his search for the odd causal factor responsible for this human exceptionality. But, in reality, there simply is no human exceptionality in this regard. Contrary to what Stanovich seems to have suggested, birds, rats or chimpanzees don’t do better than humans in terms of rational agency. Thus, the assumption fails.

1. **Where do we stand?**

The selectionist *rationale* shared by most holders of the UR and OuC standpoints as well as by Stanovich’s BR approach relies on a false premise. The evolutionary justification supporting it is, therefore, not acceptable.

In contrast, H&B and ER seem to have clearly understood that assuming living creatures to be B-rational in no way legitimizes an analysis of their individual behaviors as being E-rational in any straightforward reading of this term.

However, H&B theoreticians accept that classical rational choice approaches to E-rationality *define* behavioral and cognitive rationality. Thus, they conclude that evolution made humans non-rational. This strikes me as wrong.

As a matter of fact, such a use of ‘rational’ and ‘rationality’ by H&B theoreticians seems to me to still fall prey to a top down view of Man. A view according to which Man would ultimately be a sort of creature left somewhere halfway between “divine” rationality and “animal” nature; i.e., a being endowed with “indirect” rationality only, if I’m allowed to use here the expression once coined by J. Elster (1984). But what I think we need in this respect is to replace, once and for all, such a view of Man with a genuinely naturalistic, bottom up, view.

This is exactly what ER theoreticians try to do. Elaborating upon H. Simon’s (1957) situated rationality approach, they contend, as already mentioned in 1.4., that fast and frugal heuristics, rather than being simply dirty cognitive shortcuts, are frequently more robust ways of dealing with an uncertain and complex world than traditional optimization tools. To my view, the truth of this contention changes substantially the nature of the philosophical debate concerning the understanding of human action.

Thus, the ER approach seems to me to be the most appropriate. However, in most cases, we simply don’t know yet how to connect animal or human behavior and cognition with strategic design (B-rationality) and P-complexity (procedural rationality). Thus, heuristics approaches are still not much more than research programs.

To conclude, it seems to me that this is an area of research in which we need to be humble – what the putative future *empirical* successes of H&B or ER or other similar research programs might entail for our understanding of the specificities of human or animal decision-making behavior is something we simply cannot anticipate by means of purely analytic reasoning.

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